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Southern Region

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Draft Environmental Impact Statement

Revised Land and Resource Management Plan National Forests in Mississippi

National Forests in Mississippi
Mississippi

Draft Revised Land and Resource Management Plan
National Forests in Mississippi

Forest Supervisor's Office – Jackson, Mississippi

Bienville National Forest – Forest, Mississippi

Delta National Forest – Rolling Fork, Mississippi

De Soto National Forest –
Chickasawhay Ranger District – Laurel, Mississippi
De Soto Ranger District - Wiggins, Mississippi

Holly Springs National Forest – Oxford, Mississippi
(Includes the Yalobusha Unit)

Homochitto National Forest – Meadville, Mississippi

Tombigbee National Forest – Ackerman, Mississippi
(Includes the Ackerman and Trace Units)

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Abstract: Five alternatives for revision of the Land and Resource Management Plan (LRMP or Forest Plan) for the National Forests in Mississippi are described, compared, and analyzed in detail in this Final Environmental Impact Statement (FEIS). Alternative A provides analysis of custodial management to address minimum legal management requirements. Alternative B represents no change from the current LRMP. Alternative C is the alternative preferred by the Forest Service and was the foundation for the Proposed Plan. Alternative D addresses an increased emphasis on restoration of historical forest conditions. Alternative E addresses an emphasis on improving forest health.

It is important that you, the reviewers provide your comments at such times and in such a way that they are useful to our preparation of the EIS. Therefore, your comments should be provided prior to the close of the comment period and should clearly articulate your concerns and contentions. Your submission of timely and specific comments can affect your ability to participate in subsequent administrative review or judicial review. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record for this proposed action. If you choose to submit your comments anonymously, they will be accepted and considered; however, anonymous comments will not give you standing to participate in subsequent administrative or judicial reviews.

Send Comments to: National Forests in Mississippi
Proposed Forest Plan
P. O. Box 1919
Sacramento, CA 95812

Comments can be emailed to: NFsMSProposedForestPlan@fscomments.org

See: http://www.fs.usda.gov/mississippi for official closing date for public comments.

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Summary

This Final Environmental Impact Statement (EIS), prepared by the USDA Forest Service, describes and analyzes in detail five alternatives for managing the land and resources of the National Forests in Mississippi. It describes the affected environment, and discloses environmental effects of these alternatives.

Proposed Action

The USDA Forest Service proposes to revise the 1985 Land and Resource Management Plan for the National Forests in Mississippi. The proposed action updates the goals and desired conditions, objectives, standards and guidelines, and monitoring requirements. In addition, the proposal includes designations for 18 new Special Areas. New management direction is focused on restoring natural resources and natural processes and creating and maintaining diverse wildlife habitats

Issues Addressed

Issues, concerns, and opportunities are described in Chapter 1 under the heading Purpose and Need. The proposed action was developed to address the issues, concerns, and opportunities identified during the collaborative planning process. Alternatives to the proposed action were developed when unresolved conflicts remained concerning alternative uses of limited resources, or to address issues with significant environmental impacts. The following concerns were expressed during a comment period that took place following publication of a Notice of Intent to revise the plan. They were addressed either by clarifying or changing language in the proposed action, modifying management area prescriptions in the proposed action, or by developing an alternative to the proposed action. (1) Native Ecosystem Restoration; (2) Biodiversity and Species Viability; (3) Forest Health; (4) Vegetation Management for Timber; (5) Fire Management; (6) Old Growth; (7) Watersheds and Water, Soils, Aquatic Resources, Riparian Environments; (8) Access Management; (9) Recreation; (10) Special Area Designations; (11) Land Use and Ownership; (12) Climate Change; (13) Minerals Management; and (14) Economic Benefits.

Alternatives

Five alternatives are considered and analyzed in detail:

A. Alternative A is custodial management based on minimum legal requirements,

B. Alternative B is the 1985 Plan currently in effect,

C. Alternative C is the Proposed Action (preferred alternative),

D. Alternative D increases the emphasis on restoration of native ecosystems,

E. Alternative E increases the emphasis on improving forest health.

Effects Analysis

Soils

Implementation of the best management practices, proper mitigation measures, and monitoring by the Sale Administrator would result in minimal soil effects for all alternatives. The cumulative effects of all management actions over time are not expected to reduce soil productivity. Mitigation measures for past, present and reasonably foreseeable management activities (timber harvesting, site preparation and prescribed burning) are designed to keep the litter layer in place, or to replace the litter layer on exposed soils by seeding and fertilization; therefore, impacts associated with any one treatment would be completely recovered within three years.

Air

The air quality program for the National Forests in Mississippi provides guidance for conducting forest management activities in a manner that complies with State and Federal standards, protects human health, promotes safety, and does not degrade air quality. Prescribed burning is the activity most likely to contribute air emissions. Alternatives A through E have progressively larger prescribed burning programs with alternative A having the smallest program and alternative E having the largest. The range is 121,000 to 251,000 acres. The greater the alternative's program acres, the larger the likely air quality impacts. However, the program controls mentioned above should keep the impacts within acceptable standards for all alternatives.

Water

The Clean Water Act provides the primary regulatory framework for managing the National Forests in Mississippi water resources. In compliance with the above mandate, forest management activities are implemented in a manner that does not substantially or permanently impair water quality. Mitigation measures, in the form of State best management practices and forest standards and guidelines, are used to meet this requirement. Analysis indicates that, at the forest level, the expected intensity of management activities planned will not result in measurable changes either beneficial or detrimental to overall watershed condition ranking.

Ecological Systems

Performance measures were identified for both terrestrial and aquatic systems, criteria were set for rating each performance measure as poor, fair, good, and very good relative to ecological sustainability. Restoration of ecosystems is a priority in alternatives C, D, and E. In alternatives C, D, and E the long-term effects of restoration, management, and maintenance of the ecosystem are expected to be critical to the sustainability of these communities and associated species. Over time, associated species of regional as well as local viability concern will become increasingly sustainable. In both the 1st and 5th decades of alternative A, conditions remain slightly inadequate and they may be subject to gradual decline. Alternative B, on the other hand, provides adequate conditions in the first decade before degrading considerably by the fifth decade. Considering the total amount of disturbance that has, is, and will be occurring within the Forests, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of alternatives C, D, and E will be minor.

Species Diversity

Species diversity effects were considered by six distinct categories. These include Threatened and Endangered Species, Terrestrial Species Groups Covered by Ecological System Sustainability Forest Plan Components, Terrestrial Species Groups Requiring Additional Forest Plan Components, Aquatic Species Associations, and Management Indicator Species. The National Forests in Mississippi used these species groups as an evaluation and analysis tool to improve planning efficiency and for development of management strategies. Each species was grouped according to its habitat needs, limiting factors, threats, and specific associated habitat elements.

Ecological conditions that are needed to conserve threatened and endangered species are provided by the forest plan components for ecosystem diversity included in all alternatives. Alternatives A, C, D, and E would have more direct positive effects on threatened and endangered species than Alternative B which would not incorporate improved strategies and increased emphasis on recovery mandates.

In all alternatives, the long-term effects of ecosystem management and protection are expected to result in sustainable native communities and associated species. Each alternative includes management strategies and appropriate forest plan components for each group. Over time, associated species of regional as well as local viability concern should remain sustainable. For some species associations, the long-term effects of restoration, management, and maintenance of the ecosystem in alternatives C, D, and E are expected to be critical to sustainability. Alternative A will have negative impacts on species and communities in the long run due to reduced management of the associated systems.

Future trends in management indicator species are discussed in various sections of this document. In summary, six species have been selected as management indicator species for the revised forest plan. They will be used to assess effects of alternatives and to help monitor effects of implementing the selected alternative.

Forest Health and Protection

Each alternative is based on an overall strategy for achieving healthy forests using a combination of vegetation management practices and prescribed burning to restore and maintain resilient native ecosystems. The emphasis in this forest plan on thinning; converting loblolly and slash pine stands that are not on appropriate sites to longleaf and shortleaf pine forests; and restoring rare communities and old growth; is expected to not only improve native species diversity but also improve resilience of ecological communities to non-native invasive species, disease and insect outbreaks, extreme weather disturbances associated with climate change, and other stressors. The three most important forest health issues for the National Forests in Mississippi are non-native invasive species, southern pine beetle and the need to improve old-growth. Alternatives C, D and E will positively influence overall forest health. Alternative A would allow overall forest-wide forest health to deteriorate.

Fire Management

While suppression strategies and resources needed to combat wildland fires will not vary by alternative, the level of prescribed fire for hazardous fuel mitigation and ecosystem management will vary. Alternatives C, D, and E, because of the projected level of prescribed fires (220,000; 240,000 and 251,000 acres annually respectively), will provide the highest level of hazardous fuels reduction and ecological restoration and maintenance in fire-adapted ecosystems with an emphasis on growing season burning. Alternative B, at an average annual prescribed fire program of 190,000 acres, will likewise contribute to fuels management and ecological restoration, but will likely relegate some restoration of rare ecological communities and control of non-native invasive plant species to occurrences embedded in larger landscape burns as has been done in the past with less emphasis on growing season burning. The level of prescribed fire in alternative A (121,000 acres) will be restricted to four districts. Priorities will be established based on the need for burning for threatened and endangered species habitat areas and minimal fuels management. This level of prescribed burning will likely decrease viability trends for a number of flora and fauna, and hamper any effort to maintain condition class at or near desirable levels.

Outdoor Recreation

Alternative A would over time close all facilities due to reduced program. Under Alternative B, financial resources will continue to be limited and diminishing. Therefore there will be a challenge managing growing and changing recreation demands. Alternatives C, D and E would maintain most current developed activities. These three alternatives would include a new backcountry designation on the

Tombigbee National Forest and acquisition next to Black Creek Wilderness providing approximately 4600 acres of more remote outdoor experiences.

Scenery

Except for alternative A, where the resources will not be expended beyond the minimal legal requirements, the scenic integrity objective acreages of the alternatives do not vary directly across the current management (alternative B) and alternatives (C, D and E). What varies across the alternatives is amount of impact, most directly due to the restoration and ecological sustainability activities, total volume of timber cutting, the percentage of restoration harvests, and the location of vegetation management activities. However, implementation guides will reduce the impacts associated with these activities.

Recreational Fisheries Management

Under Alternative A limited resources and budgets would favor reduced/ minimal recreational fisheries management. As a result, this action would have reduced/minimal fisheries management resulting in a reduction in recreational fishing opportunities for the public. Angler catch rates would be reduced thus resulting in lower angler satisfaction. Under Alternatives B, C, D and E fisheries management would be conducted to improve recreational fishing opportunities for the public. The proposed recreational fisheries management activities on the National Forests in Mississippi would result in improved recreational fishing opportunities for the public. Angler catch rates would increase resulting in improved angler satisfaction.

Wilderness

Based on findings in the wilderness evaluations, no areas were found on the National Forests in Mississippi that qualified for placement on the potential wilderness inventory. At this time there are no recommended additions to the wilderness system. Wilderness management will not vary by alternative.

Wild and Scenic Rivers

No change is planned from current management. The additional reaches of Black Creek within the DeSoto National Forest will continue to be managed (for all alternatives) to protect the character that would make them eligible for designation as wild and scenic. Therefore, management of wild and scenic river designation will not vary by alternative.

Special Areas

Special area designations or management do not negatively affect other resource areas to an unreasonable degree. Eighteen additional designations are analyzed in alternatives C, D and E. Alternatives A and B do not provide for these designations. Additional botanical areas and research natural areas remove acres from the land base suitable for timber production. The additional 3,881 acres of special area designations will not have a significant effect on timber production in any alternative. Botanical area and research natural area designations contribute to development and protection of medium sized old-growth areas.

Cultural Resources

Cultural resources are potentially affected by ground disturbing activities. Alternatives A through E would have progressively higher levels of ground disturbing activities with A being the least and E having the most ground disturbing activity. However, compliance with the forest plan guidelines will result in no unreasonable impacts under any alternative.

Forest Products

Each alternative analyzed utilizes the same allocation of acres to the land base suitable for timber management. Most of the land base on the National Forests in Mississippi (81 percent) is considered suitable for timber production after identifying lands not appropriate for timber production.

The implementation under each alternative evaluated would be based on the same desired conditions and vegetation management priorities. The basic difference between alternatives is program level determined by funding and staffing levels. Alternative C is the proposed action alternative which would be an increase in vegetation management over alternative B (current management program levels). Alternative A, the custodial management alternative, would be a strategy to focus very limited resources on threatened species and their critical habitat needs under a minimal program level. Outcomes for programs based on increased funding are analyzed in two alternatives. Alternatives D and E utilize stepped up funding for increased restoration emphasis in D and increased thinning emphasis in alternative E for forest health improvement.

The harvest acre outcomes from these alternatives represent a range likely to occur based on alternative emphasis or funding and resources available. Alternative (A), (B), (C), (D) and (E) result in harvest acre outcomes of approximately 79,000, 114,000, 168,000, 164,000, and 223,000 acres respectively in the first decade of implementation. The total volumes for each alternative are 75, 120, 181, 202 and 237 million cubic feet respectively for the first decade of implementation. The excess of growth over the harvest removals in all alternatives is likely to result in higher densities and older stands. High density and older age results in reduced forest health and increased mortality. This density and age based stress and mortality will be greatest in alternatives with lower harvest volumes. A positive effect of older stands resulting from an excess of growth over removals is an increase in conditions beneficial to ecosystem components dependent on older, less disturbed forest conditions.

Minerals

In August 2010, the National Forests in Mississippi renewed its decision for Lands Available for Oil and Gas Leasing. The 2010, oil and gas leasing decision authorized all lands on the National Forests in Mississippi, except for congressionally designated wilderness areas and the deferred Sandy Creek RARE II Further Study Area), to be available for Federal oil and gas leasing through the Bureau of Land Management. All alternatives incorporate the 2010 oil and gas leasing decision as continuation of management direction. The deferred decision on oil and gas leasing availability on the Sandy Creek RARE II study area is addressed in this environmental impact statement. Alternatives A and B would not authorize oil and gas leasing in the Sandy Creek RARE II study area. Alternatives C, D, and E would permit oil and gas leasing in the Sandy Creek RARE II study area subject to the 2001 Roadless Area Conservation Rule restrictions. The restrictions include no new road construction permitted in the former RARE II study area; therefore existing system roads would be utilized as access for lease activities.

Infrastructure

The effect of vegetation management which varies by alternative on infrastructure is that alternatives C, D and E which have higher levels of timber harvests will provide higher levels of funding to upgrade and maintain existing roads. Alternative A, having a minimal level of timber harvest, would provide less funding for road maintenance. Because there is very little need for new road construction under any alternative, road infrastructure is expected to have little impact on other resources based on alternative. However, road maintenance and reconstruction would vary by alternative with greater need for these activities as vegetation management activities increase from alternative A through E.

Land Use and Ownership

Land exchange, procurement or disposal will not vary by alternative, nor will the implementation of any alternative effect the government’s ability to pursue any of these land adjustment opportunities.

Special use authorizations are issued for multiple purposes to individuals, corporations, and other government agencies. The predominant uses are for public roads, communication facilities, and utility rights-of-way. Special use authorizations for personal use are a minor land commitment such as private road easements and permits. Neither these uses nor their impacts will vary by alternative. Areas identified for disposal or special use could contain areas with important biological diversity or habitat for threatened and endangered species. Likewise, areas identified for disposal or uses could contain areas with historical or archeological importance. Forest plan guidelines will reduce or mitigate impacts to natural resources associated with implementation of special use and/or land ownership adjustment activities and would apply to all alternatives.

Other Effects

The effects of alternative implementation on the local economy were evaluated. The management of the National Forests in Mississippi has the potential to affect jobs and income within its area of influence. These effects are positive and larger as the program level increases from alternative A to E.

The principles for considering environmental justice outlined in Environmental Justice Guidance under the National Environmental Policy Act were considered in this analysis. The concerns of environmental justice encompass specific considerations of equity and fairness in resource decision-making. Benefits to the economy from National Forests in Mississippi management would accrue to all Counties where the National Forests occur, and are demonstrated in the social and economic environment sections of this document. There are no disproportionate negative environmental or health effects to minority or low-income populations anticipated from any alternative. Public involvement during forest plan revision was inclusive and provided ample opportunity for issues of environmental justice to be raised.

Other effects such as Relationship of Short-Term Use and Long-Term Productivity, Irreversible and Irretrievable Commitment of Resources, Effects on Wetlands and Floodplains, Unavailable or Incomplete Information were evaluated. No alternative would be detrimental to the long-range productivity of the National Forests in Mississippi. Irreversible and irretrievable commitments of resources are normally not made at the programmatic level of a forest plan. However, an example of such commitments considered is the allocation of management prescriptions that do not allow timber harvests. For the period of time during which such allocations are made, the opportunity to produce timber from those areas is foregone, thus irretrievable. Allocation of these unique areas to these designations will simply be making a determination that some of the harvest forgone mostly due to budgetary constraints will be in areas to be protected for their unique natural resource values. No significant adverse impacts on wetlands or floodplains are anticipated. Wetlands values and functions would be protected in all alternatives through the implementation of management area prescriptions and standards and guidelines. The National Forests in Mississippi 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 will always exist in our knowledge. 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.

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Chapter 1. Purpose and Need

1.1 Introduction

This environmental impact statement (EIS) is a companion document to the revised land and resource management plan (forest plan) for the National Forests in Mississippi (or the Forests). The EIS presents the analysis of five alternatives considered for managing the land and resources of the National Forests in Mississippi, describes the affected environment, and explains environmental effects of these alternatives. The revised forest plan guides the natural resource management activities on the Forests and provides a detailed description of the alternative that the Forest Service recommends for implementation.

1.2 Purpose and Need for Action

The proposed action is to produce a revised forest plan which will guide resource management activities on the National Forests in Mississippi for the next 10-15 years. Forest plans are required by the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA), as amended by the National Forest Management Act of 1976 (NFMA). The NFMA regulations require forest plans to be revised on a 10-15 year cycle or sooner when significant changes in conditions or demands occur in the forest plan coverage area. NFMA also requires forest supervisors to review the conditions on lands covered by a forest plan at least every five years to determine whether significant change has occurred.

The current forest plan for the National Forests in Mississippi went into effect in 1985 and has been amended 18 times to date. Periodic reviews have identified numerous areas where conditions have changed since 1985. In some cases, new scientific understanding evolved, monitoring direction needed to shift to more important resource concerns, or current direction was not having the intended outcome. For other issues, there were new public priorities, and new desired conditions were needed. In recent years, restoration and maintenance of biodiversity, old-growth forest habitats, and ecosystem management have gained public and scientific interest and have emerged as forest management issues. The amount of time since the implementation of the 1985 forest plan, new scientific understanding, and shifting public interests have all contributed to the need to revise the forest plan.

The National Forests in Mississippi began revision of the 1985 forest plan in 2000 under the existing requirements of the NFMA. In July 2005, the Forests transitioned the forest plan revision process to new 2005 planning rule requirements (36 CFR Part 219). After the 2005 rule was remanded and replaced with a new planning rule in March 2008, the Forests converted to the requirements under the 2008 rule. The 2008 planning regulations were also successfully challenged in court, and the Forests subsequently elected to use the September 1982 version of the NFMA planning regulations (36 CFR 219) to complete the forest plan revision.

1.3 Planning Process

The process for developing forest plans falls within the regulations of the NFMA and the National Environmental Policy Act of 1969 (NEPA). In this process, the forest supervisor is responsible for development and implementation of the forest plan, as well as preparation of the EIS for the forest plan. The forest supervisor appoints and oversees the interdisciplinary team which develops the forest plan and EIS.

Planning actions required by the NFMA and used in this forest plan revision process include:

- Identification of issues, concerns, and opportunities;
- Development of planning criteria;
- Inventory of resources and data collection;
- Analysis of the management situation;
- Formulation of alternatives;
- Estimation of effects of alternatives;
- Evaluation of alternatives;
- Recommendation of preferred alternative;
- Approval and implementation;
- Monitoring and evaluation.

1.4 Scope of Forest Plan Revision and Decisions to be Made

Planning for units in the National Forest System (NFS) involves two levels of decision-making. The first occurs in the approval of a forest plan that sets the direction for managing resources on the entire planning unit. These plans provide forestwide and management area direction and are adjustable through amendment and revision. Approval of the forest plan establishes multiple-use goals, desired conditions, objectives, standards, and guidelines for making future project-specific decisions.

The second level of decision-making occurs during implementation of the forest plan. Proposed site-specific projects and activities must be analyzed and carried out within the framework of the forest plan and be consistent with it.

The primary decisions made in the revised forest plan for the National Forests in Mississippi are:

- Establishment of forestwide multiple-use goals and objectives;
- Establishment of forestwide management requirements (standards and guidelines);
- Establishment of management areas and management area direction, including desired future condition statements;
- Determination of land that is suitable for timber production;
- Establishment of allowable sale quantity (ASQ) for timber;
- Inventory, evaluation, and recommendations for potential wilderness;
- Inventory, evaluation, and recommendations for potential wild and scenic rivers; and
- Establishment of monitoring and evaluation requirements.

1.5 Relationship to Other Documents

This document incorporates by reference (40 CFR 1502.21) the management direction and environmental analysis from the following regional programmatic decisions:

- Revised Route Designation Environmental Assessment, Decision Notice and Finding of No Significant Impact, National Forests in Mississippi, April 29, 2009.
- Lands Available for Oil and Gas Leasing Environmental Assessment, Decision Notice and Finding of No Significant Impact, August 6, 2010.

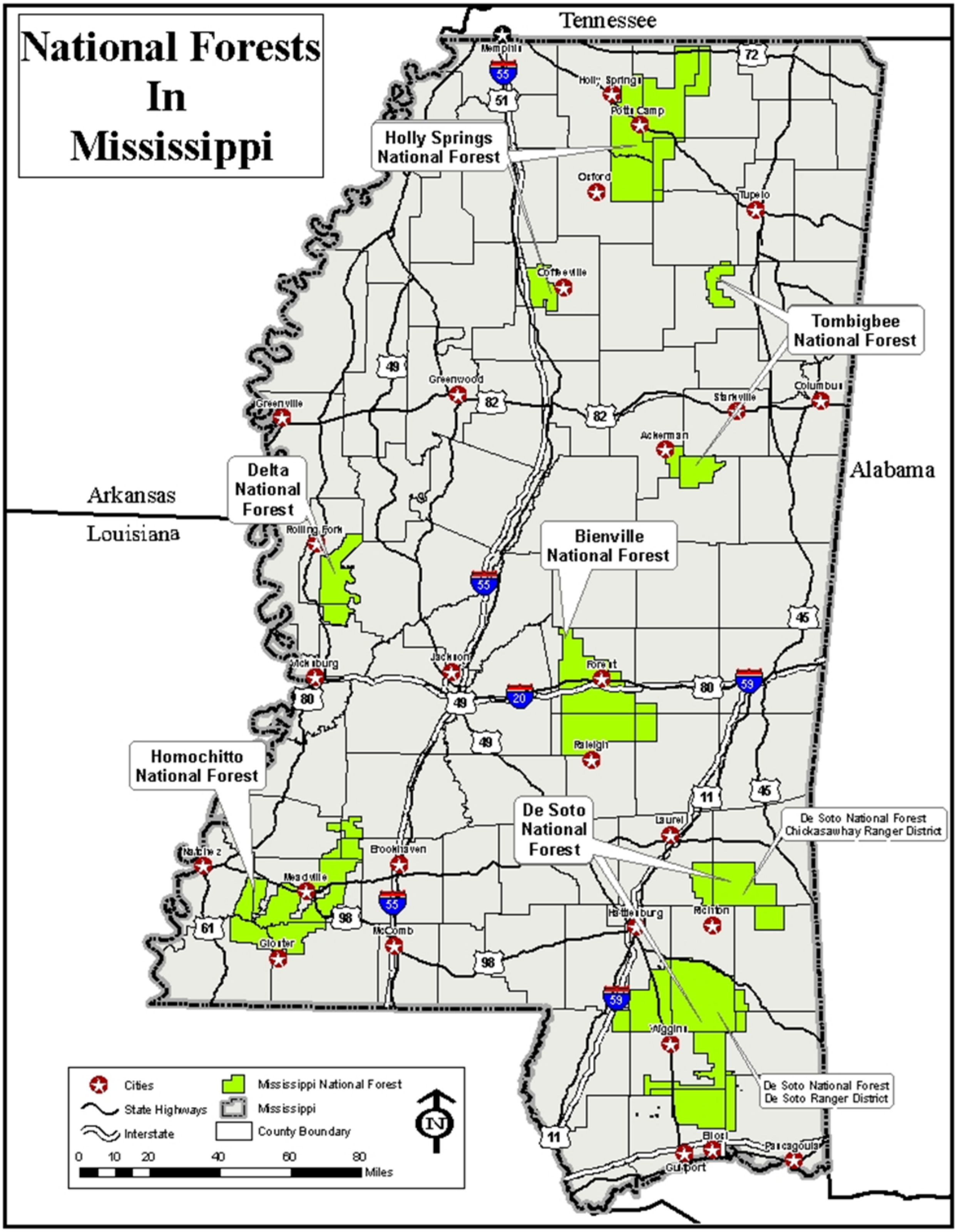

Figure 1. Map indicating the locations of national forest units within the State of Mississippi

1.6 Location and General Description of the Planning Area

Originally established in the 1930s on predominately cut-over, eroded, and abandoned farmlands, the National Forests in Mississippi now cover some 1.2 million acres of public forest land. The Forests consist of six proclaimed national forests (seven ranger districts) widely distributed across the state. Forest headquarters is the Supervisor's office in Jackson, Mississippi. District offices are located in Ackerman, Forest, Laurel, Meadville, Oxford, Rolling Fork, and Wiggins. Although each unit within the Forests has unique characteristics and conditions, they are all managed under one forest plan. See Figure 1 - Map indicating the locations of national forest units within the State of Mississippi.

1.7 Summary Descriptions of the Forests

The six National Forests in Mississippi are briefly summarized as:

- Bienville National Forest – 178,000 acres located in east-central Mississippi
- Delta National Forest – 60,000 acres located in west-central Mississippi
- De Soto National Forest – 518,000 acres located in southeastern Mississippi, comprised of two ranger districts (Chickasawhay and De Soto)
- Holly Springs National Forest – 156,000 acres located in north-central Mississippi
- The Homochitto National Forest – 192,000 acres located in southwestern Mississippi
- The Tombigbee National Forest – 67,000 acres located in northeastern Mississippi

(All acreage figures are approximate.) For detailed descriptions of the national forest geographical conditions go to chapter 3.

1.8 Identifying the Issues

Public involvement in the identification of significant issues and management concerns has been a key part of the planning process. Issues identified by the public, the Forest Service, interested groups, and other state and federal agencies guided the need for change and the development of management alternatives.

For the Forests, the forest plan revision issues that influenced the range of alternatives were identified from topics raised during public scoping efforts. Since the publication of the first Notice of Intent (NOI) to revise the National Forests in Mississippi forest plan in December 1999, approximately 45 public meetings were held across the state. Over 1300 participants attended workshops and meetings statewide, and over 6,000 individual comments were generated. The comments were reviewed by Forest personnel (both district and supervisor's office staff) and categorized by subject. Due to delays and changing rules, additional meetings were added throughout the process to re-visit previous input and identify any potentially new emerging issues. The collective comments from the various public scoping efforts were determined to be relevant for identification of the significant issues that formed the basis of forest plan revision alternatives. Appendix A - Summary of Public Participation provides a detailed discussion of the public involvement process used to identify issues and alternatives for forest plan revision.

In addition to issues identified through public involvement, the USDA Forest Service Strategic Plan for Fiscal Years 2007-2012 influenced which forest plan revision issues were most relevant. Local national forest management direction should be consistent with established national and regional policies, goals and objectives. Forest plan direction for the National Forests in Mississippi focused on implementation of Forest-specific direction consistent with national and regional policy and management emphasis. The primary National Strategic Plan goals and objectives applicable to the Forests planning direction and management included:

- Restore, sustain, and enhance the Nation’s forests and grasslands.
    - Reduce risks from wildfire.
    - Reduce adverse impacts from invasive and native species, pests, and diseases.
    - Restore and maintain healthy watersheds and diverse habitats.
- Provide and sustain benefits to the American people.
    - Provide a reliable supply of forest products over time that is consistent with achieving desired conditions on NFS lands and helps maintain or create processing capacity and infrastructure in local communities.
    - Help meet energy resource needs.
    - Promote market-based conservation and stewardship of ecosystem services.
- Sustain and enhance outdoor recreation opportunities.
    - Improve the quality and availability of outdoor recreation experiences.
    - Improve the management of off-highway vehicle use.

Accomplishment of each of these National Strategic Plan goals and objectives was considered and incorporated into forest plan revision alternatives.

In keeping with the intent of the NFMA, the revised forest plan for the National Forests in Mississippi was developed to provide a strategic framework from which project level decisions will be made. The forest plan does not deal with project specifics, but establishes the framework for identifying the vision, strategy, and design criteria that focus project decisions on accomplishment of desired conditions. Management direction in the 1985 forest plan was also reviewed, and needed management changes were incorporated into the revised forest plan.

The geographic distribution of the six national forest units or ranger districts within the National Forests in Mississippi resulted in each unit having its own unique social-economic and ecological niche. The unique characteristics of each unit generated some diversity in the way planning issues influenced management requirements for that particular unit. Therefore, the planning issues and their disposition varied somewhat between the various units of the Forests.

The significant forest plan revision issues that drove development of plan alternatives are described in the following sections. Any differences (applicability) that vary by national forest unit are noted where unique distinctions are warranted. The issues presented are not all inclusive of the many resource management facets that must be considered and evaluated during forest plan revision. The following section describes the topics that were identified as being the primary issues that defined the development of the forest plan and range of revision alternatives.

1.9 Summary of Issues

The issues described below were identified during the forest plan revision process as subjects of widespread interest concerning management of the Forests and were used to formulate alternatives and analyze environmental effects. These issues were derived from input from the public and concerns from Forest Service personnel, as well as strategic planning goals and objectives. Although a broad variety of issues were identified during the public involvement process and in consultation with other agencies, some issues became significant drivers of different management strategies while others did not notably change or vary by alternative. The following discussion describes the major issues to be addressed during the forest plan revision process.

1.9.1 Native Ecosystem Restoration

Much of the ecological emphasis in the 1985 forest plan was on management prescriptions for the major vegetation types on the Forests, particularly loblolly pine, slash pine, longleaf pine, hardwoods, and mixed pine-hardwoods. Since that time, there has been a shift in emphasis to managing for sustainable ecosystems and restoring and protecting native ecological communities on appropriate sites. Although pines are still the dominant forest type, a major part of today's management focus is on re-establishing native longleaf and shortleaf pine forests on suitable sites now occupied by loblolly and slash pine plantations. Enhancement of hardwood forest types and hardwood components in mixed stands and maintaining bottomland hardwood forests are also important priorities, as are efforts to maintain and protect rare communities. Emphasis on restoring the national forest to more natural conditions and native ecosystems was a widely-supported recommendation from the public, stakeholders, and staff.

1.9.2 Biodiversity and Species Viability

Maintaining a diversity of habitats for all species on the National Forests in Mississippi, especially threatened or endangered species, and enhancing native wildlife habitat were prominent desired conditions identified by stakeholders and our agency partners. Ecological communities provide the foundation for species diversity and, in the planning process, 15 major ecological communities and 9 rare systems or localized features were identified within the Forests. These communities provide habitat for species with viability concerns as well as a mosaic of habitats for desirable wildlife across the Forests. Vegetation management practices such as prescribed fires, thinning, and regeneration are the primary tools used on the Forests to influence vegetation composition and structural diversity of habitats. Forest management strategies that restore native ecosystems and provide a variety of species habitat conditions are important aspects in addressing this issue.

1.9.3 Forest Health

Forest health issues identified during forest plan revision included a variety of needs such as forests resilient to insects, diseases, and damaging natural disasters; forests naturally adapted to local environmental conditions; and forest structure and composition suitable for sustaining forest health into the future. Achieving healthy forests requires integration of a number of components. Healthy forest conditions involve a balance of physical conditions and essential resources; desired ecological systems and species diversity; resilience to abiotic and biotic stressors; and a diversity of vegetation seral stages, ages, and structure. Management practices considered for enhancing forest health included using commercial harvests where appropriate to restore sites to native ecosystems, creating openings for regeneration and establishment of desirable species, improving resilience to storm events and other stressors through healthier stand densities, reducing tree mortality caused by southern pine beetle outbreaks, and using prescribed burns to reduce the impacts of disease and competition on developing longleaf pine seedlings.

Control of non-native invasive species, forest pests, and pathogens was identified as a particularly important component of forest health. Although control of pest populations was recognized in the 1985 forest plan as important in achieving resource management objectives, the increasing spread of noxious weeds over the last two decades has become an increasing problem. Nonnative invasive species, particularly plant species such as cogongrass and kudzu, were generally not a management concern in 1985. Currently, non-native invasive species have been identified at the national level as one of the most serious threats to national forests, and their continued spread throughout the State of Mississippi is causing increasing damage to forest health. Consistent management practices aimed at reducing the spread of invasive species, controlling important pests such as southern pine beetle, and improving overall forest health are all included in this issue.

1.9.4 Vegetation Management for Timber

Emphasis on sustained yield of forest products through commercial harvesting was a major management priority in 1985. It was anticipated that there would be an increasing demand for wood products that would be met through more efficient and intensive vegetation management and harvesting practices. Although meeting multiple resource needs was also an important objective, there was a strong emphasis on generating the highest return from the timber sale program. Since then, forest health and native ecosystem restoration have become the main focus of vegetation management activities, with commercial harvesting viewed as one of the methods for achieving habitat and ecological results. Today, vegetation management emphasizes improving the landscape condition, and practices such as prescribed burning, thinning, and regeneration are used to create and enhance habitats for threatened and endangered species, restore native ecosystems, and minimize impacts of insects and disease. Forest products are produced as a result of these practices and still serve important economic needs through niche markets such as poles and quality sawtimber.

Over the course of forest plan revision, public feedback on the use of vegetation management practices as tools for creating desired conditions represented a broad range of perspectives, varying from wanting to reduce timber harvesting to supporting an expanded program. These issues, the potential use of forest wood and fiber as biomass for energy production, and the effects of carbon sequestration were all identified as concerns. In addition to management direction, the rates at which progress could be made toward desired conditions within anticipated budget and staffing levels are all important considerations.

1.9.5 Fire Management

Historically, the role of fire in shaping the native plant and animal communities in Mississippi was not well understood, and the use of prescribed burning as a tool for reversing the loss of habitat and native communities was not widely practiced. Today, an aggressive prescribed fire program on the Forests is returning the national forests to a more historic fire regime and at the same time maintaining human safety as the highest priority. While the prescribed burning program in 1985 averaged 124,000 acres annually, the average in recent years was over 200,000 acres, and wildland fire occurrence has been reduced.

In the forest plan revision process, creating appropriate fire regimes for native ecological communities is recognized as a necessary part of the desired conditions and objectives for ecosystem diversity. This strategy reflects increasing knowledge of the critical role of fire in restoring habitats for fire-dependent species such as red-cockaded woodpecker and gopher tortoise, and maintaining desirable stands of longleaf and shortleaf pines and rare communities such as prairies and pitcher plant bogs. Management of wildfires and prescribed burns can serve to restore and maintain native ecosystems while also protecting national forest and adjacent lands from the negative effects of fire. Since fire-dependent native ecosystems and habitats for endangered species play a major part in so many native ecosystems on the Forests, management of fire was identified as a significant issue.

1.9.6 Old Growth

Although most of the lands that became the National Forests in Mississippi had been mostly cut over before becoming part of the National Forest System, there are stands of trees across the Forests that over the years have reached the age and structural conditions classified as old growth under guidance definitions established by the Southern Region. Some tracts were missed or left with significant residual overstory after the harvests that occurred in the early 1900s. More old-growth stands was a desired condition expressed during public scoping, and it was recognized that old-growth areas provided biological richness, wildlife habitat, recreation and social values, high-value wood products, and research opportunities. The Guidance for Conserving and Restoring Old-Growth Forest Communities on National

Forests in the Southern Region (USDA Forest Service 1997) needs to be followed in developing alternatives for the revised forest plan, and incorporating a mix of old-growth areas into forest management strategies was identified as a significant issue.

1.9.7 Watersheds and Water, Soils, Aquatic Resources, Riparian Environments

The streams, lakes, meandering rivers, and backwater sloughs that define the character of the land in Mississippi also shape the ecological makeup and recreational uses of the national forest units scattered across the state. Public comments identified clear lakes and streams, water quality protection, and watershed restoration as the biggest concerns for water resources. Due to the intermingled nature of land ownership, many of the impacts to water resources happen upstream or downstream of lands managed by the Forest Service and outside agency control. In looking at management practices on national forest lands aimed toward achieving desired conditions, the focus needs to be on strategies for updating best management practices, working with partners and other agencies to improve water quality, restoring and protecting riparian ecosystems, and providing a refuge for aquatic life and waterfowl.

1.9.8 Access Management

The balance between access to national forest lands and protection of natural resources is a challenge for most national forests, including the National Forests in Mississippi. While some stakeholders want to see motorized access increase, others feel that road construction should be limited and some existing roads decommissioned. With a mix of private and public lands within the proclamation boundaries of the National Forests in Mississippi and past construction for recreation and management needs, a mature roads system has already been constructed as part of the national forest units in Mississippi. In looking at needs over the next 10-15 years, the primary concerns are maintaining this existing system, addressing a backlog of repairs and upgrades, public safety, and addressing improvements for environmental protection.

Use issues on roads and trails are also affected by national regulations, particularly the Travel Management Rule (36 CFR Parts 212, 251, 261, and 295) which requires national forests and grasslands to designate roads, trails, and areas open to motorized vehicles. In April 2009, the National Forests in Mississippi amended the 1985 forest plan to conform to Travel Management Rule requirements prohibiting motor vehicle use off of designated roads and trail and outside of designated areas. The results of this decision will also need to be incorporated into all alternatives.

1.9.9 Recreation

At the time the 1985 forest plan was developed, it was thought that there was an adequate supply of recreation opportunities to meet or exceed anticipated public demand. The 133 miles of horse and hiking trails, for example, exceeded existing demands. Now, the 265 miles of hiking, biking, and horse trails plus the 144 miles of designated motorized trails make the Forests the major trail provider in the state, but still falls short of demand in some areas. Designated and dispersed recreation opportunities continue to grow in popularity as visitation continues to increase. Supply no longer exceeds demand, and providing sufficient opportunities while maintaining existing facilities is a growing challenge. While the many public comments received during forest plan revision reflected the importance of National Forest System lands for recreation within the state, opportunities for expansion of facilities and trails is expected to be limited under anticipated future budgets.

1.9.10 Special Area Designations

Special area designations include administratively-recognized, specific geographic locations within the Forests such as wilderness, wild and scenic rivers, botanical areas, and research natural areas that have special management restrictions. The public identified several potential areas for review and consideration during scoping. The Sandy Creek RARE II Further Study Area on the Homochitto National Forest was considered for qualification as wilderness designation, and new river segments adjoining the Black Creek Scenic River on the De Soto National Forest were proposed and evaluated to see if they were eligible for possible inclusion as a wild and scenic river (see appendix C). Numerous botanical areas and new research natural areas were also proposed. Appropriate designations and applicable management direction for these areas has been evaluated as an important issue.

1.9.11 Land Use and Ownership

The population of Mississippi was approximately 2.5 million in the 1980s. Currently, the State population is over 2.9 million, with over 3 million residents projected by 2030. With an increasing population, development of private lands adjacent to the Forests has increased dramatically since 1985. This was particularly true for the De Soto National Forest close to the Gulf Coast and portions of the Holly Springs National Forest close to Memphis, Tennessee. The wildland-urban interface was not an issue in 1985 but is a growing factor in management decisions today. Also, land acquisition priorities in the 1985 forest plan were on consolidating ownership to meet the timber demands more efficiently and provide access for removal of market goods. Land acquisition priorities today still focus on consolidating ownership, but the intent is to reduce fragmentation of forest communities, provide protected habitat for wildlife, protect heritage sites, and preserve desirable ecological communities. Today's land ownership focus also includes lands that may not be contiguous but would preserve and enhance high-value habitats, rare species, or critical watersheds.

The current challenges faced by the Forests associated with managing public lands that are interspersed with numerous small parcels of private lands are typical for national forests in the South. Management direction will need to be developed that recognizes that changes in population and spreading urban development present problems in conducting effective management programs to control nonnative invasive species, carrying out prescribed burning to reduce fuel hazards and restore desired ecosystems, restoring habitat for wildlife and rare species, and protecting water quality on the national forests from upstream activities.

1.9.12 Climate Change

The forest plan set in place in 1985 was 16 years after Hurricane Camille, enough time for some of the storm effects to fade. Then on August 29, 2005, Hurricane Katrina made landfall causing catastrophic damage to the Mississippi Gulf Coast. Hurricane Katrina tracked inland across Mississippi causing extensive resource damage on the De Soto and Chickasawhay Ranger Districts in south Mississippi and varying levels of damage to the other five national forests. Across the Forests, more than 300,000 acres of timber received moderate to heavy damage, and high winds and downed trees blocked roads, closed trails, damaged facilities and recreation sites, and damaged red-cockaded woodpecker trees, with several red-cockaded woodpecker clusters lost entirely. Post-Katrina salvage operations removed approximately 300 million board feet of damaged timber, but high fuel levels continued to be a concern for wildfires on both national forest system lands and adjacent properties for years.

The increasing weather variability and climate changes projected for the future were not addressed in the 1985 forest plan but are expected to be a growing issue over the life of the revised forest plan. Although simulations indicate a range of potential climate change effects for the southeastern United States in the coming years, the key factor expected to affect Mississippi forests in the near-term is an increase in extreme weather events. During the revision process, strategies for addressing the effects of increasing weather disturbances and responding to anticipated climate changes will need to be examined.

1.9.13 Minerals Management

In August 2010, the National Forests in Mississippi updated its minerals management forest plan direction with issuance of the Lands Available for Oil and Gas Leasing Environmental Assessment and associated decision notice and finding of no significance impact (signed August 6, 2010). The 2010 minerals management decision is being incorporated into the revised forest plan. The 2010 minerals management decision made all lands on the National Forests in Mississippi available for Federal oil and gas leasing, except for congressionally designated wilderness areas (Black Creek and Leaf) and the 2,558 acre Sandy Creek RARE II Further Study Area located on the Homochitto National Forest.

The Sandy Creek RARE II Further Study Area is an area identified in the set of inventoried roadless area maps contained in the Forest Service Roadless Area Conservation, Final Environmental Impact Statement Volume 2 dated November 2000. In 2010, a minerals management decision for this area was deferred due to ongoing federal litigation concerning the Agency’s 2001 Roadless Rule. Minerals management options for the Sandy Creek Study Area are being considered and evaluated in this environmental impact statement.

1.9.14 Economic Benefits

Vegetation management, minerals development, and recreation use are the traditional forest management activities that generate the majority of revenues from National Forest System lands. In addition to outputs that can be readily valued, less quantifiable ecosystem services that benefit society are also provided by National Forest System lands such as wildlife habitat, clean water, carbon storage, and scenic landscapes. Categories of activities associated with national forests that were identified by the public as important to local economies included timber products, recreation and tourism, hunting and fishing, oil and gas leasing, and revenue sharing payments for schools and roads. Economic benefits to the communities will need to be integrated into management strategies, but the pace of progress toward desired conditions is not expected to create a significant change to local economies, even under the most aggressive alternative.

1.10 Planning Records

Additional background information, maps, and supporting documents used in the National Forests in Mississippi forest plan revision process are contained in the planning records. These records are maintained at the Forest Supervisor’s office as required by 36 CFR 219.10(h). The planning record in its entirety is incorporated here by reference. Specific records are referenced throughout the EIS and forest plan as appropriate. The planning records are available for review during regular business hours

At the end of this EIS is a glossary that defines many of the terms used in this document and in the forest plan, and a references cited section which lists literature and references cited in the EIS.

Chapter 2. Alternatives

2.1 Purpose and Organization

Chapter 2 presents alternatives for managing the National Forests in Mississippi (Forests). The chapter is divided into four major sections:

- Process used to develop alternatives
- Alternatives considered but eliminated from further detailed studies
- Alternatives considered in detail
- Comparison of alternatives

2.2 Process Used to Develop Alternatives

As part of the forest plan revision process, alternatives are developed to consider a range of strategies to manage the land and resources of the National Forests in Mississippi with the intent of moving from current conditions to desired future conditions. These alternatives illustrate different management scenarios and acres analyzed to provide the basis for selecting the alternative that most effectively addressed issues and public benefits. Development of alternatives was based on the issues and need for change described in chapter 1 and the analysis of the management situation in appendix A. Alternatives also had to be consistent with resource integration and management requirements of the implementing regulations for the National Forest Management Act (NFMA) [(36 CFR 219.12(f)].

Alternative development began with analysis of the significant issues identified during the earlier stages of the planning process. These issues reflected input from the public and Forest Service personnel, as well as strategic planning goals and objectives. They identified subjects of widespread interest concerning management of the National Forests in Mississippi.

Benchmark analysis was used to define the range within which alternatives can be constructed [36 CFR 219.12(e) (1)]. Benchmarks display physical, ecological, and technical capabilities. They are not limited by Forest Service policy or budget, discretionary constraints, or spatial feasibility. Benchmarks are physically and technically implementable, but may not be operationally feasible. Benchmarks provide reference points for comparing developed alternatives. Appendix B provides more information on the benchmarks.

A broad range of reasonable alternatives was considered, based, in part, on the following criteria:

- Alternatives are within the boundaries of the benchmarks.
- Alternatives respond to issues and concerns raised during the planning process.
- Alternatives respond to national and regional management direction.
- A variety of management practices would be applied in the various alternatives.
- A range of outputs would be produced between alternatives.

2.3 Alternatives Considered but Eliminated from Further Study

A broad range of alternatives was originally considered during the analysis process. Management scenarios for potential alternatives were analyzed for a variety of issues including effectiveness in meeting desired conditions, policy requirements, and implementation feasibility. The following briefly describes the eliminated alternatives and discusses the reasons for elimination.

Early in the revision process, comments were made to consider a strong commodity-driven focus that would emphasize production of high levels of goods and services for local markets. Under this scenario, timber management would provide a greater sustained yield of wood products with an emphasis on high-quality sawtimber, as well as providing public demand for game species for hunting. In a similar manner, comments were also made to expand developed and dispersed recreation opportunities to a broader variety of settings across the state. Based on analysis, these options were considered but eliminated from further study. Although the Forests are capable of producing a sustained yield at a much higher level of timber production, and expanded recreation opportunities are possible within the land base, maximization of these resources would come at the expense of other resources. Anticipated agency funding levels would not support higher levels of timber production or expanded recreation facilities with their associated increase in operational and maintenance costs. Also, the multiple-use mandate would not be met in emphasizing singular resource programs. While these alternatives were not carried forward, portions of these scenarios were incorporated into alternatives C, D, and E.

Another similar alternative considered but eliminated addressed comments about low levels of timber harvest on the Forests and recommendations for at least harvesting annual growth. This alternative would set harvest levels to the growth estimated through forest inventory. This alternative was not considered in detail because it would not be physically or biologically sustainable over the long term. At this level of timber harvest, there would be soil and water concerns for erosion damage, increased sedimentation, and reduction of water quality. There would also be biological concerns for reduction of species diversity and loss of habitat for threatened and endangered species. In addition, this alternative was not considered feasible because it would not meet the long-term sustained yield requirements of the NFMA. Another related alternative that considered production near long-term sustained yields was not carried forward because of similar unacceptable levels of environmental impact and lack of funding and staffing for these more intensive management levels.

Other alternatives considered looked at expanded emphasis on red-cockaded woodpecker habitat. Comments were made during the forest plan revision process to consider emphasizing thinning existing forest settings for red-cockaded woodpecker and forgoing regeneration and restoration of longleaf pine ecosystems to accommodate immediate habitat improvement. While this alternative would provide appropriate habitat in the short term, it was not considered in detail because it would not sustain optimal habitat over the long term. A mix of thinnings and regeneration is needed to sustain optimal habitat for red-cockaded woodpecker populations.

Another red-cockaded woodpecker alternative considered the potential to supplement habitat for red-cockaded woodpecker populations located on the Noxubee National Wildlife Refuge adjoining the Tombigbee National Forest. Work is underway on the Noxubee Refuge to increase red-cockaded woodpecker populations, and this scenario would shift Forest resources to the Tombigbee to support this expansion. This option was closely examined and modeled and found to be a possible opportunity in the future but not a viable option at this time. As population objectives are reached on the Noxubee in coming years, expanded habitat on the Tombigbee may be appropriate, but until red-cockaded woodpecker populations reach higher levels, this alternative would pull limited Forest resources from other areas and impede the recovery efforts for red-cockaded woodpecker populations on existing habitat management areas on the National Forests in Mississippi.

2.4 Alternatives Considered in Detail

Five alternatives were considered in detailed analysis, including the no-action alternative which would continue management under the 1985 forest plan as amended. Four action alternatives were developed in response to issues and concerns identified during the planning process as previously described in chapter 1. For ease of understanding, these alternatives have been "named" as follows:

A. Custodial Management Alternative

B. No-action Alternative

C. Proposed Action Alternative

D. Accelerated Restoration Alternative

E. Enhanced Forest Health Alternative

The alternative names suggest the general direction or theme of an alternative but should not be thought of as being exclusive. For example, the Enhanced Forest Health Alternative is not the only alternative that would implement projects to enhance forest health. However, the name was chosen to help in the understanding of what that alternative (or one of the other alternatives) would emphasize in the way of proposed project implementation.

Each alternative combines land allocations, management practices, and activity schedules which when implemented would provide a unique set of resource outputs and environmental consequences. Each alternative was developed to be fully implementable and achievable. However, some alternatives could require shifts in resources.

2.4.1 Elements Common to All Alternatives

All alternatives were designed to comply with applicable laws, regulations and policy. This included compliance with NFMA legal and regulatory requirements regarding resource protection, vegetative manipulation, silvicultural practices, even-aged management, riparian areas, soil and water protection, and community diversity and species viability. All alternatives were designed to meet health and safety standards and included the concepts of multiple-use, sustained yield, and ecosystem management.

In addition to meeting laws, regulations, and policies, the alternatives developed in detail reflected considerable agreement on primary issues. The extended public involvement period that evolved during changing Planning Rule requirements and delays for hurricane recovery allowed more opportunities for Forest Service staff to work with stakeholders and the public on important issues and desired conditions. While many different interests and concerns were identified by participants, there was considerable agreement on overarching issues. In particular, the emphasis on native ecosystem restoration, species diversity, and habitat improvement for threatened and endangered species received widespread support among the public, Forest Service staff, other agencies, and interested parties. Based on this collaborative consensus, the following management goals and strategies were common to all alternatives considered in detail.

Restore native ecological systems –Restoration of native ecological systems was a major desired condition for stakeholders and served as the primary framework for revising the forest plan. Twenty-four native ecological systems were identified on the Forests, including nine unique communities or uncommon local features. Priorities for achieving desired conditions included conversion of loblolly and slash pine stands to longleaf pine and shortleaf pine-oak ecosystems, restoration of floodplain forests, and continued maintenance and enhancement of native hardwood ecosystems and unique communities such as native prairies and bogs.

Promote diversity of species – One of the basic tenants in revising the forest plan was that managing for a diversity of healthy native ecosystems was integral to providing appropriate ecological conditions for a diversity of plant and animal species. In the revision process, a list of all potential species that could occur on the National Forests in Mississippi was developed and analyzed through a series of collaborative meetings with technical experts and taxonomic specialists familiar with the plant and animal species across Mississippi. Species that could possibly occur on the Forests were further evaluated through a series of iterative screenings and identified as federal threatened and endangered species, sensitive species, and locally rare species. The specific needs and habitats of species were addressed, primarily through ecosystem diversity management strategies, but also through integrated programs for soils, water, fire regimes, and other resource areas. Threatened and endangered species protection and habitat enhancement were important priorities in all alternatives considered, and the needs of the nine threatened and endangered species identified as potentially occurring on the Forests were emphasized.

Manage for healthy forests – A shift in focus from commodity production to native ecosystem restoration and forest health was emphasized. Vegetation management practices support a variety of integrated resource strategies including converting loblolly and slash pine plantings to native ecosystems, creating a diversity of habitats, improving resilience to natural disturbances and a changing climate, reducing impacts of insects and diseases, controlling non-native invasive species, and producing quality timber commodities.

Conserve old-growth communities – Diversity of tree ages, from regeneration to old growth, was emphasized to support a sustainable mix of ecological conditions across the landscape. A strategy to establish old-growth stands across all ecological systems and all districts, with at least 10 percent of all forested ecosystems in old-growth conditions was incorporated into all the alternatives.

Restore historic fire conditions – On the National Forests in Mississippi, periodic prescribed burning has become an important tool for recreating historic fire regimes and reducing the risk of catastrophic fires while restoring conditions that favor desirable native ecosystems and habitats for threatened and endangered species. While all alternatives included a prescribed burning component aimed at restoring historic fire conditions, the average annual prescribed fire program levels varied by alternative.

Manage for healthy watersheds – Productive soils, clean water, and clean air were important desired conditions identified by stakeholders and are essential to sustaining the ecological function and productive capacity of National Forest System lands. Use of best management practices for sustaining and improving watershed areas within national forest control while working cooperatively with other agencies and landowners to improve statewide watershed health were included in all alternatives. Desired outcomes that relate to improving or sustaining a diversity of aquatic species and water-related ecosystems were also emphasized.

Maintain sustainable infrastructure and access – The main priorities for managing the roads, trails, and facilities that make up the Forests infrastructure were safety and maintenance of existing systems. This included backlogged repairs and upgrades, improvements for environmental protection, disposal of facilities that are no longer needed, and rehabilitation of user-created trails and roads. The balance sought emphasized improved maintenance of existing roads and trails, with a focus for the roads system on reduced maintenance levels and improvements to important public safety and ecological features, such as bridges and stream culverts. The emphasis for the trails system was on sustaining a forestwide network of trails for a variety of uses across the state and bringing existing designated trails up to improved conditions. Partnerships with other agencies, communities, and special interest groups were identified as key to offering additional seasonal access to wildlife management areas and expanding or adding new trails.

Maintain sustainable recreation – Strategies for sustaining outdoor recreation opportunities on the National Forests in Mississippi under anticipated funding levels focused on maintaining and improving existing dispersed recreation opportunities and developed recreation sites, with the addition of new facilities and amenities dependent on expanding local and state-wide partnerships. Instead of sustaining a full mix of recreation opportunities on every unit, recreation use would be considered from a forestwide perspective with emphasis on sustainable programs and infrastructure that minimize impacts to the environment.

Provide stable economic benefits – The national forest activities that generate the majority of the revenues that feed back into the local economy in Mississippi come from timber, minerals, and recreation. As a result of restoring native ecosystems to appropriate sites and maintaining healthy and resilient forests, there should be a steady flow of economic benefits back to local communities.

Adapt to changing conditions – An increase in extreme weather events is the climate change factor most likely to affect the Forests in the next 10-15 years. In response to potential effects from climate change, strategies in the alternatives include reducing vulnerability by maintaining and restoring resilient native ecosystems, enhancing adaptation by reducing impacts from serious disturbances and taking advantage of disruptions, using preventative measures to reduce opportunities for forest pests, and mitigating greenhouse emissions by reducing carbon loss from hurricanes.

2.4.2 Summary of Alternatives

The five alternatives considered in detail are described below. These alternatives are presented in order of increasing management levels, with Alternative A representing a minimal management approach that lets natural processes prevail. Alternative B is the no-action alternative and depicts the current level of work on the Forest under the amended 1985 forest plan. Alternative C is the preferred alternative and describes a level of management and direction that will move the Forest toward desired conditions at a realistic pace under current agency funding levels. Alternative D accelerates the rate of progress toward desired conditions by restoring more acres of native ecological communities through additional regeneration activities. Alternative E further increases progress toward desired conditions for healthy forests by treating more acres of dense forest that need thinning to be more resilient to damage from insects and storms. Alternatives C, D and E are projected to require additional funding opportunities and staffing above current budget levels but would make faster progress toward desired conditions. The following comparisons provide additional details and distinctions among the alternatives.

Alternative A – Custodial Management Alternative

This alternative allows natural succession to dominate the landscape with minimal intervention by active management practices to achieve desired conditions or management goals. Resource management activities would focus on the protection of natural resources and meeting legally mandated requirements. Management for the conservation and recovery of threatened and endangered species and their critical habitat would dominate as the primary management focus or emphasis. Ecosystem management strategies would favor natural succession and implementation of low intensity forest health management practices. Best management practices and regulations would be followed to protect water quality and riparian areas, but watershed restoration efforts would be limited. Recreation opportunities would emphasize low impact recreation opportunities (favor nonmotorized activities). 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 management action. However, resource management intervention actions would only be implemented in response to severe or catastrophic weather events or epidemic level pest outbreaks that pose human health and safety concerns. Limited emphasis would be placed on control of invasive species due to reduced resource capabilities. Roads not needed for legal requirements and other resource needs would be closed or obliterated.

The following are distinguishing features for alternative A:

Native Ecosystem Restoration and Forest Health

- Vegetation management activities would attain an average annual timber production level of 7.0 million cubic feet (MMCF) [37 million board feet (MMBF)] from red-cockaded woodpecker habitat maintenance and enhancement, and salvage and sanitation harvests from wind or southern pine beetle occurrences.
- Longleaf restoration on the Bienville, De Soto, and Homochitto National Forests outside red-cockaded woodpecker habitat management areas would not be emphasized.
- Natural succession would result in a greater pine and hardwood component on all Forests. Shortleaf and loblolly pine management areas would be reduced with natural succession to hardwoods.

Fire Management

- Reduced emphasis on management by ignited prescribed fires and more reliance on wildland fire occurrences to achieve desired conditions and natural resource benefits.
- Prescribed fire applications would focus on threatened and endangered habitat management requirements with an average annual burn program objective of 121,000 acres or less.

Community Diversity and Species Viability

- Over the long term, community diversity and species viability would likely decline.
- This alternative would promote a tendency towards late succession with locally reduced species richness and minimal management practices to prevent species loss.
- Red-cockaded woodpecker resource management activities would do the minimum necessary to sustain populations and would be focused only in designated red-cockaded woodpecker habitat management areas.
- Population expansion potential for gopher tortoise would be reduced compared to other more intensive alternative management themes.

Old Growth

- Emphasis would be placed on providing old-growth areas through natural succession with little human intervention evident over a long period of time. The availability of medium sized (100 acre or more) old-growth stands would be left to chance and the fact that there would be less resource management activity.

Recreation Management

- No new trails, facilities, or recreation opportunities would be added, and maintenance activities would be minimal to meet safety standards.
- Conditions over time would favor areas of more primitive character with less evidence of human intervention apparent on the landscape.

Special Areas

- Current management of existing designated areas would continue and no new designations for wilderness areas, wild and scenic rivers, research natural areas, or other special areas would be recommended.

Minerals Management

Current management for oil and gas leasing would continue. However alternatives A would not authorize new oil and gas leasing in the 2,558 acre Sandy Creek RARE II Study Area.

Economic Conditions

- Reduced management activities would result in fewer commodity outputs, particularly wood products.

Alternative B – No-action Alternative

The no-action alternative reflects continued implementation of current forest plan direction as amended, consistent with expected budget and staffing levels. This alternative serves as a baseline to measure opportunity cost trade-offs associated with proposed changes to management direction. Production of both commercial wood products and creation of a variety of wildlife habitats would be emphasized. Developed and dispersed recreation opportunities would be in a variety of settings—both natural and managed. Water quality and riparian areas would be protected through implementation of best management practices and streamside management zones, with minor investment in small watershed restoration projects. Large- and medium-sized blocks of old-growth would be provided only on land classified as not suitable for timber production. Small-sized old-growth blocks would be provided as regulated late serial components. Access would be developed, maintained, and used as needed to meet goal of balanced age classes, wildlife habitat, and production of timber products.

The following are distinguishing features for Alternative B:

Native Ecosystem Restoration and Forest Health

- Vegetation management activities would attain an average annual timber production level of 12.0 MMCF (60 MMBF)[1].
- In the upper coastal plain, hardwood management strategies would focus on no net loss of hardwoods. In the lower coastal plain, hardwood retention guidelines would be applied in areas that have less than 20 percent hardwood component.
- Longleaf restoration on the Bienville, De Soto, and Homochitto National Forests would focus on restoring longleaf to its historical range.
- Pine and hardwood management would continue current management direction on loessial soils of the Homochitto National Forest.
- Current management emphasis on shortleaf would continue only on the Holly Springs National Forest. Shortleaf management would not be emphasized on other forests.

Fire Management

- Utilize prescribed fire to reduce hazardous fuels, facilitate management, and improve wildlife habitat as part of the Healthy Forest Initiative.

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[1] Note: the 1985 forest plan had an allowable sale quantity of 51 MMCF or 254 MMBF. The 60 MMBF presented here represents the level actually produced over the past six years.

- Annual prescribed fire program level would be maintained near current levels with an averaging annual burn program objective of 190,000 acres or more.

Community Diversity and Species Viability

- There would be no expected change in current community diversity and species viability.
- Forest and woodland ecosystems would be managed to restore or maintain native communities and provide the desired composition, structure and function.
- Red-cockaded woodpecker management would continue under interim guidelines and appropriate regional guidelines. The tentative habitat management areas from the red-cockaded woodpecker final environmental impact statement (1995) would continue to be used as boundaries for the red-cockaded woodpecker habitat management areas.
- Protective measures would restrict mechanical equipment in the vicinity of active gopher tortoise burrows, and management under present timber rotation and fire management regimes would continue.

Old Growth

- Areas of old growth would be provided by previously designated wilderness areas, withdrawn special management areas, and regulated late serial components. The availability of medium sized (100 acre and more) old-growth stands would be left to chance and the fact that resource management activity would be at a low level.

Special Areas

- Continue management of existing designated special areas.
- No new areas would be recommended.

Minerals Management

- Current management for oil and gas leasing would continue. However alternative B would not authorize new oil and gas leasing in the 2,558 acre Sandy Creek RARE II Study Area.

Recreation

- Maintain current recreation management opportunities subject to available funding and staffing levels.

Economic Conditions

- No change in recent levels of commodity outputs.

Alternative C – Proposed Action Alternative (Preferred Alternative)

The proposed action alternative is biologically based and driven, with emphasis on restoring natural resources and natural processes and creating and maintaining diverse wildlife habitats. Restoration of native ecological communities would be based on the ecological potential and capability of the land. Restoration activities would provide a mix of wildlife habitat conditions favorable for game and non-game species. Restoration activities would produce both large and small openings. Water quality and riparian areas would be protected through implementation of best management practices and streamside management zone, with minor investments in priority watershed restoration projects. A variety of recreation settings and opportunities would occur in areas where they would be compatible with restoration activities and in areas where restoration is not occurring. A balanced mix of small and medium-sized old-growth forest community types would be established. Access would be reduced as needed to restore and protect aquatic systems, soils, and plant and animal communities.

The following are distinguishing features for alternative C:

Native Ecosystem Restoration and Forest Health

- Vegetation management activities would attain an average annual timber production level of 18 MMCF (91 MMBF).
- Hardwood; and pine and hardwood management types would be grown and maintained where ecologically feasible on all districts.
- Longleaf pine on the Bienville, De Soto, and Homochitto National Forests would be restored within its natural range but with longer rotations and lower stocking density consistent with red-cockaded woodpecker habitat management requirements.
- Shortleaf and loblolly pine management types on the Bienville, Holly Springs, and Tombigbee National Forests would be grown and maintained where ecologically feasible. There would be an emphasis on restoration of shortleaf based on ecological potential and land capability.

Fire Management

- Focus on burning historically maintained fire ecosystems to preserve natural diversity.
- Annual prescribed fire program level would be greater than current management levels with an average annual burn program objective ranging of 220,000 acres. An increase in prescribed fire applications would be necessary to support ecosystem restoration goals and objectives.

Community Diversity and Species Viability

- Forest and woodland ecosystems would be managed to restore or maintain native communities that would provide the desired composition, structure and function. Emphasis would be placed on maintaining forest and plant community types not abundant on private lands.
- Expanded opportunities for additional red-cockaded woodpecker population growth would be provided on suitable areas outside of designated habitat management areas.
- Expansion of red-cockaded woodpecker habitat management areas would extend across the entire district on the Bienville and Chickasawhay Ranger Districts.
- Conservation management areas would be developed on the De Soto Ranger District for sandhill cranes.
- Expanded opportunities for conservation and recovery of gopher tortoise populations would be provided by promoting improved habitat conditions on additional suitable habitat areas than current management provides.

Old Growth

- Implementation of the regional old-growth strategy would achieve a balanced mix of small and medium-sized old-growth forest community types with a goal to meet species viability and diversity requirements.
- There would be sufficient levels of old growth in all communities for biological needs and desired conditions.

Special Areas

- Approximately sixteen botanical areas would be designated and two research natural areas proposed for designation.

Minerals Management

- Current management for oil and gas leasing would continue, and alternative C would authorize new oil and gas leasing in the 2,558 acre Sandy Creek RARE II Study Area subject to the 2001 Roadless Area Conservation Rule restrictions.

Recreation Management

- A back country special emphasis area would be developed on the Tombigbee National Forest (Ackerman Unit).

Economic Conditions

- Increased management activities would result in slightly increased commodity outputs and jobs, primarily in wood products.

Alternative D – Accelerated Restoration Alternative

This alternative, like the proposed action alternative, is biologically based and driven, with emphasis on restoring natural resources and natural processes, and creating and maintaining diverse wildlife habitats. Restoration of native ecological communities would be based on the ecological potential and capability of the land, and the pace of restoration would be accelerated by additional regeneration activities. Restoration of native ecosystems would provide a mix of wildlife habitat conditions favorable for game and non-game species, and both large and small openings would be produced. Water quality and riparian areas would be protected through implementation of best management practices and streamside management zone, with minor investments in priority watershed restoration projects. A variety of recreation opportunities and settings would occur in areas where they would be compatible with restoration activities and in areas where restoration in not occurring. A balanced mix of small and medium-sized old-growth forest community types would be established. Access would be reduced as needed to restore and protect aquatic systems, soils, and plant and animal communities.

The following are distinguishing features for alternative D:

Native Ecosystem Restoration and Forest Health

- Vegetation management activities would attain an average annual timber production level of 20.0 MMCF (101 MMBF).
- Hardwood and pine and hardwood management types would be grown and maintained where ecologically feasible on all districts.
- Longleaf pine on the Bienville, De Soto, and Homochitto National Forests would be restored within its natural range but with longer rotations and lower stocking density consistent with red-cockaded woodpecker habitat management requirements.
- Shortleaf and loblolly pine management types on the Bienville, Holly Springs, and Tombigbee National Forests would be grown and maintained where ecologically feasible. There would be an emphasis on restoration of shortleaf based on ecological potential and land capability.

Fire Management

- Focus on burning historically maintained fire ecosystems to preserve natural diversity.
- Annual prescribed fire program level would be greater than the proposed action alternative levels with a minimum average annual burn program objective of 240,000 acres or more. An increase in prescribed fire applications would be necessary to support expanded ecosystem restoration goals and objectives.

Community Diversity and Species Viability

- Forest and woodland ecosystems would be managed to restore or maintain native communities that would provide the desired composition, structure, and function. Emphasis would be placed on maintaining forest and plant community types not abundant on private lands.
- Expanded opportunities for additional red-cockaded woodpecker population growth would be provided on suitable areas outside of designated habitat management areas.
- Expansion of red-cockaded woodpecker habitat management areas would extend across the entire district on the Bienville and Chickasawhay Ranger Districts.
- Conservation management areas would be developed on the De Soto Ranger District for sandhill crane.
- Expanded opportunities for conservation and recovery of gopher tortoise populations would be provided by promoting improved habitat conditions on additional suitable habitat areas due to higher levels of vegetation management and prescribed fire application.

Old Growth

- Implementation of the regional old-growth strategy would achieve a balanced mix of small and medium-sized old-growth forest community types with a goal to meet species viability and diversity requirements.
- Although there may be slightly fewer acres of old growth in some forest types for the short term, there would be a more sustainable mix of old growth in all communities for future biological needs and desired conditions.
- There would be sufficient levels of old growth in all communities for biological needs and desired conditions.

Special Areas

- Approximately sixteen botanical areas would be designated and two research natural areas proposed for designation.

Minerals Management

- Current management for oil and gas leasing would continue, and alternative D would authorize new oil and gas leasing in the 2,558 acre Sandy Creek RARE II Study Area subject to the 2001 Roadless Area Conservation Rule restrictions.

Recreation Management

- A back country special emphasis area would be developed on the Tombigbee National Forest.

Economic Conditions

- Increased management activities would continue the trend toward slightly increased commodity outputs and jobs, primarily in wood products.

Alternative E – Enhanced Forest Health Alternative

This alternative implements a vegetation management program at the estimated long-term sustained yield capacity for the National Forests in Mississippi land base. This alternative is biologically based and driven, with emphasis on restoring natural resources and natural processes and creating and maintaining diverse wildlife habitats. Restoration of native ecological communities would be based on the ecological potential and capability of the land, and the pace of restoration would be further accelerated by increasing both regeneration and thinning activities. Thinning of stand densities would improve resilience to southern pine beetle and other pests and reduce damage from intense storms. Management activities would provide a mix of wildlife habitat conditions favorable for game and non-game species and produce both large and small openings. Water quality and riparian areas would be protected through implementation of best management practices and streamside management zone, with additional investment in priority watershed restoration projects. A variety of recreation opportunities and settings would occur in areas where they would be compatible with restoration activities and in areas where restoration in not occurring. A balanced mix of small and medium-sized old-growth forest community types would be established. Access would be reduced as needed to restore and protect aquatic systems, soils, and plant and animal communities.

The following are distinguishing features for alternative E:

Native Ecosystem Restoration and Forest Health

- Vegetation management activities would attain an average annual timber production level of 24.0 MMCF (118 MMBF). This level would result in achieving desired conditions in the shortest (biologically feasible) timeframe while also ensuring compliance with the multiple-use sustained yield act requirements of non-declining sustained yields.
- Hardwood, and pine and hardwood management types would be grown and maintained where ecologically feasible on all districts.
- Longleaf pine on the Bienville, De Soto, and Homochitto National Forests would be restored within its natural range but with longer rotations and lower stocking density consistent with red-cockaded woodpecker habitat management requirements.
- Shortleaf and loblolly pine management types on the Bienville, Holly Springs, and Tombigbee National Forests would be grown and maintained where ecologically feasible. There would be an emphasis on restoration of shortleaf based on ecological potential and land capability.

Community Diversity and Species Viability

- Forest and woodland ecosystems would be managed to restore or maintain native communities that would provide the desired composition, structure and function. Emphasis would be placed on maintaining forest and plant community types not abundant on private lands.
- Expanded opportunities for additional red-cockaded woodpecker population growth would be provided on suitable areas outside of designated habitat management areas.
- Expansion of red-cockaded woodpecker habitat management areas would extend across the entire district on the Bienville and Chickasawhay Ranger Districts.
- Conservation management areas would be developed on the De Soto Ranger District for sandhill crane.
- Expanded opportunities for conservation and recovery of gopher tortoise populations would be provided by promoting improved habitat conditions on additional suitable habitat areas due to higher levels of vegetation management and prescribed fire application.

Old Growth

- Implementation of the regional old-growth strategy would achieve a balanced mix of small and medium-sized old-growth forest community types with a goal to meet species viability and diversity requirements.
- Although there may be slightly fewer acres of old growth in some areas for the short term, there would be a more sustainable mix of old growth in all communities for future biological needs and desired conditions.

Fire Management

- Focus on burning historically maintained fire ecosystems to preserve natural diversity.
- Annual prescribed fire program level would be greater than Alternative D with an average annual burn program objective of 251,000 acres or more. Increased prescribed fire applications would be necessary to support expanded ecosystem restoration goals and objectives.

Special Areas

- Approximately sixteen botanical areas would be designated and two research natural areas proposed for designation.

Minerals Management

- Current management for oil and gas leasing would continue, and alternative E would authorize new oil and gas leasing in the 2,558 acre Sandy Creek RARE II Study Area subject to the 2001 Roadless Area Conservation Rule restrictions.

Recreation

- A back country special emphasis area would be developed on the Tombigbee National Forest.

Economic Conditions

- Increased management activities would continue the trend toward slightly increased commodity outputs and jobs, primarily in wood products.

2.5 Comparison of Alternatives

The types of management areas, approach to various issues, concerns and opportunities, pace of progress toward desired conditions; and levels of output of various goods and services that would result from the alternatives are described in the following section. These tables and narrative discussions do not provide a comprehensive comparison but summarize how the alternatives treat a selection of topics of most interest and issues that would vary most by alternative.

2.5.1 Management Areas and Prescriptions

For the National Forests in Mississippi, management areas and prescriptions are based on the general locations and extent of the major ecosystems on the Forests. On these broad general areas of the Forests, management prescriptions are applied to achieve desired conditions. The ecologically-based management areas do not have precise boundaries and may contain less-common ecosystems or other designated areas or special uses that have additional requirements or different prescriptions. The major ecosystems identified as management areas on the National Forests in Mississippi are listed in Table 1 along with the approximate number of acres under the five alternatives after the 10-15 years covered by the revised forest plan. These ecosystems are mapped by ranger district and found in appendix H.

Ultimate desired conditions for the ecosystem-based management areas did not vary under the five alternatives, but the rate at which these conditions were achieved and the management actions and resources required were major distinguishing factors. In some locations on the Forests, the distribution of native ecosystems systems is close to what should occur based on landscape characteristics and soil classifications; however, in other settings, major regeneration activities and many decades will be needed to restore desirable native communities. In comparing the alternatives, restoration of native ecosystems will be slowest and restore the fewest acres over the life of the forest plan under alternative A – Custodial Management. Under the alternative A scenario, restoration changes would primarily result from natural succession, which would favor hardwood components over time. Alternatives B and C assume agency funding levels similar to current conditions but with more emphasis and integration of restoration actions under alternative C. Alternative D depicts a faster rate of progress toward desired conditions (more acres restored) by adding regeneration activities. Alternative E further increases restoration progress and forest health by treating more acres of dense forest that need thinning to be more resilient to damage from insects such as southern pine beetle and to survive severe storms. Alternatives D and E are projected to require additional funding opportunities and staffing above current budget levels but would make faster progress toward desired conditions.

Table 1. Comparison of acres within management areas over the planning period

Ecosystem-Based Management Areas	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Upland Longleaf Pine Forest and Woodland	238,876	246,660	251,152	261,285	251,705
Shortleaf Pine-Oak Forest and Woodland	59,139	60,819	61,815	68,049	66,616
Upland and Mesic Loblolly Pine Forest	299,317	299,042	286,524	277,087	276,880
Southern Loblolly – Hardwood Flatwoods	143,109	143,468	142,982	140,993	142,183
Slash Pine Forest	114,231	110,745	109,537	105,625	110,547
Northern Dry Upland Hardwood Forest	52,376	54,084	56,021	58,816	57,762
Southern Dry Upland Hardwood Forest and Southern Loess Bluff Forest	52,030	51,768	51,997	52,570	52,425
Southern Mesic Slope Forest	15,833	16,465	16,551	17,496	16,822
Northern Mesic Hardwood Forest	3,568	3,782	3,879	4,248	3,981
Floodplain Forest	96,424	96,924	97,346	96,905	97,885
Lower Mississippi River Bottomland and Floodplain Forest	59,197	59,197	59,197	59,197	59,197

2.5.2 Designated Geographic or Special Areas

In addition to the management areas based on major ecosystems, there are distinct, administratively-defined geographic areas that have special characteristics or uses which may modify or take precedence over management area prescriptions for ecosystems. These designated special areas include a variety of distinctive uses or settings with exceptional or uncommon botanical, scenic, research, wilderness, recreational, or archaeological values.

Many of these areas exhibit or support desired attributes and diversity. For example, some designated geographic areas are mature examples of desired ecosystems and serve as some of the best locations of mid-sized or larger expanses of old-growth conditions. These areas also provide sites for native ecosystems, habitats for species diversity, refuge areas for aquatic and terrestrial wildlife and threatened and endangered species, experimental sites for vegetation management practices, unique recreational opportunities, and desirable scenic conditions. Designating and managing these areas for their special characteristics are part of our strategy for moving toward desired conditions. Table 2 compares the existing plus proposed acres of designated special areas by alternative. Maps of these geographic areas can be found in Appendix D.

Table 2. Comparison of geographic or special area allocations by alternative

Special Area Description	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Administrative Areas	No change	No change	No change	No change	No change
Archaeological Areas	39 acres	39 acres	39 acres	39 acres	39 acres
Botanical Areas	722 acres	722 acres	4,169 acres	4,169 acres	4,169 acres
Developed Recreation Areas	No change	No change	No change	No change	No change
Experimental Forests	7,568 acres	7,568 acres	7,568 acres	7,568 acres	7,568 acres
Red-Cockaded Woodpecker Habitat Management Area	390,886	367,169	390,886	390,886	390,886
Research Natural Areas	1,030 acres	1,030 acres	1,464 acres	1,464 acres	1,464 acres
Scenic Areas	9,338 acres	9,338 acres	9,338 acres	9,338 acres	9,338 acres
Special Recreation Areas	40 acres	40 acres	40 acres	40 acres	40 acres
Wild and Scenic Rivers	21 miles	21 miles	21 miles	21 miles	21 miles
Wilderness Areas	6,046 acres	6,046 acres	6,046 acres	6,046 acres	6,046 acres

Under alternatives A and B, current special areas would be retained but no additional designations would be planned. Alternatives C, D, and E would add approximately seventeen new botanical areas and propose designation of two new research natural areas. Management actions under alternatives C, D, and E would also include expansion of current red-cockaded woodpecker habitat management areas. Under alternatives A and B, new mineral leases in the Sandy Creek inventoried roadless area would not be authorized. Under alternatives C, D, and E the Sandy Creek inventoried roadless area would become available for new oil and gas leasing with a No Surface Occupancy stipulation on the 300 acre Sandy Creek Botanical area and a stipulation that prohibits National Forest System road construction for newly leased areas on the former Sandy Creek inventoried roadless area.

2.5.3 Vegetation Management

Vegetation management activities are the primary tools for restoring native ecosystems, creating a diversity of habitats, controlling the spread of non-native invasive species and insect pests, sustaining healthy forests, and producing wood-product commodities to benefit local communities. For the National Forests in Mississippi, prescribed burning, thinning, and regeneration are the principal management practices used for vegetation management, and the five alternatives depict varying levels of management activities aimed at accomplishing desired conditions. Table 3 compares outputs under the various alternatives as a quantitative measure of the different management strategies.

Under the custodial management focus of Alternative A, there would be minimal use of active management practices, natural succession would result in a greater hardwood component, longleaf pine restoration efforts would be limited to habitat management areas on the Bienville, De Soto, and Homochitto National Forests, and occurrence of shortleaf and loblolly pines would be reduced. Average annual timber production would be reduced from current levels and would be a byproduct from red-cockaded woodpecker habitat maintenance and enhancement and salvage and sanitation harvests from wind or southern pine beetle occurrences.

Alternative B is the no-action alternative and would continue current direction and levels of vegetation management. The average annual timber production level in Table 3 for Alternative B lists production levels for recent years under revisions to the 1985 forest plan and reflects reduced output and available management resources from the original forest plan.

Alternatives C, D, and E focus on restoring a variety of native ecosystems and habitats and creating healthier, more sustainable forests. Longleaf pine would be restored within its natural range; hardwood, and pine and hardwood management types would be grown and maintained where ecologically feasible on all districts; hardwood, and pine and hardwood management types would be grown and maintained on appropriate sites, and there would be an emphasis on restoration of shortleaf based on ecological potential and land capability. Forest products are produced as a result of vegetation management practices although they do not drive the process. Alternative C would move toward desired conditions at a realistic pace under current agency funding levels. Alternative D restores more native ecosystem acres through regeneration activities, and Alternative E further improves forest health through thinning. Alternative E would result in achieving desired conditions in the shortest (biologically feasible) timeframe while also ensuring compliance with the multiple-use sustained yield act requirements of non-declining sustained yields. However, alternatives D and E would require additional funding and management resources above current levels.

Table 3. Comparison of vegetation management levels by alternative

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Average annual program level = 7.5 MMCF[a] (37 MMBF[b])	Average annual program level = 12.0 MMCF (60 MMBF)	Average annual program level = 18.0 MMCF (91 MMBF)	Average annual program level = 20.0 MMCF (101 MMBF)	Average annual program level = 24.0 MMCF (118 MMBF)
Minimal management activities (slower ecosystem restoration and more insect and disease problems).	No change	Slight increase in native ecosystem restoration (starts trend toward restoration but slow pace initially).	More regeneration to appropriate native ecosystems.	More regeneration plus more thinning of dense stands for improved resilience to Southern Pine Beetle, other pests, and storm damage.

a – MMCF = Million cubic feet
b - MMBF = Million board feet

2.5.4 Community Diversity and Species Viability

Ecological communities provide the foundation for biological diversity. By restoring and maintaining the key characteristics, composition, conditions, and functionality of native ecological systems, the National Forests in Mississippi should be able to improve ecosystem diversity and provide for the needs of diverse plant and animal species across the Forests.

Under Alternative A, community diversity and species viability would likely decline over time. This alternative would promote a tendency towards late succession with locally reduced species richness and minimal management practices to prevent species loss. Red-cockaded woodpecker resource management activities would do the minimum necessary to sustain populations and would be focused only in designated red-cockaded woodpecker habitat management areas. Population expansion potential for gopher tortoise would be reduced compared to other more intensive alternative management themes.

Under alternatives C, D, and E, forest and woodland ecosystems would be managed to restore or maintain native communities that would provide the desired composition, structure and function. Emphasis would be placed on maintaining forest and plant community types not abundant on private lands. Expanded opportunities for additional red-cockaded woodpecker population growth would be provided on suitable areas outside of designated habitat management areas. Expansion of red-cockaded woodpecker habitat management areas would extend across the entire district on the Bienville and Chickasawhay Ranger Districts. Conservation management areas would be developed on the De Soto Ranger District for sandhill crane. Expanded opportunities for conservation and recovery of gopher tortoise populations would be provided by promoting improved habitat conditions on additional suitable habitat areas due to higher levels of vegetation management and prescribed fire application.

2.5.5 Fire Management

In Mississippi, fire management is a necessary part of creating appropriate habitats for native ecological communities and fire-dependent species as well as protecting National Forest System and private lands. Table 4 compares annual prescribed burning levels by alternative.

Alternative A would generate the lowest prescribed burn program and would be limited to threatened and endangered habitat management requirements and response to wildland fire occurrences. Alternatives C, D, and E would focus on burning historically maintained fire ecosystems to preserve natural diversity and would have annual prescribed fire levels slightly greater than under current management (Alternative B). Increased prescribed fire applications under C, D, and E would be necessary to support expanded ecosystem restoration goals and objectives.

Table 4. Comparison of average annual prescribed burn programs by alternative

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
121,000 acres or less	190,000 acres	220,000 acres	240,000 acres	251,000 acres

2.5.6 Recreation Management

Forest management strategies for recreation considered an appropriate mix of sustainable recreation opportunities that would balance increasing and changing demands with concerns for public health and safety and ecosystem protection. For the National Forests in Mississippi, anticipated budget and staffing levels required our focus to be on maintaining current infrastructure and recreation opportunities rather than expanding and adding new facilities. This approach did not vary significantly by alternative, but there were slight differences between Alternative A, which would emphasize low impact recreation opportunities and minimal management, and alternatives C, D, and E, which would include the addition of a back country special emphasis area on the Tombigbee National Forest.

2.5.7 Minerals Management

In August 2010, the National Forests in Mississippi renewed its decision for Lands Available for Oil and Gas Leasing (National Forests in Mississippi - Lands Available for Oil and Gas Leasing Environmental Assessment, August 2010). The 2010, oil and gas leasing decision authorized all lands on the National Forests in Mississippi, except for congressionally designated wilderness areas (Black Creek and Leaf) and the deferred Sandy Creek RARE II Further Study Area, available for Federal oil and gas leasing through the Bureau of Land Management (BLM). These lands, approximately 1.2 million acres, would be administratively available subject to 1) management direction in the National Forests in Mississippi Forest Plan, 2) oil and gas lease stipulations, 3) the wide range of laws and regulations that require environmental protections for oil and gas exploration and development and 4) site-specific environmental analysis as detailed exploration proposals are made by lease holders. Additionally, all administratively available lands will be available for lease by the BLM, subject to the stipulations identified in the analysis, the standard USDA stipulations, and the environmental requirements of the standard federal lease terms detailed in appendix B of the National Forests in Mississippi Lands Available for Oil and Gas Leasing Environmental Assessment, August 2010.

A decision regarding oil and gas leasing availability on the Sandy Creek RARE II study area is being evaluated and addressed in this environmental disclosure document. Alternatives A and B would not authorize new oil and gas leasing in the 2,558 acre Sandy Creek RARE II Study Area. However, alternatives C, D, and E would permit new oil and gas leasing in the Sandy Creek RARE II Study Area subject to the 2001 Roadless Area Conservation Rule restrictions. The restrictions include no new road construction permitted in the former RARE II Study Area; therefore existing system roads would be utilized as access for lease activities.

Chapter 3. Affected Environment

3.1 Introduction

Chapter 3 describes the existing environment of the areas on the National Forests in Mississippi (Forests) affected by the alternatives. This chapter begins with background information on the ecological and management units that comprise the Forests, followed by descriptions of the current physical, biological, social, and economic characteristics. Environmental consequences associated with implementing the alternatives are discussed over the short term and long term in Chapter 4.

3.2 Descriptions of Ecological Units

The Forest Service has adopted the National Hierarchical Framework of Ecological Units (Cleland et al. 1997) as a consistent nationwide classification system to describe similar ecosystems for planning purposes. This framework provides a standardized method for classifying, mapping, and describing ecological units at various geographic, planning and analysis scales. Ecological units across the U.S. are mapped based on patterns of climate, soils, hydrology, geology, landform, and topography. These classifications represent homogeneous units having similarities among their resource capabilities and relationships.

Ecological classification is useful for:

- Evaluating the inherent capability of land and water resources.
- Estimating ecosystem productivity.
- Determining probable responses to land management activities.
- Addressing environmental issues such as air pollution, forest diseases, and climate change over large areas.
- Predicting changes occurring over time.
- Discussing and analyzing ecosystems and biodiversity at multiple scales.

The national hierarchical framework system is composed of four planning and analysis scales—ecoregions, subregions, landscapes, and land units—that progressively range in size from millions of square miles to less than ten acres. Ecological units within the upper scales (ecoregions and subregions) are further divided into domains, divisions, provinces, sections, and subsections. Sections are nested within provinces, and these are the scales of physical and vegetative features typically most useful in management planning for multiple forest locations within a state such as the National Forests in Mississippi.

The National Forest System lands which make up the National Forests in Mississippi lie within the humid temperate domain, the subtropical division, and the three provinces that occur within the state—southeastern mixed forest, outer coastal plain mixed forest, and lower Mississippi riverine forest. Within the three provinces, the locations of the Forests units can further be defined by sections and subsections. The province and section descriptions for the Forests are summarized below and were derived from the Ecological Subregions: Sections and Subsections of the Conterminous United States (USDA 2007) and depicted in Figure 2.

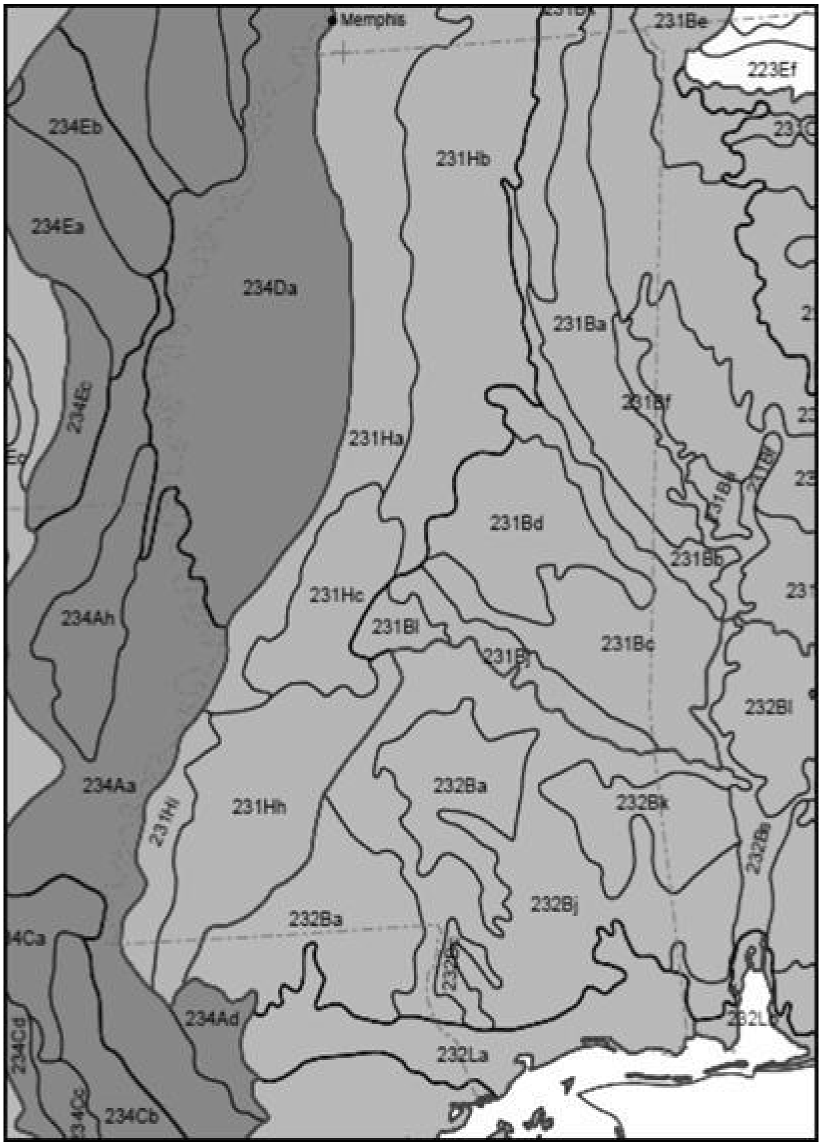

Figure 2. Map indicating ecological sections and provinces for Mississippi

Southeastern Mixed Forest Province (231) – This province covers much of the central, eastern, northern, and southwestern portions of the state of Mississippi and includes the Holly Springs, Tombigbee, Bienville, and Homochitto National Forests. There is a generally uniform maritime climate with mild winters and hot, humid summers. Annual precipitation is evenly distributed, but a brief period of mid- to late-summer drought occurs in most years. Landscape is hilly with increasing relief farther inland. Forest vegetation is a mixture of deciduous hardwoods and conifers.

Coastal Plains – Middle Section (231B) – The topography varies from strongly rolling to hilly landscapes of marine-deposited sediments ranging from sands and silt to chalk and clays, which vary in reaction from acid to alkaline. Vegetation is variable and includes oak-pine, loblolly-shortleaf pine, or oak-hickory cover types.

Coastal Plains – Loess Section (231H) – This section has weakly to moderately dissected irregular plains. Forest cover is primarily loblolly-shortleaf pine and oak-gum-cypress cover types.

Outer Coastal Plain Mixed Forest Province (232) – This province is located in the southern part of the state along the Gulf Coast and includes the De Soto and Chickasawhay National Forests. This area has a humid, maritime climate; winters are mild and summers are warm. Precipitation is abundant with rare periods of summer drought. Upland forest vegetation is dominated by conifers, with deciduous hardwoods along major floodplains.

> **Gulf Coastal Plains and Flatwoods Section (232B)** – This section has a flat, weakly dissected landscape of irregular or smooth plains formed on marine deposits of sands and clays. Natural vegetation consists of longleaf-slash pine, loblolly-shortleaf pine, and oak-hickory cover types, with oak-gum-cypress along rivers.

Lower Mississippi Riverine Forest Province (234) – This province is located along the Mississippi River on the western side of the state and includes the Delta National Forest. The climate of this province is characterized by warm winters and hot summers. Precipitation occurs throughout the year with minimum in fall. Much of this subregion is influenced by periodic flooding of the Mississippi River. Vegetation was initially forests of cold-deciduous, mesophytic hardwoods, which have now largely been cleared and cultivated.

> **White and Black River Alluvial Plain Section (234D)** – This section is a flat, weakly to moderately dissected alluvial plain formed by deposition of continental sediments. Much of the natural vegetation has been cleared for cultivation; small areas remain of oak-gum-cypress and oak-hickory cover types.

3.3 Descriptions of Management Units

The National Forests in Mississippi are widely dispersed across the state, providing ecological diversity and a representative cross-section of Mississippi's natural and cultural heritage (see Figure 1. Map indicating the locations of national forest units within the State of Mississippi). Originally established in the 1930s on predominately cut-over and eroded abandoned farmlands, the six national forests (or seven ranger districts) that make up the National Forests in Mississippi provide a forested setting that offers a variety of uses and opportunities. These National Forest System lands, although separated from each other, cover approximately 1.2 million acres and are managed under one forest plan. The following provides an overview of the individual national forests and ranger districts or management units that make up the National Forests in Mississippi.

3.3.1 Bienville National Forest

Location and Size: The Bienville National Forest is located in the east-central part of the state and contains approximately 180,000 acres. Parts of the National Forest are in Scott, Smith, Jasper, and Newton counties. The principal towns within the area are Forest, Morton, and Raleigh. The major travel routes are Interstate 20, U.S. Highway 80, and State Route 18 east and west, and State Route 35 north and south. The closest metropolitan area is Jackson, Mississippi, located about 43 miles to the west.

Key Characteristics: The headwaters of the Strong River flow through the western part of the Bienville National Forest. There are extensive acreages of 70+-year-old loblolly pine and dense hardwood midstory, which is also home to the largest state population of the endangered red-cockaded woodpecker. The soils on the northern half of the forest are primarily a heavy clay (Jackson Prairie) which restricts many activities to dry seasons due to potential for rutting and compaction problems. The Bienville National Forest has the largest remaining acreage of the rare Jackson Prairie ecological system which provides refuge to rare species including the endemic Jackson Prairie crayfish. There are approximately 6,000 acres of longleaf pine forest present on the Bienville National Forest. The Bienville has some broad hardwood bottoms that provide excellent wildlife habitat. There is limited oil and gas activity on the Bienville. There is one large developed recreational site at Marathon Lake Recreation Area. The Shockaloe National Recreation Trail, which has two base camps designed for horseback riders, is also located on the Bienville.

3.3.2 Delta National Forest

Location and size: The Delta National Forest is located in the west-central part of the state and covers approximately 60,000 acres. The proclamation boundary includes parts of Issaquena and Warren counties; however, national forest ownership is entirely in Sharkey County. There are no towns within the boundaries. The closest communities are Rolling Fork, Holly Bluff, and Valley Park.

Key Characteristics: The Delta National Forest is the only bottomland hardwood national forest in the Nation. Much of the area is subject to annual slackwater flooding. The Delta National Forest is also critical for recovery efforts for the endangered pondberry and the threatened Louisiana black bear. This area contains three research natural areas and five greentree reservoirs managed for waterfowl. The potential for wildlife habitat is high, and dispersed recreation opportunities focus on traditional hunting and fishing uses.

3.3.3 De Soto National Forest

Location and size: The De Soto National Forest is located in the southeastern portion of Mississippi and contains a total of approximately 532,000 acres. This national forest is divided into two ranger districts. The Chickasawhay Ranger District (approximately 150,000 acres) is located in Wayne, Jones, and Greene counties. The De Soto Ranger District (approximately 382,000 acres) is located in Greene, Perry, Forrest, Pearl River, Stone, George, Harrison, and Jackson counties. The principal communities within or adjacent to the De Soto National Forest are Waynesboro, Laurel, Richton New Augusta, Beaumont, McLain, and Brooklyn. The closest metropolitan areas are the Biloxi-Gulfport area, Hattiesburg, and Laurel. The major travel routes are U.S. Highways 49 and 98, and State Highways 67, 15, 57, 26, 29, 13, 63, and 42.

Chickasawhay Ranger District: The Chickasawhay Ranger District is a separate approximately 150,000-acre administrative unit within the De Soto National Forest. The Chickasawhay Ranger District includes Thompson Creek, a broad hardwood bottom. The Chickasawhay Ranger District has several unique pitcher plant flats and xeric sandhill communities. Both De Soto and Chickasawhay Ranger Districts are known for recovery efforts of threatened and endangered species. The Chickasawhay Ranger District's recovery efforts are primarily for red-cockaded woodpecker, gopher tortoise, and Louisiana quillwort. Hurricane Katrina (2005) and the associated salvage operation effected a thinning of landscape scale improving habitat for many wildlife species. The Chickasawhay Ranger District is known for the Gavin Forest Education Auto Tour and Turkey Fork Recreation Area.

De Soto Ranger District: The De Soto Ranger District is a separate approximately 382,000-acre administrative unit within the De Soto National Forest. The De Soto Ranger District has several unique pitcher plant flats and xeric sandhill communities. The soils in the southernmost portion of Mississippi have less fertile, sandy soils compared to the rest of the state. Southern Mississippi is known for its diversity of plant communities such as longleaf pine, pitcher plant flats, and titi swamps. It is characterized by large areas of planted pine forests, interlaced with blackwater streams. The De Soto Ranger District manages for red-cockaded woodpecker, gopher tortoise, and Louisiana quillwort and also gives management consideration for Mississippi sandhill crane, eastern indigo snake, and the endemic federally endangered gopher frog. As also noted on the Chickasawhay Ranger District, Hurricane Katrina (2005) and the associated salvage operation effected a thinning of landscape scale improving habitat for many wildlife species. There is moderate oil and gas activity on both units of the De Soto National Forest.

About 117,000 acres on the northern end of the De Soto Ranger District are under special use permit to the Mississippi National Guard for Camp Shelby as a training area. The Harrison Experimental Forest is located on the southern end of the district. In addition to the two wilderness areas and the scenic river corridor, several botanical and research natural areas are located on the De Soto Ranger District. The De Soto Ranger District offers two wilderness areas (Black Creek and Leaf Wilderness), the Black Creek National Wild and Scenic River, Tuxachanie National Recreation Trails as well as ATV, horse, bicycle, motorcycle and hiking trails.

3.3.4 Holly Springs National Forest

Location and Size: The Holly Springs National Forest is located in the north-central part of the state and contains approximately 156,000 acres. This national forest is located in Benton, Lafayette, Marshall, Tippah, Union, and Yalobusha counties. The portion of the Holly Springs National Forest in Yalobusha County is separated from the rest of the national forest by about 30 miles. The principal communities within the boundaries are Hickory Flat and Potts Camp. The nearest towns are Holly Springs, Oxford, and New Albany. The closest metropolitan area is Memphis, Tennessee, about 50 miles northwest of the Holly Springs National Forest. Being only a short drive from Memphis, the national forest attracts many recreational users from that area. The major travel routes are U.S. Highways 78 and 72, and State Routes 30, 7, 4, 370, 5, 2, 349, and 355.

Key Characteristics: Soils are moderately to highly erosive, with a number of areas where gullies occurred prior to the establishment of the national forest. The Holly Springs National Forest has two primary recreation areas at Chewalla and Puskus Lakes. There are three Corps of Engineers reservoirs adjacent to the Holly Springs National Forest and many smaller fishing lakes on national forest administered lands.

3.3.5 Homochitto National Forest

Location and Size: The Homochitto National Forest is located in southwest Mississippi and contains approximately 189,000 acres. It lies in Adams, Amite, Copiah, Franklin, Jefferson, Lincoln, and Wilkinson counties. The principal towns are Natchez to the west; Brookhaven and McComb to the east; and Meadville, Bude, and Gloster within the area. The major travel routes are U.S. Highways 84 and 98, and State Highways 33, 563, and 550. The closest metropolitan areas are Jackson, Mississippi, which is about 50 miles north, and Baton Rouge, Louisiana, which is about 45 miles south.

Key Characteristics: This national forest provides excellent wildlife habitat with large areas of mixed pine-hardwood forest type. The terrain is very irregular, and the loessial soils are more productive than those found on the other national forests. There is extensive and active oil and gas exploration and production on the Homochitto National Forest. The Homochitto River flows through the national forest. The Homochitto is known for its management of the federally endangered red-cockaded woodpecker and is also home to the Natchez and Chukcho stoneflies. Both of these stonefly species are endemic to southwest Mississippi. The Homochitto National Forest provides the best remaining habitat for their continued survival. There are two large recreation areas on the Homochitto, Clear Springs and the recently completed Okhissa Lake. Sandy Creek Botanical Area is also of special interest on the national forest.

3.3.6 Tombigbee National Forest

Location and Size: The Tombigbee National Forest is located in northeast Mississippi and encompasses approximately 66,000 acres. This national forest is divided into two parts: one in Chickasaw and Pontotoc counties, and the other in Winston, Choctaw, and Oktibbeha counties. There are no towns within the forest boundaries, but Ackerman, Louisville, and Starkville are adjacent to the southern block; Houlka, Houston, and Van Vleet are adjacent to the northern block; and Tupelo is 15 miles northeast. The major travel routes are the Natchez Trace and State Highways 32 and 41 in the north, and State Highways 12, 25, and 15 in the south. The nearest metropolitan areas are Jackson, Mississippi (90 miles southwest) and Meridian, Mississippi (60 miles south) of the southern block; and Memphis, Tennessee (90 miles northwest) of the northern block.

Key Characteristics: The Tombigbee National Forest is made up of old farmland that was abandoned and replanted to trees. Soils are fragile and erosive with many gullied areas. The black belt calcareous prairie ecological system occurs on the northern unit of the Tombigbee. Oil and gas activity is minor on the Forest. The Natchez Trace crosses a portion of the Tombigbee, making it easily accessible from the north and south. The Tombigbee has two large recreation areas that draw some travelers from the Natchez Trace. Several archaeological sites of Native American origin are located in the area.

3.4 Physical Environment

The physical environment includes the geology, topography, soils, water, air, and climate that define the general setting for the National Forests in Mississippi. Over time, these physical processes and conditions have shaped the characteristics of the land and influenced the development of ecosystems and biological diversity throughout the state. Since the six national forests that make up the National Forests in Mississippi are spread across the state, many of the major physiographic or geomorphic regions of the state are represented within the national forests.

3.4.1 Geology and Topography

Geology is the foundation for the diverse settings and ecosystems that define the National Forests in Mississippi. Deposition and weathering of geologic material over time have created today’s topography and landscape as well as the soils which are the basis of ecosystem diversity in Mississippi. Surface geologic processes such as erosion, flooding, and stream movement are part of the natural disturbance regime of the national forests and shape the topography of the land surface.

The state of Mississippi covers 31 million acres of surface area and is approximately 340 miles in length and 180 miles at its widest (Stewart 2003). The highest point is Woodall Mountain in Tishomingo County at 806 feet above mean sea level, and the lowest point is in the southern portion of the state at sea level along the Gulf of Mexico. Much of the state of Mississippi and most of the Forests lie within the East Gulf Coastal Plain. The exception to this is the Delta National Forest which lies within the Mississippi Alluvial Plain physiographic region along the Mississippi River on western edge of the state.

Coastal plain landscapes are relatively low-lying areas of water-deposited sediments bordering oceans. Topography is generally flat to rolling hills. The Mississippi River Alluvial Plain in the northwest part of the state consists of level and nearly level floodplains that extend to the foothills of the loess bluffs on its eastern edge. This landscape feature is locally called the "delta" and also occurs along the Mississippi River in eastern Louisiana and Arkansas and southeastern Missouri. Figure 3 portrays the general locations of the major physiographic regions of Mississippi.

Figure 3. Major physiographic regions of Mississippi

Portions of three major sedimentary basins dominate the geologic setting in the state of Mississippi: the Mississippi Embayment, the Black Warrior Basin, and the Mississippi Salt Basin. Each is a regional feature that extends into several states and whose origins are tied to major tectonic events at various times in geologic history. The Mississippi Embayment was the first to form, resulting from Precambrian shear forces, followed by Cambrian rifting. Sediments tied to this feature are found across much of the south and far into the continental interior. Creation of the Black Warrior Basin followed later, being connected to the Appalachian-Ouachita mountain-building event. Continental break initiated in the Triassic lead to the creation of the Mississippi Salt Basin, an ancillary rift feature associated with the development of the Gulf Coast Geosyncline. Deposition in the Mississippi Embayment was eventually renewed, as well. Each of these features is further described in the paragraphs that follow. Figure 4 is a diagram showing the approximate locations of the Black Warrior Basin and the Mississippi Salt Basin (Seismic Exchange, Inc. 2012).

Episodes of inundation and erosion throughout geologic time, have led to the deposition of a thick, complex sedimentary pile that covers the entire state. The stratigraphic column includes rock formations ranging from the Devonian in the extreme northeast corner of the state thru the Paleocene along the southern extent. In general, formations dip to the south and west as a part of sedimentary wedge that thickens in the same directions. Some accounts estimate that approximately 30,000 feet of sediments have accumulated in the thickest segments of the wedge. The Permian is present as a series of metamorphic intrusives that underlay the Wiggins Arch, Jackson Dome, Monroe Arch and Sharkey Dome, as well as a number of other intrusions scattered across several central western counties, including Washington, Issaquena, Sharkey and Humphreys.

Additional details on the geology and potential mineral development of the National Forests in Mississippi can be found in the Reasonable Foreseeable Development Scenario Summary prepared for the Forest Service by BLM in 2005. A geologic outcrop map from the Mississippi Department of Environmental Quality is presented in Figure 5 (Mississippi Department of Environmental Quality 2011).

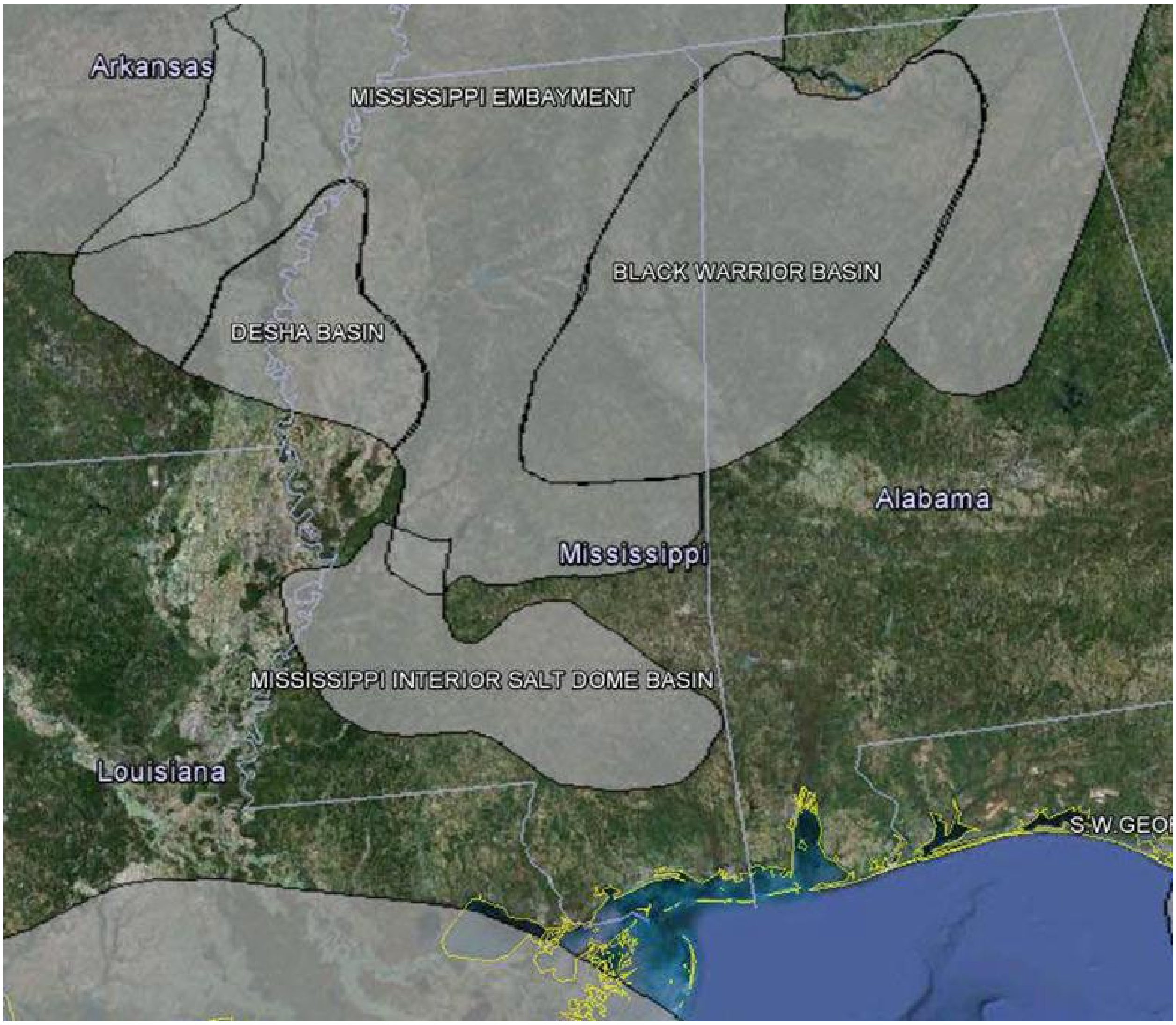

Figure 4. Basin outlines of Mississippi (www.seismicexchange.com/res/dwf/US-BASINS.kmz Google Earth 2012)

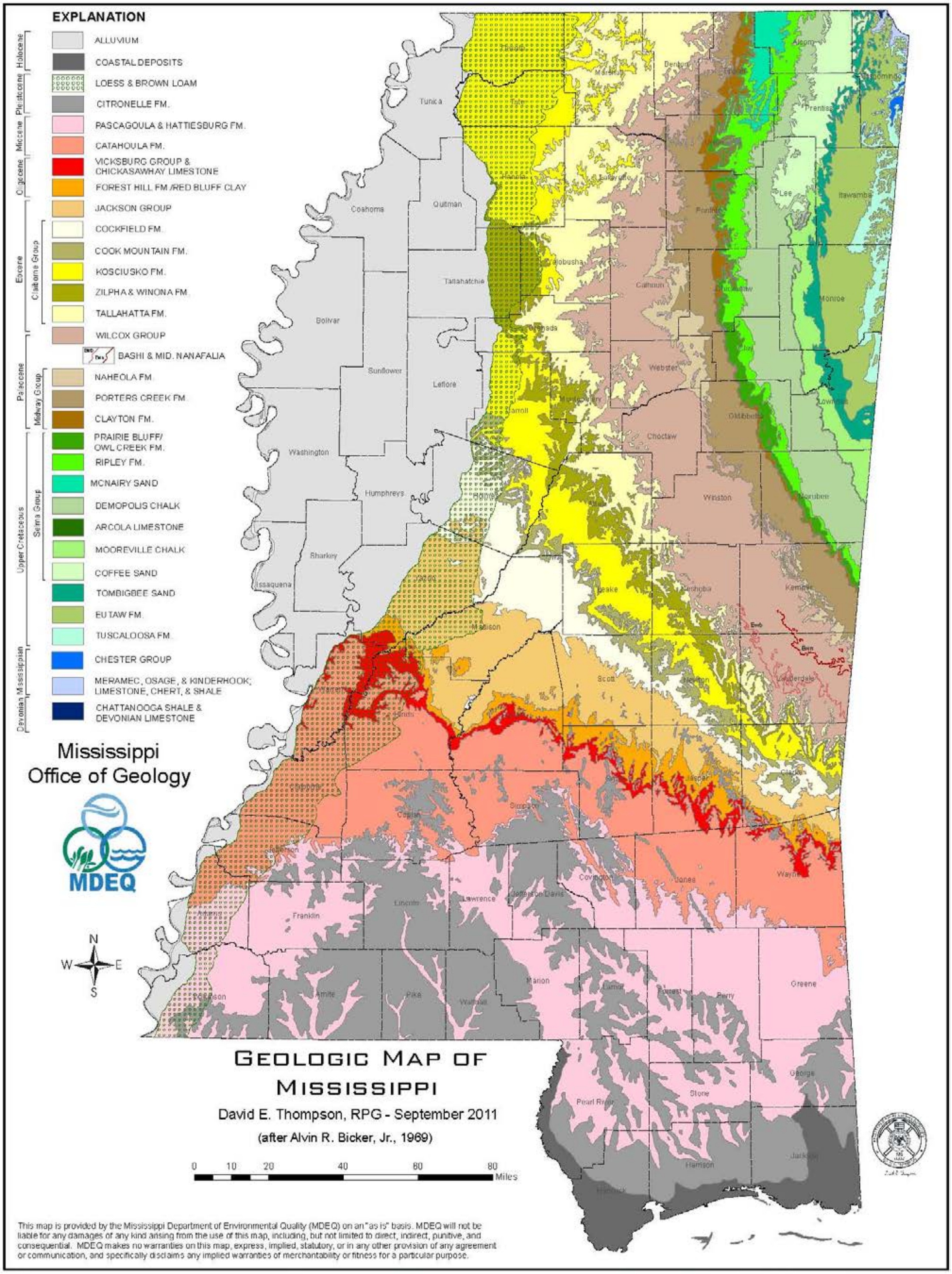

Figure 5. Geologic outcrop map of Mississippi (http://www.deq.state.ms.us/mdeq.nsf/pdf/Geology_MSGeology1969Map/$File/MS_Geology1969.pdf?OpenElement)

3.4.2 Soils

Within the National Forests in Mississippi, soil resource inventories have identified approximately 93 soil series. Soil series are the grouping of soils with similar physical and chemical properties. Soil series can be further divided into soil map units which are phases of a soil series with more specific properties, such as slope, flood frequency, surface texture, etc. About 170 soil map units have been identified within the Forests.

Soil units across the Forests range from deep, sandy, excessively well-drained to shallow soils with restrictive root zones to soils with shrink-swell clays that have poor internal drainage. Soils cover a range of slopes. In uplands, slopes range from nearly level (less than 2 percent slope) to very steep (up to 60 percent slope). Along floodplains and wetlands, slopes are less varied and range from gently sloping to nearly level. Soil productivity in Mississippi ranges from very high site indexes on loess soils of Homochitto National Forest to very low site indexes on wetlands bogs of De Soto National Forest. Throughout the National Forests in Mississippi, the majority of the land (approximately 90 percent) has high to moderate soil productivity, with high to moderate capability and slight to moderate limitations of use. Approximately 10 percent of National Forest System land consists of unproductive soils that frequently have low capability, high hazards, severe limitations for use and management. Most of these lower productivity soils are very significant from the ecological stand point, offering critical habitat for a variety of sensitive species.

Soil plays an integral role in the use and management of National Forest System land. The physical and chemical properties determine the capability and limitation for use and management. Soils should have adequate physical, biological, and chemical properties that maintain or improve ecological systems, soil productivity, soil hydrologic function, and slope stability. Healthy soils maintain or enhance water and air quality, ensure long-term soil productivity, provide habitat for diverse wildlife, as well as create beautiful landscapes. Soils do this by regulating water flow and infiltration, filtering potential pollutants, cycling nutrients, and sustaining plant and animal life.

Forest soil quality is maintained primarily through the implementation of soil conservation measures such as state best management practices, forest standards and guidelines, and region 8-southern region soil and water conservation practices. On a small scale (usually less than 20 acres per year) forest soil quality is improved through watershed restoration projects.

3.4.3 Air

The Clean Air Act of 1990 provides the primary regulatory framework for the protection of air resources on the National Forests in Mississippi. Under the Clean Air Act, national ambient air quality standards have been established by the Environmental Protection Agency and states to protect public health and welfare from individual pollutants and prevent the significant deterioration of clean air areas. For the state of Mississippi, air quality is generally good, and the state has been designated in attainment for meeting all national ambient air quality standards. The 1977 and 1990 amendments to the Clean Air Act provide special protection from air pollution to Class I areas. However, there are no Class I areas on the Forests.

3.4.4 Water

Watersheds, in the general sense, are geographic boundaries for describing water drainage pathways for both surface and ground waters. Surface water moves through a network of rivers, streams, and tributaries which may become progressively larger as water moves downstream or downslope eventually reaching an ocean. In contrast, groundwater moves beneath the Earth’s surface through rock pore space and fractures of geologic formations, such as aquifers. Sometimes groundwater flows interchangeably with surface water toward a downdip and can be recharged from surface-water flow from springs, seeps, oases, and wetlands. Because both surface water and groundwater have a downward flow, upstream activities often affect the water quality, quantity, or rate of movement at locations downstream.

There are nine major watershed basins in Mississippi, and the National Forests in Mississippi interconnect with all nine basins. The major basins are identified in Table 5 and drain more than 48,000 square miles.

Table 5. Major Mississippi watershed basins

Major Basins	Estimated Acreage (mi^2)
Big Black River	3,400
Coastal Streams	1,545
North Independent Streams	1,075
Pascagoula River	9,700
Pearl River	8,000
South Independent Streams	4,418
Tennessee River	417
Tombigbee River	6,100
Yazoo River	13,375
Total:	**48,030**

Mississippi’s major watersheds are delineated by utilizing a nationwide, standardized interagency hydrologic unit code (HUC) generated by the United States Geological Service (USGS). For planning and project management purposes, sub-watersheds are typically analyzed in terms of HUCs at or greater than the 4th level to better understand the possible effects of activities on watershed health. Table 6 displays the 25 sub-basins located on the National Forests in Mississippi by unit, and the percentage of the sub-basin occurring on National Forest System lands. About 36 percent (9 of 25) of the sub-watersheds listed have greater than 5 percent national forest occurrence; but only about 16 percent (4 of 25) cover a National Forest System area of more than 10 percent. Although National Forest System lands comprise only a small percentage of the sub-basins, it provides important habitats for aquatic species. Historically, long-term watershed-health issues in and near Forest Service boundaries evolved from and are affected more by actions of other landowners (e.g., channelizations).

Surface Water

Watershed health is essential to sustaining the ecological function and productive capacity of National Forest System land. Within the proclamation boundaries of the National Forests in Mississippi there are over 11,000 miles of streams and more than 2,000 acres of lakes and permanent ponds. Average annual rainfall ranges from 65 inches along the gulf coast to about 55 inches in the northern part of the state.

Stream conditions vary across the Forests, and many streams have been channelized or modified in the past. Due to the fragmented land ownership patterns across national forest units, stream condition is often heavily affected by land use upstream and on adjacent private properties. Erosion and headcutting are problems on national forests with steeper topography, especially the Homochitto, Holly Springs, and Tombigbee National Forests, but they are often caused or exacerbated by offsite sources outside Forest Service control. Much of the adverse impacts to surface waters on national forest lands, such as deterioration of water quality (i.e., sedimentation, siltation, channelization, nutrient loading, pathogens, and other pollutants) and loss of aquatic habitats, are due to past actions or upstream activities.

Table 6. Major Sub-basins on the National Forests in Mississippi

Sub-basins	National Forests	Forest Units	8-digit HUCs	Percent NF Land Area
Wolf River	Holly Springs	Holly Springs	08010210	7.81%
Porter's Creek	Holly Springs	Holly Springs	08010208	7.85%
Hatchie River	Holly Springs	Holly Springs	08010207	0.88%
Coldwater River below Arkabutla Dam	Holly Springs	Holly Springs	08030204	0.04%
Little Tallahatchie River above Sardis Dam	Holly Springs	Holly Springs	08030201	10.24%
Yocona River above Enid Dam	Holly Springs	Holly Springs Yalobusha	08030203	2.51%
Yalobusha River	Holly Springs	Yalobusha	08030205	0.91%
Tallahatchie River	Holly Springs	Yalobusha	08030202	0.76%
Town Creek	Tombigbee	Trace	03160102	0.07%
Tibbee Creek	Tombigbee	Trace	03160104	3.70%
Noxubee River	Tombigbee	Ackerman	03160108	4.92%
Yockanookany River	Tombigbee Bienville	Ackerman Bienville	03180001	1.70%
Pearl River above Strong River	Bienville	Bienville	03180002	4.88%
Upper Leaf River	Bienville	Bienville	03170004	8.00%
Lower Chickasawhay River	De Soto	Chickasawhay	03170003	6.38%
Lower Leaf River	De Soto	Chickasawhay De Soto	03170005	11.93%
Black and Red Creeks	De Soto	De Soto	03170007	25.48%
Pascagoula River	De Soto	De Soto	03170006	9.22%
Jourdan River	De Soto	De Soto	03170009	9.37%
Bayou Pierre	Homochitto	Homochitto	08060203	0.79%
Homochitto River	Homochitto	Homochitto	08060205	23.32%
Buffalo River	Homochitto	Homochitto	08060206	0.41%
Amite River	Homochitto	Homochitto	08070202	0.09%
Bogue Phalia River	Delta	Delta	08030207	2.94%
Lower Yazoo River	Delta	Delta	08030208	1.36%

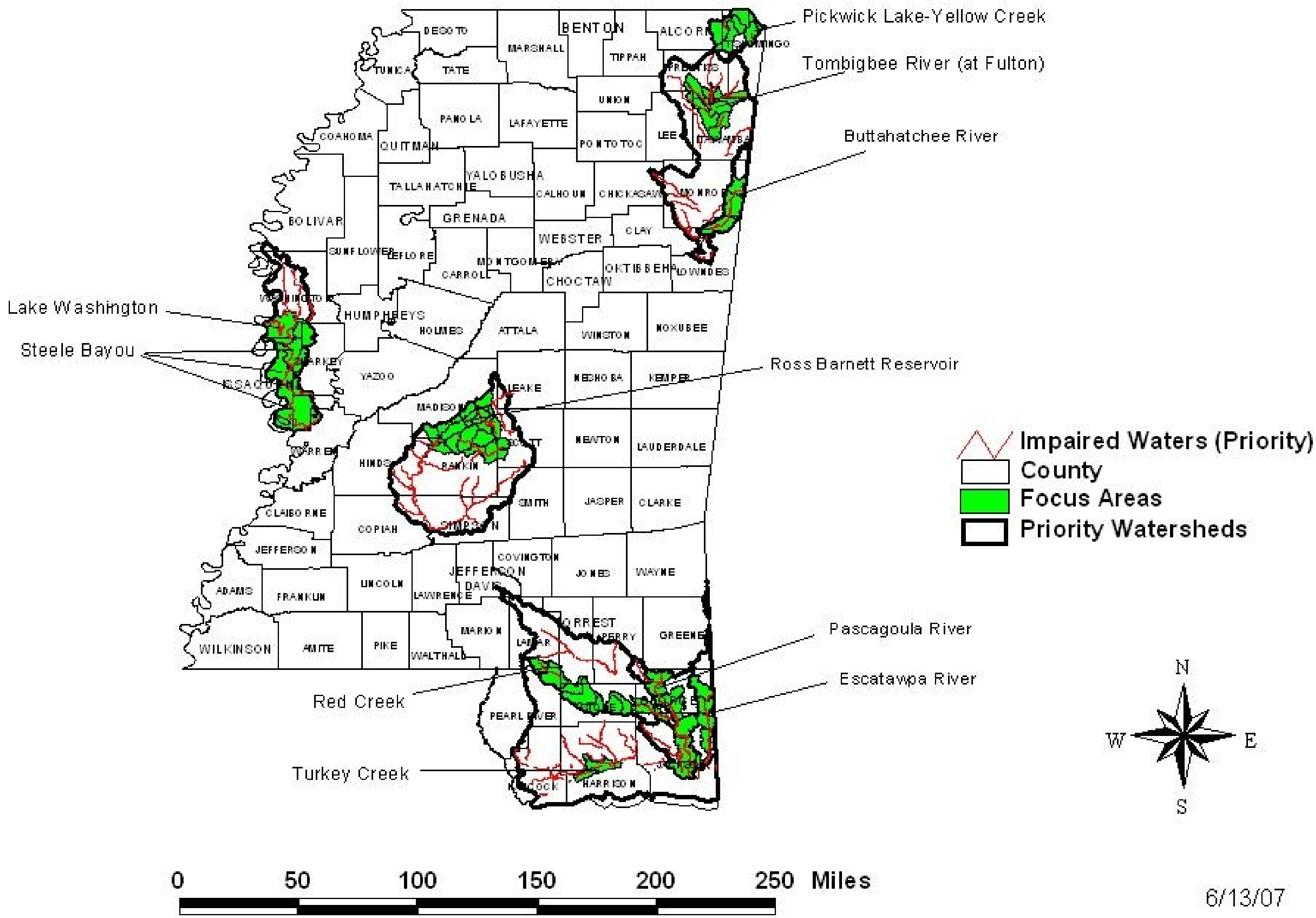

Figure 6. Mississippi priority watersheds identified by Mississippi Department of Environmental Quality

Because Section 303(d) of the Clean Water Act requires each state to identify water bodies that do not meet one or more applicable water quality standards, the Forest Service works cooperatively and collaboratively with Mississippi Department of Environmental Quality, the State regulator, and other organizations (i.e., private, Federal, academia, Tribal and other partners) to protect and restore the quality and quantity of Mississippi water resources. The Clean Water Act Section 303(d) listing requirement applies to water bodies impaired by point and non-point sources as reported to the U. S. Environmental Protection Agency (EPA). In cooperation with the EPA and Mississippi Department of Environmental Quality, the National Forests in Mississippi assists in priority rankings of such watersheds, taking into account the severity of the pollution and the uses to be made of the water bodies. Using integrated approaches and building and fostering relationships and partnerships with other governmental and non-governmental organizations, the Forests have been very successful in addressing water-resource impairments over the past decade. Water resource impairment data from 2006 show that more than 20 water bodies flowing through the Forest Service proclamation boundaries are included on EPA's Section 303(d) lists.

Ranked priority watersheds identified by Mississippi Department of Environmental Quality are shown in Figure 6 identified by Mississippi Department of Environmental Quality. As shown on the map, impaired 303(d)-listed (priority ranked) waters occur throughout the state. The Forest Service, along with other watershed stakeholders and partners, are currently focusing on priority waters primarily in the northeastern, northwestern, central, and southern parts of Mississippi (as highlighted in the green areas). Forest Service lands affected by the 2006 and 2007 priority ranking data include the Tombigbee, Delta, and De Soto National Forests. Water-resource monitoring along with applying best management practices, implementing pollution prevention strategies, and adopting mitigation measures for impairment issues aid in improving the overall watershed conditions; thus protecting, restoring, maintaining, or enhancing our vital nation's water supply.

Groundwater

Groundwater generally moves through small openings (pore spaces) and in fractured rock layers. Groundwater movement in sediments (aquifers) is under the influence of gravity. This natural discharge allows water to generally move from higher elevations to lower elevations in an aquifer, a saturated geologic layer that permits water use and yield of useable quantities to wells. Wells are most oftentimes constructed and used for ground-water extraction for agriculture, municipal, and industrial purposes.

Table 7. Major Mississippi aquifer systems

MS Ranger Districts	Major MS Aquifer Systems
Bienville	Cockfield, Oligocene
Chickasawhay	Oligocene, Miocene
Delta	Mississippi River Valley Alluvium
De Soto	Citronelle, Miocene
Holly Springs	Meridian-Upper Wilcox, Lower Wilcox, Winona-Tallahatta
Homochitto	Citronelle, Miocene
Tombigbee	Ripley

According to the U.S. Geological Survey, the State of Mississippi has an abundant supply of fresh groundwater which extends to depths of more than 3,000 feet in some parts of the State, but the common range is 100 feet to 1,800 feet. Ground water supplies most of the water used in Mississippi where prevalent hydrologic groundwater conditions exist. There are 15 major aquifers in Mississippi that are used to supply freshwater for domestic and industrial supplies and for public supply, industrial, agricultural and domestic uses. More than 93 percent of drinking water or freshwater supplies in the state originate from the State's major aquifers. The Mississippi national forests are underlain by 8 of the State's 15 major aquifers.

Much of the groundwater used for domestic purposes (i.e., drinking water) throughout the Forests is supplied through municipal water associations. Public water associations pumped significant groundwater from aquifers via wells. The aquifers and their respective outcrop areas commonly reflect water table levels where streams drain surface areas; thereby contributing water to streams even during periods of no precipitation, such as the case throughout the Delta National Forest. Generally, water levels in the Mississippi River Valley alluvial aquifer's outcrop area commonly range from land surface to 100 feet below land surface.

Trends

- The National Forests in Mississippi have an abundant system of lakes, streams, and wetlands which provide diverse habitats for aquatic plant and animal species. Since 1985, aquatic resource conditions have generally improved statewide through the use of best management practices.
- Water resources and aquatic ecosystems (i.e., rivers, streams, and wetlands) provide critical habitats for fish, mussels, invertebrates, reptiles, and amphibians. Many hydrologic and aquatic systems are impacted by fragmentation of aquatic habitats by road crossings and dams that hinder or block upstream movements of aquatic organisms.
- Since 1995, water demand has significantly increased due to forest management activities and urban sprawl.
- From a forestwide perspective, the primary areas of concern for the future associated with water quality conditions include erosion, gullying, headcutting, sedimentation, nutrient loading, oil contamination and pollution, mercury, and low dissolved oxygen.

3.4.5 Climate

For the National Forests in Mississippi (Forests) and much of the Southeastern United States, climate variability and weather events such as hurricanes, heat waves, droughts, tornadoes, floods, and lightning storms have long been part of the natural environment. The Southeast has some of the warmest temperatures and, although there are wet and dry periods, generally receives more rainfall than any other region (U.S. Global Change Research Program 2001). However, with increasing climate variability and weather extremes projected for the future, climate change has been recognized as an emerging issue that may require a new look at management strategies for forest ecosystems across the South.

In developing strategies for addressing climate change, some of the challenges facing national forests are the uncertainties about the direction of change, especially at local levels, and how natural ecosystems will respond to future natural and human-induced pressures. Forest Service scientists have been studying various aspects of climate change on forests for many years, and the Forest Service Chief has identified climate change as one of three overarching challenges facing the agency. Yet, our knowledge of how plants and ecosystems respond to the threats of a changing climate and how to react appropriately at local levels where management actions are most effective is still very limited (Solomon 2008).

Southern forests provide a wealth of services and products including clean water, clean air, biological habitats, recreation opportunities, carbon storage, timber, specialty commodities, fuel, and aesthetic and cultural values. Scientists have indicated that a changing climate can affect the future biodiversity and function of the forest ecosystems that support these services and products. Species distributions may shift, some species are likely to decline while others expand, and whole new communities may form. Forest productivity may be reduced in some instances due to a decline in photosynthesis caused by increased ozone, and productivity may be enhanced in other settings where elevated levels of carbon dioxide (CO_2) have a fertilizing effect on overall tree growth. Anticipated increases in extreme weather events outside the historic range of natural variability may alter the frequency, intensity, duration, and timing of disturbances such as fire, drought, invasive species, insect and pathogen outbreaks, and hurricanes. Changes in forest composition and growth may also have associated impacts on wildlife habitats, the supply of wood products, specialty markets, and recreational opportunities (Marques 2008).

In developing management strategies to deal with a changing climate, it has been recognized that forests can play an important role in both mitigating and adapting to climate change. Mitigation measures focus on strategies such as carbon sequestration by natural systems, ways to increase carbon stored in wood products, ways to provide renewable energy from woody biomass to reduce fossil fuel consumption, and ways to reduce environmental footprints. Adaptation measures address ways to maintain forest health, diversity, productivity, and resilience under uncertain future conditions. Forest Service research activities in the coming years are expected to help both public and private land managers better understand changing conditions and determine appropriate management approaches for both adaptation and mitigation. The global change research approach that will guide Forest Service research and development for the next 10 years will not only address enhanced ecosystem sustainability (adaptation) and increased carbon sequestration (mitigation) but will also provide decision support models for land managers and facilitate scientific collaboration and technology transfer (USDA Forest Service 2008).

In light of the evolving research and extent of unknowns regarding climate change impacts, this discussion focuses on our current understanding of what the potential climate change-related stresses are that may impact the National Forests in Mississippi, which factors may influence desired conditions identified in the forest plan, and what appropriate management strategies and future research studies are being developed to address climate change. At this time, the science of climate change modeling is at the stage of stepping down global models to regional scales (Davis 2007), so regional-level climate trends for the Southeastern United States will be used as the most reliable context for describing expected climate changes and impacts. Specifics regarding many mitigation measures, such as the appropriate calculations for carbon offsets and how to consider carbon sequestration rates, are still being developed, so most of our focus at the forest level for now will be on using management options to improve resilience and adaptability of native ecosystems under changing conditions. Then, over the 10- to 15-year life of the forest plan, as issues are better understood and appropriate measures are identified, climate change strategies can be adjusted through the adaptive management process.

Southern Region Climate Change Trends and Expectations

Although climate change is a global occurrence, impacts will vary from region to region. Over the past decade, a number of models have been developed to simulate climatic effects anticipated in the future. These scenarios are based on historical data, trends, and analysis of different plausible assumptions. While climate model simulations are continuing to be developed and refined, climate projections typically do not yet accurately address expected conditions below the regional scale in the United States. In the report by the United States Global Change Research Program; Climate Change Impacts on the United States (U.S. Global Change Research Program 2001); the two principal models that were found to best simulate future climate change conditions for the various regions across the country were the Hadley Centre model (developed in the United Kingdom) and the Canadian Climate Centre model. Unless otherwise noted, the following summary of climate change expectations for the Southern United States is derived from the 2001 U.S. Global Change Research Program report and is primarily based on projections from these two models.

For some nationwide aspects of climate change, virtually all models agree on the types of changes to be expected:

- The climate is going to get warmer, especially warmer minimum winter temperatures. Both the Hadley and Canadian models show increased warming in the Southeast but at different rates (see Table 8). Overall regional temperature changes are projected to be equivalent to shifting the climate of the Southern U.S. to the Central U.S. and the Central U.S. climate to the Northern U.S.
- The heat index, which is a measure of comfort based on temperature and humidity, is going to rise. The principal climate model simulations agree that the heat index will increase more in the Southeast than in other regions. By 2100, the heat index in the Southeast under the Hadley model is projected to increase by as much as 8-10°F and by over 15°F in the Canadian model. The Northeast may feel like the Southeast does today, the Southeast is likely to feel more like today's south Texas coast, and the south Texas coast is likely to feel more like the hottest parts of Central America.
- Threats to coastal areas will increase, including rising sea levels, beach erosion, subsidence, salt water intrusion, shoreline loss, and impacts to urban development.
- Precipitation is more likely to come in heavy, extreme events.

Table 8. Southern region climate change trends

Warmer temperatures: Maximum summer temperature increase: Hadley model = 2.3° F (2030) Canadian = 5° F (2030), 12° F (2100) Mean annual temperature increase: Hadley = 1.8° F (2030), 4.1° F (2100) Canadian = 3°F (2030); 10° F (2100)
Higher summer heat index (average increase): Hadley model = 8-15° F (2100) Canadian model = 15° F (2100)
Moisture changes: Intensified El Nino and La Nina phases as CO_2 increases. Hadley = 20% increased moisture Canadian = decreased moisture; droughts
Increased extreme weather events: Droughts, floods, hurricanes, tornadoes, freezes, winds, ice storms, heat waves.
Higher sea levels for Atlantic and Gulf Coasts: Hadley = 8-12 inch rise (2100) Canadian = 20-24 inch rise (2100)

For other aspects, models tend to differ on expectations. The Southeast is the only region where climate models are currently simulating large and opposite variations in precipitation patterns over the next 100 years. The Canadian model projects more extensive and frequent droughts in the Southeast, starting with little change in precipitation until 2030 followed by much drier conditions over the next 70 years. The Hadley model, in contrast, suggests there will be a slight decrease in precipitation over the region during the next 30 years followed by increased precipitation. There is also uncertainty over the extent of effects of El Nino and La Nina cycles. El Nino events typically result in cooler, wetter winters in the Southeast and fewer Atlantic tropical storms, while La Nina events tend to have the opposite effects with warmer, drier winters and more hurricanes.

Unexpected interactions among multiple disturbances happening at the same time add to the level of uncertainty. For example, tree growth is generally projected to be stimulated by increases in CO_2, but limits on availability of water and soil nutrients during droughts often weaken tree health leading to insect infestations or disease, which in turn promotes future fires by increasing fuel loads and further weakening tree health (Marques 2008). The inset on future climate scenarios summarizes climate change expectations for the Southeastern United States. (U.S. Global Change Research Program 2001).

Based on these current projections, the following discussion highlights some of the potential impacts of a changing climate on forests in the Southeastern United States.

Forest productivity – In general, biological productivity of southeastern forests will likely be enhanced by increased levels of CO_2, as long as there is no decline in precipitation and as long as any increases in moisture stress due to higher air temperatures are low enough to be offset by CO_2 benefits. Hardwoods are more likely to benefit from increased CO_2 and modest temperature increases than pines, since pines have greater water demands than hardwoods on a year-round basis. Without management adaptations, simulations using the Hadley model show pine forest productivity will likely increase 11 percent by 2040 and then exhibit a declining trend to an 8 percent increase by 2100 compared to 1990 productivity estimates. Hardwood productivity will likely continue to rise, with projections of a 22 percent increase by 2040 and 25 percent by 2100. This shift in productivity could have significant effects in the South. Forest productivity increases may be offset, however, by escalating damage from forest pests and more extreme weather disturbances.

Forest pests – The potential for a changing climate to increase the distribution of forest pests and diseases is a concern, particularly for pests that already cause widespread damage such as southern pine beetles. Higher winter temperatures are expected to increase over-wintering beetle survival rates, and higher annual temperatures will produce more generations each year leading to increased beetle infestations. Other factors, however, complicate projections of future infestation levels. Field research has demonstrated that moderate drought stress increases pine resin production thus reducing colonization success, while severe drought stress reduces resin production and increases pine susceptibility to beetle infestation. Insufficient evidence currently exists to predict which of these factors will control future beetle populations and impacts (McNulty et al. 1998).

Fires – Fire frequency, size, intensity, and seasonality are directly influenced by weather and climate conditions. Nationwide projections show seasonal fire severity is likely to increase by 10 percent over much of the United States, with possibly larger increases in the Southeast. At least two ecosystem models run under the Canadian climate change scenario suggest a 25-50 percent increase in fires, and a shift of some southeastern pine forests to pine savannas and grasslands due to moisture stress. Under a hotter, drier climate, an aggressive fire management strategy could prove critical to maintaining regional vegetation patterns.

Shifts in major vegetation types for the Southeast – The broad variety of ecosystem types found across the Southeast ranges from coastal marshes to mountaintop spruce-fir forests. Although the South is one of the fastest growing population regions in the country, forests are still common in many parts of the Southeast, and forestland averages approximately 30 percent of each state. Potential changes in vegetation distribution due to climate change vary with different model scenarios. Under the Hadley model, forests remain the dominant natural vegetation in the Southeast, but the mix of forest types changes. Under the Canadian model, savannas and grasslands expand and replace parts of the southeastern pine forests along the coastal plain due to increased moisture stress. In this scenario, the current southeastern forest moves into the north-central part of the United States. Both drought and increased fire disturbance play an important role in the potential forest breakup.

Weather-related stresses on human populations – Low-lying Gulf and Atlantic coastal areas are particularly vulnerable to flooding. With floods already the leading cause of death from natural disasters in the Southeast, increased flooding from more active El Nino and La Nina cycles could have greater adverse impacts. Even if storms do not increase in frequency or intensity, sea level rise alone will increase storm surge flooding in virtually all southeastern coastal areas. Another concern is the prolonged effect of elevated summertime heat events, which coupled with drought conditions, not only causes elevated heat stress to humans but also increases smog levels.

Increased forest disturbances – Increases in extreme events and changes in disturbance patterns may have more significant impacts, at least in the near future, than long-term changes in temperature or precipitation. Natural disturbances that may be associated with climate change include hurricanes, tornadoes, storms, droughts, floods, fires, insects, diseases, and non-native invasive species. Although disturbances are a natural and vital part of southern ecosystems, it is the change in frequency, intensity, duration, and timing that exceeds the natural range of variation that is a concern (Marques 2008). Multiple disturbances interact and further exacerbate damages. Hurricanes can cause severe disturbance that not only results in direct loss of biological communities and habitat, but the widespread damages can also shift successional direction leading to higher rates of species change and faster biomass and nutrient turnover. Invasive species and insect pests often have high reproductive rates, good dispersal abilities, and rapid growth rates enabling them to thrive in disturbed environments.

Water stresses – The difficulty in predicting whether precipitation will increase or decrease in the Southeast over the next 30-100 years extends to uncertainties over future water quantity and quality conditions. Current water quality stresses across the southern region of the country are primarily associated with intensive agricultural practices, urban development, and coastal processes such as saltwater intrusion. Although water quality problems are generally not critical under current conditions, stresses are expected to be more frequent under extreme conditions, particularly in low stream flow situations associated with droughts. Under the Hadley model, stream flow in the Southeast has been projected to decline as much as 10 percent during the early summer months over the next 30 years. The Chattahoochee and Tombigbee River basins are projected to have decreased water availability over the next 50 years, and as stream flow and soil moisture decrease, agricultural fertilizer applications and irrigation demands tend to increase creating further stress and conflicts over competing uses. Parts of the Southeast that depend more on ground water are particularly vulnerable to depletion of aquifers, which can take centuries to recharge after chronic drought conditions (Hoyle 2008).

Outdoor recreation – Outdoor recreation opportunities are likely to be impacted by climate change but would vary by location and activity. Higher summer temperatures could extend summer activities such as swimming and boating but may also reduce other outdoor activities such as hiking and trails use in hot, humid sections of the South. Warmer waters would increase fish production and fishing opportunities for some species but decrease fishing for other cold water species. Summer recreation activities are likely to expand in cooler mountainous areas as temperatures warm along the coastal plain and lowland elevations.

Threats to coastal areas - Sea level rise is regarded as one of the more certain consequences of increased global temperatures. During the past 100 years, average sea level rose 4-8 inches and is projected to rise an additional 19 inches by the year 2100 (International Panel on Climate Change 1996). Large cities such as New Orleans, Charleston, and Houston are already impacted by frequent and intense flooding. Low-lying marshes and barrier islands off the Southeast coast are considered particularly vulnerable to inundation. Based on current projections of sea level rise, many southeastern coastal areas will lose shoreline as well as coastal wetlands and estuaries. In some areas, forests will decline due to saltwater intrusion. Storm surge is also likely to intensify as sea level rises and barrier protections are lost. Even if the frequency and intensity of hurricanes do not increase, these storms are expected to be more damaging when making landfall due to changes in coastal landforms.

Key Climate Change Factors for National Forests in Mississippi

Based on current projections, the primary regional-level effects of climate change in the Southeast are expected to include (1) warmer temperatures and a rising heat index, (2) moisture changes, (3) rising sea levels and coastal erosion, and (4) increased extreme disturbance events.

Although warming temperatures, moisture changes, and rising sea levels may all have either direct or indirect future impacts on the National Forests in Mississippi, the key area of climate change most likely to be a concern to the Forests during the next 10-15 years is an increase in extreme weather events and other natural disturbances. Based on current projections, the climate-related disturbance factors that are most likely to affect the Forests and impact desired conditions in the revised forest plan are:

- Hurricanes,
- Other extreme weather events,
- Outbreaks of insects, diseases, and non-native invasive species, and
- Fire.

These disturbance events and the potential impacts on desired conditions for the Forests are described below.

Hurricanes

In the wake of Hurricanes Katrina and Rita in 2005, much attention has been focused on the damaging effects of large-scale hurricanes and the potential for increases in frequency or intensity of these storms due to climate change. Hurricanes are part of the natural weather cycle in the Southeast and, whether natural variability or global climate change may be accelerating the intensity and frequency of these storms, most studies agree that hurricane frequency is increasing (U.S. Global Change Research Program 2001). A recent study on disturbance and coastal forests (Stanturf et al. 2007) noted that the past 10 hurricane seasons have been the most active on record (Emanuel et al. 2006), and the consensus among climatologists is that greater hurricane activity could persist for another 10-40 years (Goldenberg et al. 2001).

The potential for increasing risk of hurricane disturbance is of particular concern for Gulf Coast States such as Mississippi. As shown in Figure 7, the area at greatest risk for severe hurricanes in the Southeast is the gulf coast from Texas to Alabama. The circles represent storm intensity (small circles are category 3, large open circles are category 4, and large filled circles are category 5). The tracks are for those storms that were categories 3-5 at some point in their lifecycle (Stanturf et al. 2007). This figure depicts the storm tracks of major hurricanes from 1851-2005 and illustrates the large number of highest category storms that hit Gulf Coast States. Although studies have found that vulnerability of coastal ecosystems are a function of distance from the coast, severe hurricanes such as Katrina can affect inland forests as well. For Hurricane Katrina, approximately 90 percent of the damage was within 60 miles of the coast, and 67 percent of the damage was in Mississippi (Stanturf et al. 2007). While wind and flooding damage to forest ecosystems was worse on the De Soto and Chickasawhay units in the southern part of the state, all of the units in the Forests were affected to some degree.

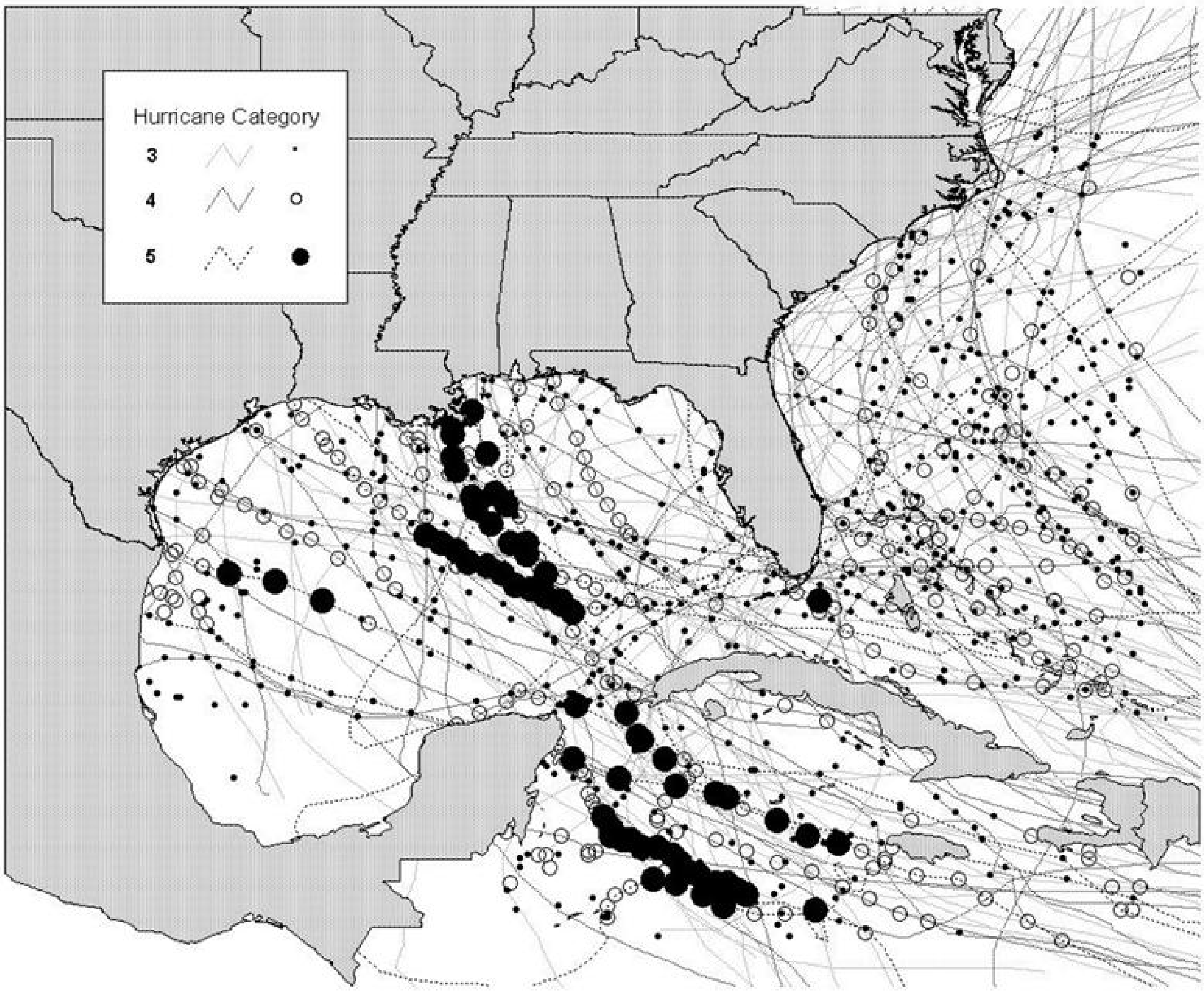

Figure 7. Major (category 3-5) hurricanes making landfall in the Eastern United States (1851 - 2005)

The widespread effects of hurricanes and the length of time it takes to recover from storm damage make them a significant disturbance factor that can impact attaining and sustaining many desired conditions in the forest plan. Desired conditions for ecosystem diversity, species diversity, healthy watersheds, healthy forests, infrastructure, forest fuels, recreation, wilderness areas and scenic rivers, scenic quality, and economic benefits may all be affected by hurricane disturbances. Although southern forests are adapted to a degree of disturbance from hurricane cycles, any increases in occurrence of these large storms can have widespread effects.

Coastal ecosystems in the southern part of the state are the most likely to be affected by more frequent wind and flood damage from increased hurricane disturbances. These ecosystems include longleaf pine, loblolly pine, slash pine, southern dry upland hardwoods, southern mesic slope forests, floodplain forests, near-coast pine flatwoods, xeric sandhills, wet pine savannas, herbaceous seepage bogs and flats, rivers and streams, ephemeral ponds and emergent wetlands, and seepage springs and swamps. In some cases, hurricane damage to forest stands that are not occupying appropriate sites may offer an opportunity to move more rapidly toward restoration of native ecological systems such as longleaf pines. Longleaf pine has been found to be more resistant to breakage and mortality following hurricanes than the more widely planted loblolly pine (Stanturf et al. 2007), and conversion of “off-site” loblolly stands to longleaf is a primary desired condition for the National Forests in Mississippi.

For species diversity, the desire to move threatened and endangered species toward recovery can be set back by hurricane impacts. Maintaining habitat for threatened and endangered species is challenging for species such as the red-cockaded woodpecker and gopher tortoise that occupy pine forests vulnerable to wind damage in the southern part of the state. Since the red-cockaded woodpecker is a cavity nester, these nest trees are particularly susceptible to breakage.

Damage to aquatic systems from downed trees and inundation from flooding can change streamside habitats, affect aquatic life, and impact proper functioning of stream channels. Other effects from the aftermath of hurricanes on forest health include increases in fuel loading and wildfire hazards, insect and disease outbreaks, and opportunities for non-native invasive species to move into altered habitats. Since the designated wilderness and wild and scenic river areas for the National Forests in Mississippi are located on the De Soto National Forest, site conditions and access to these areas near the coast are likely to be repeatedly affected. As a result of Hurricane Katrina, all 18 recreation areas on the De Soto received heavy damage, over 170 miles of district trails were made impassible or nearly obliterated, all roads were blocked by fallen trees, and practically all Forest Service facilities were damaged (Bryant and Boykin 2007). Even occasional re-occurrence of similar hurricane damage can divert limited national forest staff and funding to recovery efforts for years and delay progress toward desired conditions or require reconsideration of desired conditions to allow for a more dynamic resilience.

Other extreme weather events

Although typically less devastating than hurricanes, other weather events that occur more commonly such as droughts, tornadoes, heat waves, wind storms, flooding, and occasional ice storms and warm winter days that cause untimely bud break may be influenced by climate change. Over the past 100 years, the occurrence of intense precipitation events has increased across the Southeast, and this trend is expected to continue (Marques 2007). Disturbances that exceed the historic range of natural variation can change the composition, structure, and function of forests and could affect a number of desired conditions. Impacts on desired conditions from extreme weather events could include changes in the composition and diversity of desired ecosystems; destruction of habitat; timber loss; increasing damage to infrastructure such as trails, facilities, and roads; and loss of recreation opportunities.

Outbreaks of insects, diseases, and non-native invasive species

Disturbances associated with climate change can have secondary impacts indirectly caused by weather-related extremes. Increased variation in temperature and moisture can cause stress and increase the susceptibility of forest ecosystems to invasions by insects, diseases, and non-native species. New environmental conditions can lead to a different mix of species and tend to be favorable to plants and animals that can adapt their biological functions or are aggressive in colonizing new territories (Whitlock 2008). However, changes in adaptability may be too slow given the predicted rate of change. Species that are already broadly adapted may become more prevalent and species with narrow adaptability may become less prevalent. Disturbance factors that create more vulnerability in native ecosystems or require extensive controls to maintain the status quo are likely to affect desired conditions for healthy and diverse forests.

Desired conditions for healthy forests include resilience to dramatic change caused by abiotic and biotic stressors and mortality agents (particularly the southern pine beetle) and a balanced supply of essential resources (light, moisture, nutrients, growing space). Forestwide, southern pine beetle epidemics usually cause the greatest insect damage, and cogongrass and kudzu are the most problematic invasive species. Insects and diseases typically invade in cycles followed by periods of relative inactivity. However, recent studies have shown that periods of attack for some insects, such as southern pine beetle, are becoming continuous (Whitlock 2008). As conditions fluctuate, non-native invasive species may lack the predators and former climate controls that kept them in check. Vulnerabilities to forest threats from an environment that may be much different from the historic range of natural variability is an active area of research right now and includes developing new management approaches for changing conditions.

Fire

One of the natural disturbances that is an integral part of southern forests is fire. Many of the native ecosystems that make up the National Forests in Mississippi are adapted to or dependent on some level of periodic fire. These include commonly occurring ecosystems such as longleaf pine forests and shortleaf pine and oak woodlands as well as the more rare xeric sandhills, prairies, and savannas. Loblolly and slash pine forests are also maintained by fire. However, changes in temperature, more frequent droughts, and more extensive disturbances can change the historic range of natural variability and result in more fuel loading and fire hazards.

Fire frequency, size, intensity, seasonality, and severity are highly dependent on weather and climate. As noted earlier, model results predict that seasonal severity of fire hazard is likely to increase by 10 percent over much of the United States., with possibly larger increases in the Southeast (U.S. Global Climate Change Program 2001). The warmer Canadian model scenario which anticipates increased drought stress, projects a 30 percent increase in fire severity for the Southeast. If extreme events such as hurricanes further increase forest fuel levels with widespread downed trees, there is a potential for larger, more catastrophic fires that could impact many of the desired conditions for the Forests.

3.5 Biological Environment

3.5.1 Ecological Systems

The National Forests in Mississippi include a wide variety of ecological systems that represent the distinctive character of the state. National Forest System lands are interspersed with tracts of private land but represent relatively large parcels of vegetated and undeveloped land that is important for maintenance and recovery of native ecosystems. Forest management has historically been accomplished on longer intervals than those used by industrial and private forest properties. These generally older forest conditions, combined with an expanded program of prescribed burning, offer a variety of ecological conditions not found elsewhere in the state. There are 13 major ecological communities (Table 9) located within the Forests and 9 rare systems or localized features that are currently identified. Additional information about current conditions for these ecological systems is provided in the ecosystem and species diversity report which analyzed sustainability of ecological communities for the revised forest plan and serves as a key part of the ecological sustainability evaluation framework summarized in Appendix G.

For the forest plan revision process, the Forest Service developed a relational database, the ecological sustainability evaluation tool, based on the structure of the ecological planning tool designed by The Nature Conservancy. The ecological sustainability evaluation tool contains data on current and desired conditions for each ecological system and compares it to expected outcomes based on our projected management. The ecological sustainability evaluation database served as the source for evaluating ecosystem diversity on the Forests and developing plan components for the revised forest plan. Some of the systems were already at desired condition and are expected to require only maintenance. Other systems will require management to reach desired ecological conditions. Many of the desired condition will take decades or longer to achieve.

Table 9. Ecological communities within the National Forests in Mississippi

Major Ecological Systems	Rare Communities or Localized Features
Upland Longleaf Pine Forest and Woodland	Xeric Sandhills
Shortleaf Pine-Oak Forest and Woodland	Rock Outcrops
Loblolly Pine Forest	Black Belt Calcareous Prairie and Woodland
Slash Pine Forest	Jackson Prairie and Woodland
Northern Dry Upland Hardwood Forest	Ephemeral Ponds and Emergent Wetlands
Southern Dry Upland Hardwood Forest	Cypress Dominated Wetlands
Southern Loess Bluff Forest	Wet Pine Savanna
Southern Mesic Slope Forest	Seeps, Springs, and Seepage Swamps
Northern Mesic Hardwood Forest	Herbaceous Seepage Bogs and Flats
Southern Loblolly-Hardwood Flatwoods	
Floodplain Forest	
Lower Mississippi River Bottomland and Floodplain Forest	
Near-Coast Pine Flatwoods	

Trends

The National Forests in Mississippi are generally forested landscapes today much as they were when the 1985 forest plan was implemented.

When the National Forests in Mississippi were established during the Great Depression, much of the land was cleared, abandoned, and severely-eroding farmland. The planting of fast-growing pine trees (predominantly loblolly and slash pine) provided not only re-vegetation and recovery of soils and water, but also an economic commodity that continued to be emphasized in the 1985 forest plan. Today, the focus has shifted toward restoration of healthy and thriving native ecological communities, and vegetation management activities are used as tools for achieving habitat and ecosystem restoration.

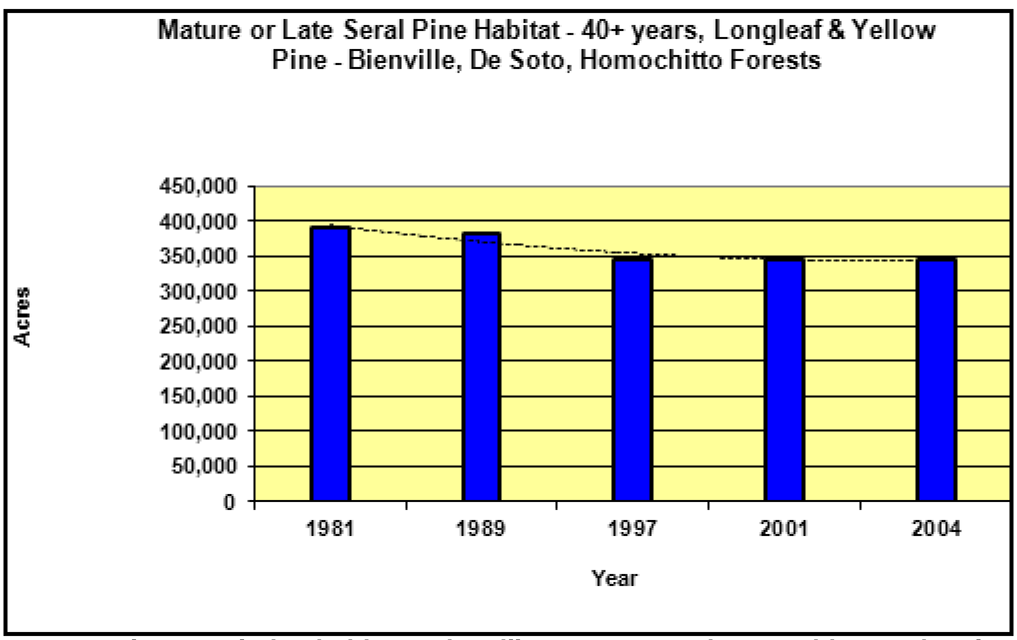

Figure 8. Mature or late seral pine habitat - Bienville, De Soto, and Homochitto National Forests

Pines are still the dominant forest type statewide and are expected to continue to be common but shift toward native pine species. Due to its historic range, longleaf pine is the preferred choice for management on most upland sites on the De Soto and Homochitto National Forests and to a lesser degree, on the Bienville National Forest.

Since 1981, there has been a decline in all types of early-seral (1–10 years) habitats or younger forests due to reduction of regeneration harvests. Declines in younger forests are particularly great for those forest types not frequently regenerated, such as hardwoods. Increased thinning of pine forest types, accompanied by burning, has provided substitute habitat for some early-seral associated species.

Mature or late seral pine habitats (40 plus years) have declined in area because those habitats have been the focus of most regeneration efforts (Figure 8).

Additionally, some of this decline is an artifact of changing classification of existing habitat from pine to pine and hardwood to better recognize the hardwood component in mixed stands. Compounding this trend, reclassification of pine to pine and hardwood is occurring due to mortality of the pine component. Attrition from ice and windstorms, and insects and disease losses, has also converted large acreages from pine to pine and hardwood (Figure 9).

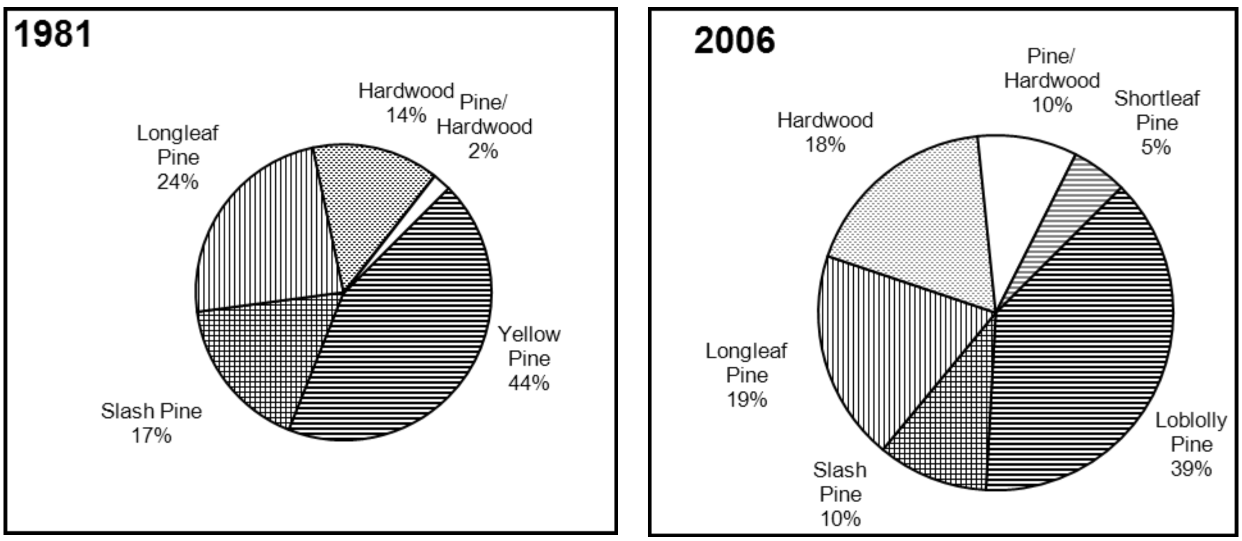

Figure 9. Forest-type composition comparisons 1981 to 2006

In-growth has exceeded regeneration harvest for mature forests of all types on most units, which has resulted in an overall increase in combined mature forest types.

Hurricane Katrina caused heavy random thinning of forests on the De Soto and Chickasawhay Ranger Districts.

Background and Distribution of Ecological Systems

The National Forests in Mississippi are widely distributed throughout the state, and each forest is interspersed with tracts of private and other publicly administered lands. National Forest System lands are significant from an ecological perspective in being relatively large parcels of vegetated and undeveloped lands with focused management goals that contain a range of habitats and natural features supporting a variety of locally rare species. The National Forests in Mississippi also have an extensive prescribed burning program that contributes to sustaining fire-dependent native ecological systems. These factors plus the continued loss of forested land to developed uses on private lands is likely to make National Forest System lands even more important in the future for supporting ecological sustainability.

Table 10. Distribution of ecological systems on the National Forests in Mississippi

Ecological System	Bienville	Chickasawhay	De Soto	Homochitto	Delta	Holly Springs	Yalobusha	Ackerman	Trace
Upland Longleaf Pine Forest and Woodland	■	■	■	■					
Shortleaf Pine-Oak Forest and Woodland	■					■	■	■	■
Loblolly Pine Forest	■	■	■	■		■	■	■	■
Southern Loblolly-Hardwood Flatwoods	■								
Slash Pine Forest		■	■				■	■	■
Northern Dry Upland Hardwood Forest						■	■	■	■
Southern Dry Upland Hardwood Forest	■	■	■	■					
Southern Loess Bluff Forest				■					
Southern Mesic Slope Forest	■	■	■	■					
Northern Mesic Hardwood Forest						■	■	■	■
Floodplain Forest	■	■	■	■		■	■	■	■
Lower Mississippi River Bottomland and Floodplain Forest					■				
Near-Coast Pine Flatwoods			■						
Xeric Sandhills		■	■						
Rock Outcrops	■	■	■	■		■	■	■	■
Black Belt Calcareous Prairie and Woodland									■
Jackson Prairie and Woodland	■								
Ephemeral Ponds and Emergent Wetlands	■	■	■	■	■	■	■	■	■
Cypress Dominated Wetlands				■	■	■			
Wet Pine Savanna			■						
Seeps, Springs, and Seepage Swamps	■	■	■	■		■	■	■	■
Herbaceous Seepage Bog and Flats		■	■						

Table 10 lists the 22 ecological systems which were identified for the Forests and the units on which they generally occur. Ecological systems represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes, such as fire or flooding. Categorizing physical environments into ecological systems allows for more efficient management or restoration of each particular system on the landscape. Ecological systems are specifically defined as a group of plant community types that tend to occur on landscapes with similar ecological processes, substrates, or environmental gradients. The ecological systems for the Forests represent both common and rare community types, both of which are important for sustaining ecological and species diversity. Currently, many of the rare communities are not completely mapped or inventoried.

Status of Ecological System Sustainability

Current distribution and extent of the major ecological systems on the National Forests in Mississippi are summarized in Table 11. Forest plan components that provide for ecological system sustainability include desired conditions, objectives, special areas, and guidelines. Although some forest plan components support ecological system sustainability more directly than others, these four are the primary components for sustaining diversity on the Forests. Desired conditions and objectives for ecological system sustainability will be integrated throughout the forest plan and be addressed not only under ecosystem diversity but also in forest plan components for species diversity, healthy watersheds, and healthy forests. The four forest plan components that will provide for ecological system sustainability are summarized in Table 11.

Table 11. Current percent of forested ecological systems by unit on the National Forests in Mississippi

	Unit Name								
Ecological System	**Bienville**	**Chickasawhay**	**De Soto**	**Homochitto**	**Delta**	**Holly Springs**	**Yalobusha**	**Ackerman**	**Trace**
	Current percentage								
Upland Longleaf Pine Forest and Woodland	3	40	45	9					
Shortleaf Pine-Oak Forest and Woodland	3					28	4	12	14
Loblolly Pine Forest	31	16	13	76		38	65	53	51
Southern Loblolly-Hardwood Flatwoods	38								
Slash Pine Forest		26	21				2	0	0
Northern Dry Upland Hardwood Forest						21	18	20	16
Southern Dry Upland Hardwood Forest	2	1	1	3					
Southern Loess Bluff Forest				2					
Southern Mesic Slope Forest	11	2	2	4					
Northern Mesic Hardwood Forest						10	10	12	15
Floodplain Forest	12	15	6	6		2	2	3	2
Lower Mississippi River Bottomland and Floodplain Forest					100				
Near-Coast Pine Flatwoods			4						
Wet Pine Savanna									

Upland Longleaf Pine Forest and Woodland

This ecological system represents forests and woodlands dominated by longleaf pine occurring across a range of soil and moisture conditions. It occurs on the De Soto, Chickasawhay, Homochitto, and Bienville National Forests. It is synonymous with the NatureServe's east gulf coastal plain interior upland longleaf pine woodland (CES203.496).

Longleaf pine was once the dominant tree species of the piney woods region of south Mississippi. Longleaf pine extended as far north as Kemper and Rankin counties, with an isolated "island" of longleaf pine in Attala and Leake Counties. Fires, both natural and human-caused, maintained forests and woodlands with a rich grass-forb understory. This rich, fire-maintained community supported a diverse fauna and flora, with many species unique to this system. Rare animals such as eastern diamondback rattlesnake, indigo snake, black pine snake, red-cockaded woodpecker, and Mississippi gopher frog were once common in this community. Blackjack oak, post oak and southern red oaks were common trees while turkey oak, sand post oak and flowering dogwood were less common. Longleaf pine once dominated all or significant portions of lands now included in the Chickasawhay, De Soto, Homochitto, and Bienville National Forests.

The extensive stands of virgin longleaf pine were viewed by many at the time of original settlement as commodities or impediments to human progress, and were essentially clear-cut around the turn of the 20th century. Following the removal of the forest, livestock grazing and burning the woods to improve forage quality and quantity was commonplace. The remaining longleaf pines were either too small or deformed or injured in such a way as to have little or no commercial value. By the time the Forest Service acquired the lands in the 1930s, management emphasis was on reforestation, conservation of wildlife, and controlling wild fire. Because the technology of the time did not allow for planting of longleaf pine on large areas, virgin longleaf pine forests were replaced by loblolly pine and slash pine stands. Ironically, wildfire suppression ultimately hampered reforestation and wildlife conservation. The following period of active fire exclusion from the piney woods allowed the establishment of tree species that were not fire adapted and that had not been present in the original fire-maintained system. Trees such as sweetgum, water oak, and red maple which naturally grew in bottoms and terraces became established and sub-dominant in what had been a fire-maintained ecological system.

Under historical reference conditions, fire is believed to have been frequent enough to limit development of fire-intolerant hardwoods and both loblolly and shortleaf pines and to stimulate rich understories of grasses and forbs. Fire suppression has led to increases in overstory canopy and shrub densities, which in turn reduces densities of grass-forb understories. Additionally, plant species diversity in these understories also has been adversely affected by intensive grazing and mechanical site preparation in some places. Management activities are frequently needed to restore the open canopies, historical fire regimes, and characteristic grass-forb understories of longleaf pine communities.

Shortleaf Pine-Oak Forest and Woodland

This ecological system represents forests and woodlands dominated by shortleaf pine occurring on dry to dry-mesic ecological site types. It occurs on the Bienville, Holly Springs, and Tombigbee National Forests. It is synonymous with NatureServe's east gulf coastal plain interior shortleaf pine-oak forest ecological system (CES203.506).

This forested system of the east gulf coastal plain occurs most extensively on generally rolling uplands north of the range of longleaf pine. Stands tend to occur on generally well-drained sandy or clayey soils with dry to dry-mesic moisture regimes. Shortleaf pine is the dominant pine species of the generally dry and dry-mesic oak-pine forest type in the gulf coastal plain and is the most characteristic floristic component of this system. The actual amount of shortleaf pine present varies based on a number of factors, but intact examples of this system often include stands that are dominated by shortleaf pine grading into stands with a mixture of upland hardwoods. Locally on mid to lower slopes, loblolly pine may be a component that extends further upslope in the absence of fire. Fire is possibly the most important natural process affecting the floristic composition and vegetation structure of this system, although fire-return intervals are lower than those associated with the east gulf coastal plain interior upland longleaf pine woodland. Shortleaf pine may have difficulty replacing itself in the absence of fire, particularly on less xeric sites. Where fire is most frequent, the system may develop an essentially pure canopy of shortleaf pine typified by a very open woodland structure with scattered overstory trees and an herbaceous-dominated understory; however, examples are rare on the modern landscape. More typical are areas in which oaks, hickories, sweetgum, yellow poplar, maples, and blackgum have become prominent in the midstory and even overstory and in which herbaceous patches are rare (NatureServe 2004a, 2004b). Current information on location and acreage of this community type is fairly well documented for the National Forests in Mississippi.

Under historical reference conditions, frequent fire regimes limited the development of fire-intolerant hardwoods and encouraged development of fire-adapted species. Fire also stimulated species-rich groundcover plant communities. Many forests on historic shortleaf pine – oak forest sites have been converted to other forest types or support only relict individuals due to a long history of exploitation, conversion, and fire suppression. Additionally, fire seasonality has altered community structure in pine-oak communities. Fire-sensitive species of trees, shrubs and woody vines survive dormant-season prescribed burns while fire-adapted species are unable to successfully reproduce. Management activities are frequently needed to restore shortleaf pine overstories, open canopies, historical fire regimes, and characteristic species-rich ground cover communities.

Loblolly Forest

This system represents loblolly pine dominated forests and woodlands occurring predominately on upland sites. These forests and woodlands, which occupy more acres of habitat than any other in the Forests, is the result of the reforestation efforts of the Forest Service in the 1930s. Loblolly pine was easily established, had value for stopping soil erosion, and was valued in being fast growing and producing valuable timber products. As a result, this association has been planted in places in which the species did not historically occur. Currently, loblolly pine forests occur on every management unit on the Forests with the exception of Delta National Forest, where no native pine occurs. Both current acreage and condition are well known for this community type.

Historically, loblolly pine occurred naturally in pine and mixed hardwood-pine stands on moist upland flats, mid and lower slopes of drains and high stream terraces in areas merging into the longleaf pine region to the south, and the shortleaf pine-oak associations of north Mississippi. With suppression of fire, a dense growth of hardwoods, shrubs and woody vines became established and thick leaf litter accumulates on the forest floor. Without management intervention, hardwoods will gain dominance as pines are reduced to snags by insect damage or old age.

There is no historical reference condition for planted loblolly pine forest that occurs outside of the normal range of this species, although many of these forests occur on historic longleaf and shortleaf pine sites. In addition, fire suppression has led to increases in overstory canopy and shrub densities, reducing densities of grass-forb understories and increasing levels of organic matter (needles). Plant species diversity in these understories has been adversely affected by intensive grazing and mechanical site preparation in some places. Management activities are frequently needed to restore longleaf or shortleaf pine overstories, open canopies, historical fire regimes, and characteristic grass-forb understories. Other communities such as upland hardwood, mesic slope forest will also be restored from these acres as well.

Southern Loblolly-Hardwood Flatwoods

This ecological system represents open forests dominated by loblolly pine with patches of hardwoods on alternating mounds and depressions occurring in a tight local mosaic (gilgai), and this system only occurs on the Bienville National Forest on both mesic and xeric sites. The specific role of fire in this system is unknown. This community is synonymous with NatureServe's east gulf coastal plain southern loblolly-hardwood flatwoods (CES203.557).

Slash Pine Forest

This system represents slash pine dominated forests and woodlands in areas of natural historic occurrence and areas where this species has been planted on both appropriate and atypical locations. Planted forests and woodlands are the result of the reforestation efforts of the Forest Service in the 1930s and the boom of forest economics in the 1960s. Slash pine was easily established, had value for stopping soil erosion, and was valued in being fast growing and producing valuable timber products. As a result, this species has been planted in places where it did not historically occur. This system occurs on the Chickasawhay, De Soto, and Tombigbee National Forests and the Yalobusha Unit of the Holly Springs National Forest. Slash pine historically occurred on the Chickasawhay and De Soto National Forests but has been planted outside of the historical range on the other listed forests.

Within its natural range, the distribution of slash pine was determined by its susceptibility to fire injury during the seedling stage. It was common along streams and the edges of swamps and bays where either ample soil moisture or standing water protected the young seedlings from frequent wildfires. Naturally occurring sites with slash pine would be part of the near coast pine flatwoods association (NatureServe 2004a, 2004b). On other sites, slash pine stands occur that were either planted or naturally regenerated on old-field or former longleaf pine sites. Ground layer composition is highly variable and may range from substantially natural to highly altered, or very sparse, depending on management, canopy closure, and other factors.

There is no historical reference condition for a man-created pine forest that occurs outside of the normal limits of slash pine. Most forests occur on historic longleaf pine sites on the Chickasawhay and De Soto National Forests. On the other districts, slash pine is planted on sites that may have historically supported shortleaf pine-oak or hardwood ecological systems. Fire suppression has led to increases in overstory canopy and shrub densities, reducing densities of grass-forb understories and increasing levels of organic matter (needles). Plant species diversity in these understories also has likely been adversely affected by intensive grazing and mechanical site preparation in some places. Management activities are frequently needed to restore longleaf pine overstories, open canopies, historical fire regimes, and characteristic grass-forb understories.

Northern Dry Upland Hardwood Forest

This ecological system represents forests dominated by upland hardwoods occupying xeric upland slopes and ridgetops with nutrient-poor soils. The range of this ecological system includes portions of the coastal plain of western Kentucky and Tennessee, northern Mississippi, and Alabama. This habitat is found on the Holly Springs and Tombigbee National Forests. Northern dry upland hardwood forest is synonymous with NatureServe's east gulf coastal plain northern dry upland hardwood forest (CES203.483).

Typical associated species of this system are upland oaks (post, southern red, blackjack and white) and hickories (mocker nut and sand). Often shortleaf pine, and occasionally loblolly pine, is mingled with the hardwoods.

Northern dry upland hardwood forests are found on small 50- to 100-acre patches on ridgetops and uplands that divide watersheds throughout northern Mississippi. Many acres of this type have been converted to pine plantations. This community also is frequently traversed by transportation corridors associated with roads and trails. As a result, northern dry upland hardwood forests are often highly fragmented and infrequently burned.

Under historical reference conditions, fire is believed to have been frequent enough to limit development of both fire-intolerant hardwoods and loblolly and shortleaf pines. Fire played an important role in maintaining this community by reducing densities of young saplings, recycling nutrients, and oxidizing the ground layer. Many forests on historic northern dry upland hardwood forests have been converted to other forest types or support only diminished examples due to a long history of exploitation and fire suppression. In addition, fire suppression has led to increases in overstory canopy and shrub densities. Management activities are frequently needed to restore typical northern dry upland hardwood forest overstories, historical fire regimes, and characteristic grass-forb understories.

Southern Dry Upland Hardwood Forest

This ecological system represents forests dominated by upland hardwoods. It occurs on xeric or intermediate -acidic soils in naturally fire-protected landscapes, and is found on the Desoto, Chickasawhay, Homochitto, and Bienville National Forests. This community is synonymous with NatureServe's southern coastal plain dry upland hardwood forest (CES203.560).

Southern dry upland hardwood forest overstories are typically dominated by upland oaks (post, southern red, and white) and hickories (mockernut and sand). Pines (shortleaf, longleaf, loblolly) may be a significant component but are not dominant. Midstories are typically dominated by dogwood and other hardwoods. Stands of this association are found on sandy coastal plain sites associated with natural firebreaks such as bluffs or isolated ridges. The core range of this type extends northward with the approximate historical range of longleaf pine. Like all hardwood systems of this region, southern dry upland forests occur within a landscape matrix historically occupied by pine-dominated uplands and consequently only occurred in fire-sheltered locations in naturally small patches. This ecological system tends to occur on xeric to intermediate sites. Toward the northern range limits of this system, it may have been less restricted to small patches in fire-protected locations and may have been formerly more prevalent on the landscape even in areas heavily influenced by fire (NatureServe 2004b). Current information on location, condition and size is not well documented for this community type.

Southern Loess Bluff Forest

This ecological system represents forests dominated by a mix of hardwood species occurring on loess soil. Historically, pine was absent from this system. The southern loess bluff forest occurs on the Homochitto National Forest. This community is synonymous with NatureServe's east gulf coastal plain southern loess bluff forest (CES203.556).

This system of upland hardwood-dominated forests ranges from the steep loess bluffs bordering the eastern edge of the Mississippi River alluvial plain to south-central Mississippi to southeastern Louisiana, and the hardwood vegetation of the loess plains immediately to the east of these bluffs and ravines. The vegetation is often richer than surrounding non-loessal areas or those with only thin loess deposits. In some examples of this system, tree species normally associated with bottomland habitats are found to be abundant or even dominant in non-flooded uplands. In many cases, the bluffs provide habitat refugia for plant species that are more common to the north. The general composition of forests along the bluffs changes from north to south; the more northerly examples are represented in this classification by east gulf coastal plain northern loess bluff forest, north of the range of southern magnolia and spruce pine. As currently defined, this system ranges from about 32 degrees N latitude (where the Big Black River dissects the bluffs) southward and is restricted to the southern part of the loess bluff (NatureServe 2004b).

In the National Forests in Mississippi, this association is restricted to the southwestern portions of the Homochitto National Forest. Past land management practices have converted portions of this to loblolly pine forest. The silty loess soils are highly erodible in nature and the risk of erosion while logging these sites is high. The steepest areas remain the least likely to have been previously cultivated and maintain some of the highest species diversity. Chinese privet, kudzu, and other invasive species have become established in this ecological system.

Under historical reference conditions, fire is believed to have been an uncommon, low-intensity and low-severity event. The rich, thick organic layers that built up in the absence of intense, frequent fire allowed rich understories of moisture-loving herbaceous species such as trillium, northern maiden-hair fern and Solomon’s seal to become established. Plant species diversity in the understory has the potential to be very high and supportive of rare species such as wild sarsaparilla vine, fetid trillium, and others. Many forests on historic southern loess bluff forest sites have been converted to loblolly pine dominated forests, and fire suppression has led to decreases in oak reproduction. Management activities are frequently needed to restore southern loess bluff forest, along with its significant associates. Protection and restoration of the best examples most mesic old-growth sites in this system should be a priority for the Forests.

Southern Mesic Slope Forest

This ecological system represents forests dominated by hardwoods occurring on steep slopes, bluffs, or sheltered ravines where fire is naturally rare, generally within the natural range of spruce pine and southern magnolia. The system occurs on the De Soto, Chickasawhay, Homochitto, and Bienville National Forests. Loblolly pine may dominate on non-riverine hydric site types on the Bienville National Forest. This community is synonymous with NatureServe’s east gulf coastal plain southern mesic slope forest (CES203.476) on all areas except the Bienville National Forest. On the Bienville, this system includes NatureServe’s east gulf coastal plain southern loblolly-hardwood flatwoods (CES203.557).

Stands are mesic, and vegetation typically includes species such as American beech, southern magnolia, Florida anise, and other species rarely encountered outside this system in the region. Related forests which occur on deep loess soils along the western margin of the region are classified as east gulf coastal plain southern loess bluff forest. Some component associations are also found in temporarily flooded floodplains adjacent to these slopes, but this is primarily an upland system (NatureServe 2004b). Past land management practices have converted portions of this to loblolly pine forest, and current prescribed burn practices may be creating too intense fire at too frequent a return interval.

Under historical reference conditions, fire is believed to have been uncommon low-intensity and low-severity events. The rich, thick organic layers that built up in the absence of intense, frequent fire allowed rich understories of moisture-loving herbaceous species such as trillium, northern maiden-hair fern and Solomon’s seal. Many forests on historic southern loess bluff forest sites have been converted to loblolly pine dominated forests. Plant species diversity in these understories has the potential to be very high and supportive of rare species such as wild sarsaparilla vine, fetid trillium, and others. Management activities are frequently needed to restore southern loess bluff forest, along with its significant associates. Protection and restoration of the best examples of mesic old-growth stands should be a priority of the Forests.

On the Bienville National Forest, this forested system occurs on broad upland flats in the east gulf coastal plain of Mississippi. Known examples in the Mississippi parts of the range include a mosaic of open forests dominated by loblolly pine interspersed with patches of willow oak and sometimes other tree species. The ground surface displays an evident microtopography of alternating mounds and swales occurring in a tight local mosaic. These mounds are most likely "gilgai" resulting from the shrink-swell properties of the Luinn soil series. Moisture conditions range from xeric to mesic, and the most mesic sites trap significant moisture from local rainfall events. These ephemeral pools hold water for a minimum of several days, but often hold water for longer periods, especially when evapotranspiration is lowest. The vegetation of this system supports relatively low vascular plant diversity and thus may appear floristically similar to other pine-hardwood vegetation of the region. The dry portion of this vegetation mosaic is dominated by grassy ground cover with scattered emergent greenbriers underneath a nearly pure loblolly pine overstory. The historical composition of this type is unknown, but it seems likely that loblolly pine was a natural dominant component of this system, as it is in related systems in the west gulf coast. Wetter areas are dominated by an overstory of willow oak with an abundance of dwarf palmetto in the understory. Although the specific role of fire in this system is unknown, low-intensity ground fires may have been ecologically important, and such fires could have originated in the surrounding east gulf coastal plain interior shortleaf pine-oak forest (CES203.506).

Northern Mesic Hardwood Forest

This ecological system represents forests dominated by hardwoods occurring on slopes and ravines between dry uplands and stream bottoms. It occurs on the Holly Springs and Tombigbee National Forests. This community is synonymous with NatureServe's east gulf coastal plain northern mesic hardwood forest (CES203.477).

This system includes mesic deciduous hardwood forests of inland portions of the east gulf coastal plain, including Alabama, Mississippi, western Kentucky, and western Tennessee. The northern mesic hardwood forest overstories are typically dominated by hardwoods, such as beech, white oak, cherrybark oak and southern magnolia. Additionally, mixed loblolly pine-hardwood conditions may exist within this system in the southern portion of the range. In addition, loblolly pine may be common in some examples in the southern portion of the range, and may be locally dominant depending on previous disturbance and site conditions. To the south this system is replaced by east gulf coastal plain southern mesic slope forest, which is within the range of spruce pine and southern magnolia. Most of the vegetation is recovering from one or more forms of severe disturbance often resulting in conversion to one of the pine types (NatureServe 2004a). Current acreage and location are not well known for this community type.

Subcanopies are more or less open and typically contain magnolia, hornbeam, yellow poplar, red maple, and flowering dogwood. Shrubs include red buckeye, switch cane, witch hazel, and deciduous holly. The forest floor typically has a rich organic layer with abundant leaf litter. This system supports populations of associated uncommon species, including Webster's salamander, American ginseng, and Turk's-cap lily. Where site conditions are suitable, several rare communities are typically embedded within this larger system including rock outcrops, seeps, and springs. This system is dominated by mature forest and woodland (60 years old or older), and a network of well-distributed old growth is present. Early-seral components exist in sufficient quantities to sustain this system over time. Forests are typically closed, with canopy closure in mature examples of this system being greater than 80 percent. Low intensity fire creeps into this system from the surrounding upland community and occurs at an interval of 1-6 years.

Under historical reference conditions, fire is believed to have been uncommon, low-intensity and low-severity events. The rich, thick organic layers that built up in the absence of intense, frequent fire allowed rich understories of moisture-loving herbaceous species such as trillium, northern maiden-hair fern and Solomon's seal. Many forests on historic northern mesic hardwood forest sites have been converted to loblolly pine dominated forests. Additionally, fire suppression has led to decreases in oak regeneration. Plant species diversity in these understories has the potential to be very high and supportive of rare species such as wild sarsaparilla vine, fetid trillium, and others. Management activities are frequently needed to restore northern mesic hardwood forest and its significant associates. The designation of the best examples old-growth stands in this system should be a priority.

Floodplain Forest

This ecological system represents forests dominated by bottomland hardwoods occurring on alluvial soils in riparian areas. It occurs on all portions of the National Forests in Mississippi except the Delta National Forest. This community is synonymous with Natureserve's east gulf coastal plain large river floodplain forest (CES203.489), east gulf coastal plain small stream and river floodplain forest (CES203.559), and the southern coastal plain blackwater river floodplain forest (CES203.493).

This is a predominately forested system of the east gulf coastal plain and includes large river floodplain forest, small stream and river floodplain forest, and blackwater river floodplain forest. Several distinct plant communities may occur based on geomorphic and other factors that may be present. Bottomland hardwood tree species are diagnostic, although mesic hardwood species may also be present in areas less frequently flooded. Lower areas may contain beaver impoundments, providing wetland habitat for waterfowl and other species. Past land management practices have resulted in disturbances to the hydrologic regime as well as conversion of hardwood forests to loblolly pine dominated forests. Current inventory information is considered good although some examples are possibly coded as loblolly pine forest.

Under historical reference conditions, fire is believed to have been very uncommon with long return intervals. Many floodplain forests have been converted to other forest types, mainly loblolly pine. Additionally, these forests have been selectively cut in the past resulting in atypical species composition. These communities are dependent on healthy hydrologic function, including overbank flooding for maintenance. In some cases, headcutting has lowered the stream level to such a point that overbank flooding seldom occurs. Management activities are frequently needed to restore floodplain forest overstories and healthy hydrologic function.

Lower Mississippi River Bottomland and Floodplain Forest

This ecological system represents forests dominated by bottomland hardwoods occurring on the Mississippi River alluvial plain. This community is synonymous with Natureserve's lower Mississippi River bottomland and floodplain forest (CES203.195).

This system is found on fertile, fine textured clay or loam soils of floodplains, stream terraces and wet lowland flats of the Yazoo-Mississippi River Delta, with the Sharkey soil series the dominant soil type. This system is represented in National Forests in Mississippi only by the Delta National Forest. The Delta consists of extensive flats of very deep, poorly and very poorly drained, very slowly permeable alluvial clays. Common trees include willow, water, overcup, and Nuttall oaks, pecan, sugarberry, American elm, green ash, and sweetgum. Found in the subcanopy are possumhaw, cedar elm, swamp-privet, boxelder, dwarf palmetto and giant cane. Past land management practices have resulted in a forest with atypical species composition rather than the desired distribution of species that would have occurred in the historical forest. Pondberry, an endangered plant species, is present in larger numbers on the Delta National Forest than anywhere else in its range.

Under historical reference conditions, fire is believed to have been very uncommon and of a long return interval. These communities are dependent on healthy hydrologic function, including overbank flooding for maintenance. Efforts to restrict overbank flooding may inhibit this function. Management activities are frequently needed to restore floodplain forest overstories and healthy hydrologic function.

Near-coast Pine Flatwoods

This ecological system represents sparse woodlands dominated by longleaf and slash pine with scattered loblolly pine, and predominately occurs on non-riverine hydric soil site types on the De Soto National

Forest. This community is synonymous with NatureServe's east gulf coastal plain near-coast pine flatwoods (CES203.375).

The near-coast pine flatwoods system occupies broad, sandy flatlands in a relatively narrow band along the northern Gulf of Mexico coast east of the Mississippi River. These areas, often called flatwoods or flatlands, are subject to high fire-return intervals even though seasonally high water tables are common. Original vegetative condition was characterized by widely scattered longleaf pine and scattered slash pine in mesic areas. Scattered loblolly pine may also occur in this ecological system. Understory conditions range from open herbaceous-dominated areas to dense shrubs, dependent largely upon fire history.

Historically, fire occurred with lower frequency than adjacent longleaf pine or pine savanna types. Frequency and intensity of fire determined density and structure of the shrub layer. For example, intense and frequent burning often resulted in an understory of pitcher plant flats. In the past, forests of this ecological system were often bedded, fertilized and planted to slash pine to increase forest site production. On sites for which this silvicultural technique was successful, slash pine grew quickly, outcompeted native shrubs and altered the hydrologic regime through increased uptake of water. Fertilizer application also created a flush of woody shrub growth and a decrease in carnivorous plant numbers. Plant species diversity in this community has been adversely affected by these silvicultural activities. Management activities are needed to restore near-coast pine flatwood conditions, historical fire regimes, and characteristic grass-forb understories.

Xeric Sandhills

This rare ecological system represents sandhills characterized by deep, well-drained sands supporting plants adapted to xeric conditions such as wiregrass, prickly pear cactus, and saw palmetto. Dominant tree species include longleaf pine, and bluejack, turkey and other oaks. This system includes all gopher tortoise priority soils as identified by the US Fish and Wildlife Service. Gopher tortoise burrows are often a distinctive feature of sandhill communities, and provide shelter to many vertebrate and invertebrate species, such as the federally endangered indigo snake, black pine snake, and old field mouse.

Historically, fire combined with extreme aridity is believed to have been frequent enough to limit development of fire-intolerant hardwoods and both loblolly and shortleaf pines. Drought tolerant species of grass and forbs dominate the sparse understory. Some historic longleaf sites have been converted to scrub oak forest types by early removal of longleaf pine. Also, well-intentioned efforts to protect gopher tortoise "priority soil" areas often have left these special areas unburned and unharvested resulting in thick vegetative cover. Plant species diversity in these understories has likely been adversely affected by repeated unsuccessful attempts to replant these sites. Management activities are frequently needed to restore longleaf pine overstories, historical fire regimes, and characteristic grass-forb understories. A priority of the National Forests in Mississippi should be selection of the best examples of the most xeric of these as old-growth stands.

Rock Outcrops

Rock outcrops are rare, localized features of the landscape which mainly occur along steep hill slopes, ravines, or river channels where soils have eroded away. They are usually embedded in a larger ecological system and rely heavily on surrounding habitats for landscape scale functions and processes. There are an estimated 500 acres of this habitat in the entire state of Mississippi. Distribution on the National Forests in Mississippi is unknown; however, rock outcrops may occur on all Forests except the De Soto Chickasawhay and Delta Units. Although of minor extent, the rock outcrops provide quality habitat for several species of animals and plants including Webster's salamander and hairy lipfern.

Historically, fire is believed to have occurred at the same frequency as the surrounding matrix community. Most impacts to rock outcrops have been by quarrying and erosion from management activities in the surrounding forest. Rock outcrops in a shaded moist condition are excellent habitat for bryophytes, ferns and other shade loving herbs. Management activities are frequently needed to restore hardwood overstories and healthy hydrologic regimes such as springs and seeps that often co-occur with rock outcrops. The inclusion of rock outcrops in designated old-growth or botanical areas should be a priority of the National Forests in Mississippi.

Black Belt Calcareous Prairie and Woodland

This rare ecological system represents open grassy areas dominated by characteristic prairie species. Within this grassland matrix, woody vegetation occurs sparingly in stream bottoms and hilltops with caps of acid soil. It occurs on the Trace Unit of the Tombigbee National Forest. This community is synonymous with NatureServe's east gulf coastal plain black belt calcareous prairie and woodland ecological system (CES203.478).

Native prairie vegetation once occurred on an estimated 100,000 acres in the black belt prairie region, extending in a narrow band from the Tennessee border through northeastern Mississippi into eastern Alabama. The open grassy areas were dominated by characteristic prairie species such as indiangrass, bluestem grasses, rosinweeds, prairie-clovers, yellow-puffs, purple cone-flower, prairie cone-flowers and others. Within this grassland matrix, woody vegetation occurred sparingly in stream bottoms and on hilltops with caps of acid soil. Individual trees and shrubs native to the black belt were post oak, Durand oak, nutmeg hickory, rock chestnut oak, and burr oak. Pine trees were notable for their rarity or absence. Due to the fertility of these lands and their open character, these prairies were among the first to become settled and were soon converted to crop or pasture. The agricultural lands were abandoned as soil fertility diminished and soil erosion increased. When the Forest Service acquired these lands, they were planted with trees as the best alternative to retain soil and prevent soil erosion.

Degraded examples of this type are known to occur on the Trace Unit of the Tombigbee National Forest, but it is uncertain of how many examples exist or how many acres are involved. No examples of the original large expanses of deep black soil prairie are known to exist, and current examples approximate chalk barrens, although both have essentially the same species. Former sites, because of past land use practices, are now in a woodland or sparse forest condition. Many may show signs of past erosion such as gullies.

Historically, fire is believed to have been frequent enough to prevent woody encroachment into grassy openings. Fire also encouraged the forb component. Many black belt prairies have reverted to other forest types due to settlement, conversion, and fire suppression. Plant species diversity in these understories has likely been affected by past intensive grazing and use of the prairie openings as wildlife food plots, roads and log landings. Management activities are frequently needed to restore prairie vegetation, enlarge present openings, restore damage done by past management actions, and restore historical fire regimes. Future management actions should include identifying and mapping all occurrences of this rare community.

Jackson Prairie and Woodland

This rare ecological system represents open grassy areas dominated by characteristic prairie species. Jackson prairie occurs as calcareous islands (less than 1 to 160 acres) on gently sloping uplands surrounded by pine and hardwood forest on generally acid soils. This community is synonymous with NatureServe's east gulf coastal plain Jackson prairie and woodland ecological system (CES203.555).

On the National Forests in Mississippi, prairie remnants range in size from less than 1, to 160 acres and total about 802 acres. Composites (21 percent), legumes (12 percent), and graminoids (15 percent) make up the floral composition in the prairie remnants. This ecological system is restricted to the Bienville National Forest. The once dominant or important prairie species included bluestem grasses, rosinweeds, prairie-clovers, yellow-puffs, purple cone-flower, prairie cone-flowers and others. Due to the fertility of these lands and their open character, they were among the first to become settled and were soon converted to cropland or pasture.

When the National Forests in Mississippi were established, these lands were allowed to revert to forest. Fire suppression contributed to the size reduction of prairie openings by allowing encroachment of woody vegetation. A study of representative sites on the Bienville indicated a decrease in size of 60 to 80 percent over a 50 year period (1936-1988). Due to the open nature of the community, past land management has often utilized these openings as log landings, woods roads and wildlife food plots. Former sites are degraded because of past land use practices and most are now in a woodland or sparse forest condition. Past inventory efforts have identified 65 prairie relicts on the Bienville. Not all relicts have been identified, and the aerial extent of these prairie relicts is yet to be determined.

Historically, fire is believed to have been frequent enough to prevent encroachment into the grassy openings. Fire also encouraged the forb component. Many Jackson prairies have reverted to other forest types due to settlement, conversion, and fire suppression. Plant species diversity in these understories also has likely been affected by past intensive grazing and use of the prairie openings as wildlife food plots, roads and log landings. Management activities are frequently needed to restore prairie vegetation, enlarge present openings, and restore historical fire regimes. Future management actions should include identifying and mapping all occurrences of this rare community.

Ephemeral ponds and emergent wetlands

This wetland system represents a variety of seasonally flooded depression wetlands, freshwater marshes, and ephemeral ponds. Included are ponds of various geomorphic origins in a variety of substrates including lime sinks and Grady ponds which may hold areas of shallow open water for significant portions of the year. Ephemeral ponds and emergent wetlands occur on all portions of the National Forests in Mississippi. This community includes, but is not limited to, NatureServe's east gulf coastal plain depression pondshore ecological system (CES203.558).

Ephemeral ponds and emergent wetlands generally occur in isolated upland situations and are not part of a stream system. In some examples, distinct bands of vegetation are present, while in others the bands are not distinct or they are present in a complex mosaic. Many examples have been altered or destroyed (e.g., converted to stock ponds or affected by erosion from adjacent uplands). The few remaining examples are vulnerable to off-highway vehicle use, ditching and drainage, and invasion by non-native plants and animals. Since they are of small size and often dry up during the year, they are valuable as breeding sites for amphibians and for Mississippi sandhill cranes breeding on the De Soto National Forest and environs. These habitats are also essential for Mississippi gopher frog breeding and habitat. Information on location and size of this community type is not well known or documented. Due to past land use actions, these habitats may be degraded due to woody plant encroachment and drainage.

Cypress Dominated Wetlands

This rare wetland system represents cypress dominated wetlands in a range of sizes, generally conforming to the size of the depression in which they occur. These wetlands may be located in floodplain forest or other wetland systems, around oxbow lakes and abandoned stream channels, and in smaller backwater areas adjacent to other bottomland hardwood forest types. This system occurs on the Bienville, Delta, Homochitto, and Holly Springs National Forests.

Depending on past history of disturbance and other factors, bald cypress may occur with other species such as black gum, water tupelo, green ash, ironwood and red maple. Cypress dominated wetlands may be found throughout the Forests, but due to inconsistencies in past mapping practices there is no current accurate estimate of the amount of acreage in this type. Current condition of this type on the forest is probably relatively young forest growing back from harvest in the early part of this century. Several key locations are at risk due to headcutting of streams threatening to drain the wetland, while other locations have been harvested without successful cypress regeneration and await restoration.

Wet Pine Savanna

This rare wetland system represents open savannas dominated by grasses, sedges, orchids, and carnivorous plants, and is located on low, flat plains with poorly drained soils. These sites are often saturated for 50-100 days per year. The system occurs on the De Soto National Forest. This community is synonymous with NatureServe's east gulf coastal plain treeless savanna and wet prairie (CES203.192).

This savanna or wet prairie association occurs in the western Florida Panhandle and adjacent areas of Alabama and Mississippi. It occurs in pine flatwoods landscape on gently sloping to almost level topography, and often has a scattered canopy (typically 5-10 percent cover) of stunted longleaf pine and slash pine. This fire-dependent community is part of the longleaf pine ecosystem, which once dominated the coastal plain landscape, and depends on frequent, low-intensity, growing-season fires to control understory vegetation. Carnivorous plants such as pitcher plants are diagnostic of this ecological system. Pitcher plant abundance ranges from dominant or co-dominant to sparse, and one or more species may be present. Where ephemeral ponds and emergent wetlands are interspersed, this is habitat for the endangered Mississippi sandhill crane. Frequent fires, including growing-season burns, are essential for maintenance of this system (NatureServe 2004a, 2004b). It is uncertain how many acres of this community type occur on the National Forests in Mississippi.

Under historical reference conditions, fire is believed to have been frequent enough to limit development of fire-intolerant hardwood and to stimulate rich understories of grasses and forbs. Many wet pine savanna sites have been converted to forest or support only depauperate[2] communities due to a long history of system drainage and fire suppression. Management activities are frequently needed to restore healthy hydrologic function, historical fire regimes, and characteristic grass-forb understories of wet pine savannas.

Seeps, Springs, and Seepage Swamps

This wetland system represents forested wetlands in acidic, seepage-influenced habitats. Seeps, springs, and seepage swamps occur on all areas of the National Forests in Mississippi except the Delta National Forest. This ecological system combines elements of NatureServe's southern coastal plain seepage swamp and baygall (CES203.505) and the east gulf coastal plain northern seepage swamp (CES203.504).

This wetland system occurs mostly in deciduous forests (and less commonly herbaceous communities), generally found at the base of slopes or other habitats where seepage flow is concentrated and resulting moisture conditions are saturated or inundated. Vegetation is characterized by black gum, tupelo gum, and red maple. To the south, this system grades into southern coastal plain seepage swamp and baygall where evergreen species are important in the canopy and understory. Due to excessive wetness, these habitats are normally protected from fire, except during extreme droughty periods. These environments are prone to long-duration standing water and tend to occur on highly acidic, nutrient-poor soils (NatureServe 2004a, 2004b). Current information on location and size of this community type is not well documented. Due to excessive wetness, these sites have not been as highly disturbed as have adjacent upland areas. Many

[2] Having a limited biodiversity.

seeps and springs may dry during part of the year as water tables recede. Maintenance of saturated to inundated soil conditions is important to maintenance of the unique forb, grass, and sedge dominated diversity of these sites. Without wet conditions, sites would soon be dominated by more xeric or mesic species from surrounding habitats. Management activities are frequently needed to maintain canopy closure as appropriate over these communities and to ensure maintenance of the water table.

Herbaceous Seepage Bogs and Flats

This rare wetland system represents open seepage communities dominated by grasses, sedges, orchids, and carnivorous plants. These wetlands are generally found on gentle, almost imperceptible slopes maintained by constant seepage zones or perched water tables. Pitcher plants are notable indicators of this system. It occurs on the De Soto National Forest. This community includes NatureServe's southern coastal plain herbaceous seepage bog (CES203.078).

This small-patch ecological system includes wet, fire-maintained, seepage communities in the outermost portions of the east gulf coastal plain, east of the Mississippi River in Louisiana, Mississippi, Alabama, and northern Florida. Sites are typically grass and sedge dominated and species rich. Pitcher plants are notable indicators of this system. In the absence of fire, shrub encroachment is common, although due to greater topographic isolation, the most interior examples are often naturally shrubbier (NatureServe 2004b). The most established herbaceous seepage bogs and flats may be called “quaking bogs” and have deep (in excess of 2 meters) organic, mucky peats instead of inorganic soil. They are considered to be imperiled in the state due to their rarity as a result of a history of fire exclusion and attempts at hydrologic modification. Examples of this community are known to exist on the De Soto National Forest, but it is uncertain how many examples persist and how many acres are involved. Occurrences on the National Forests in Mississippi typically have too much canopy closure with resultant impacts on hydrologic regime.

Historically, fire is believed to have been frequent enough to limit development of woody shrubs and vines while allowing for the maintenance of a very rich grass, sedge, forb ground cover. The balancing of fire seasonality, intensity and frequency is important to maintain rare components of both shrub (e.g., bog spice bush and odorless wax myrtle) and herbaceous layers (e.g., Harper's yellow-eyed grass, coast sedge and large-leaved grass-of-Parnassus). Too frequent or too intense burns will eliminate the rare components of the shrub layer, while too infrequent or cooler burns will lead to exclusion of herbaceous layer and establishment of titi thickets. It should be noted that during drought periods, intense fire in this system can result in reduction of the peat layer of the bog. In the past, there have been attempts to drain these “unproductive wetlands.” Management activities are needed to restore the hydrologic function, open canopies, historical fire regimes, and characteristic grass, sedge, forb understories of this ecological system.

3.5.2 Species Diversity

There are an estimated 2,500 plant species and 306 animal species that occupy an extremely wide array of habitats across the diverse landscapes of the National Forests in Mississippi. Habitat management is designed to provide for a diversity of cover types and successional stages to sustain native and desired non-native wildlife species. Forest lands serve as refuges for unique or rare species, offer large contiguous forested areas where animal species can successfully reproduce and rear their young, afford key rest and feeding areas for waterfowl and other migratory bird species, and provide important linkages (travel corridors) between State and Federal wildlife refuges and other blocks of forested land. Additional background information about species diversity is including in the ecosystem and species diversity report (Appendix G) and the ecological sustainability evaluation tool which analyzed sustainability of ecological communities for the revised forest plan and serves as a key part of the ecological sustainability evaluation framework.

One focus of habitat management programs is demand species associated with recreational wildlife pursuits such as hunting, fishing, and viewing. Because these activities are generally limited or restricted on private lands, the National Forests in Mississippi offer a unique opportunity within the state for those wishing to participate in these activities. Some demand species are white-tailed deer, eastern wild turkey, fox and gray squirrels, northern bobwhite, eastern bluebird, and a diversity of neo-tropical migratory birds passing through during migration.

The National Forests in Mississippi have 14 wildlife management areas designated throughout its 7 ranger districts which are managed under a cooperative agreement between the Forest Service and the Mississippi Department of Wildlife, Fisheries, and Parks. While Mississippi Department of Wildlife, Fisheries, and Parks holds authority for regulation of hunting and trapping and provides equipment and labor for wildlife food plots, the Forests are primarily responsible for protecting and managing habitat.

The Forests also conduct activities and programs to assist in identification, conservation, and recovery of threatened and endangered plant and animal species in cooperation with the US Fish and Wildlife Service (USFWS). Four threatened and endangered wildlife species were listed in the 1985 forest plan: the red-cockaded woodpecker, Mississippi sandhill crane, American alligator, and eastern indigo snake. Since 1985, eight additional listed plant or animal species have been confirmed on the National Forests in Mississippi. However, since then two species, the bald eagle and American alligator have been delisted. Currently, seven additional species include: pondberry, Louisiana quillwort, gopher tortoise, Louisiana black bear, gulf sturgeon, pallid sturgeon, and Mississippi gopher frog. The National Forests in Mississippi provides habitat for nine federally listed threatened or endangered species (Table 12). Habitats for all threatened and endangered species are provided through forestwide management prescriptions in associated forest communities.

Table 12. Federally threatened or endangered species that occur on the National Forests in Mississippi

Threatened and Endangered Species	Status	District Most Likely to Occur
Red-cockaded Woodpecker (*Picoides borealis*)	Endangered	Bienville, Chickasawhay, De Soto, Homochitto
Gopher Tortoise (*Gopherus polyphemus*)	Threatened	Chickasawhay De Soto
Louisiana Black Bear (*Ursus americanus luteolis*)	Threatened	Delta, De Soto Homochitto
Mississippi Gopher Frog (*Rano capito sevosa*)	Endangered	De Soto
Louisiana Quillwort (Isoetes louisianensis)	Endangered	Chickasawhay De Soto
Pondberry (*Lindera melissifolia*)	Endangered	Delta
Mississippi Sandhill Crane (*Grus Canadensis pula*)	Endangered	De Soto
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)	Threatened	Chickasawhay
Pallid Sturgeon (*Scaphirhynchus albus*)	Endangered	Delta

Aquatic Resources

Surface water resources (creeks, streams, rivers, lakes, ponds, bayous, and greentree reservoirs) within the National Forests in Mississippi are abundant. Stream systems provide critical habitats for fish, mussels, invertebrates, reptiles, and amphibians, and the larger streams and rivers on the Forests are important sport fishing resources. At least 143 species of fish are known to occur in streams and lakes on the Forests, several of which have significance as game species while others have significance as ecological indicators. The National Forests in Mississippi have extensive acreage of riparian areas. Riparian and aquatic-associated terrestrial communities are managed to protect and maintain water quality, productivity, bank stability, and habitat for riparian dependent or aquatic species. Because of the mixed land ownership pattern on these forests, many streams traverse intermittently across private land and National Forest System land, making management somewhat challenging. Many of the streams were channelized or modified in the past and are still recovering. Stream systems are impacted by road crossings and dams that hinder or block upstream movements of aquatic organisms. In-stream water flows are essential for fishing, boating, and the habitat needs of a variety of game and non-game fish and other aquatic species.

Other surface waters of the Forests include man-made lakes and ponds. These systems provide a water source for a wide range of plants and animals. The Forests contain over 50 man-made lakes and ponds totaling more than 3,100 acres of water. These impoundments range in size from 1 to 1051 acres. The original purpose for the construction of these impoundments was floodwater prevention and erosion control. However, these impoundments were also stocked with largemouth bass, bluegill, and red-ear sunfish and now provide recreational fishing benefits. Most of the lakes and ponds over one acre in size are managed for sustainable sport fishing.

Fisheries management is practiced on the Forests to provide fishing opportunities to the public. Management practices include angler access improvement, liming and fertilization, aquatic weed control, fish habitat improvement, and fish stocking. Demand species associated with fishing include: largemouth bass, bluegill, redear sunfish, channel catfish, black crappie, white crappie, spotted bass, longear sunfish, and white bass.

The following is a summary of current water conditions on the National Forests in Mississippi:

- Streams on the Holly Springs and Tombigbee National Forests are characteristically small, often turbid with warm varying flow and low in pH. Many of these streams have been extensively channelized and are poorly to moderately shaded, generally with hard clay bottoms and occasionally with silty, soft substrate.
- Streams on the Delta National Forest are typified as highly modified, low gradient, turbid with large floodplains. Management activities on the Delta have minimal influence on the functioning of these systems compared to the extensive agricultural practices that occur upstream.
- Streams on the Homochitto National Forest are characteristically slow flowing, clear, and warm with a sand-gravel substrate. These streams are moderately shaded, wide and shallow. Head-cutting (sloughing, instable stream banks) has become a recurring problem and is a serious threat to maintaining aquatic ecosystems.
- Streams on the Bienville National Forest are small to moderate in size and flow. Because of flat topography and low flow conditions, many of these streams dry up during the summer.
- Most streams on the De Soto National Forest are classified as black-water streams. These streams typically occur in the pine forest areas of the southeastern United States where little or no agriculture occurs. These streams are usually clear or tea-colored with a sandy bottom.

Trends

- The National Forests in Mississippi have an abundant system of lakes, streams, and wetlands which provide diverse habitats for aquatic plant and animal species. Since 1985, aquatic resource conditions have generally improved statewide through the use of best management practices.
- Water resources and aquatic ecosystems (i.e., rivers, streams, and wetlands) provide critical habitats for fish, mussels, invertebrates, reptiles, and amphibians. Many hydrologic and aquatic systems are impacted by fragmentation of aquatic habitats by road crossings and dams that hinder or block upstream movements of aquatic organisms.
- Since 1995, water demand has significantly increased due to forest management activities and urban sprawl.
- From a forestwide perspective, the primary areas of concern for the future associated with water quality conditions include erosion, gully creation, head-cutting, sedimentation, nutrient loading, oil contamination and pollution, mercury, and low dissolved oxygen.

3.5.3 Threatened and Endangered Species

Mississippi Gopher Frog

The Mississippi gopher frog is listed as federally endangered and is distributed across three localities. The largest and best known population, of approximately 100 adult frogs, breed at a pond (Glen’s Pond) located in Harrison County, Mississippi on the De Soto Ranger District of De Soto National Forest. Mississippi gopher frogs were found in 2004 at two other pond sites one of which is owned by the state of Mississippi and the other on private land with the nearest recently found pond at least 20 miles from Glen’s Pond.

Glen’s Pond is an ephemeral pond, typically dry during the summer. The frogs come to the pond to breed in the fall and winter in years when there has been adequate rainfall. The adults subsequently leave the pond after breeding. Metamorphosed juveniles leave the pond in the summer. A water well and pump is in place to supplement water levels in the pond due to inadequate rainfall in recent years.

Gopher frog habitat includes both upland foraging sites with a subterranean refuge and isolated temporary wetland breeding sites embedded within the forested landscape. This species is associated with longleaf pine habitat and utilizes burrows of the gopher tortoise and small mammals as a refuge from heat and predators. Frequent fires are necessary to maintain the open canopy and groundcover vegetation in the aquatic and terrestrial habitats (U.S. Fish and Wildlife Service 2001).

Mississippi Gopher Frog Current Threats

The greatest threat to the Mississippi gopher frog is its small population numbers that makes it extremely vulnerable to extinction from natural and man-made processes. In 2003, an undescribed disease was discovered in gopher frog tadpoles at Glen’s Pond. Initial work on the disease by researchers at the National Wildlife Health Research Center indicated it is similar to Perkinsus, a genus of Mesomycetozoan that occurs in marine invertebrates. During work conducted to study the Perkinsus-like disease, an additional disease, a chytrid fungus, was found in two other species of amphibians at Glen’s Pond. This disease has been implicated in amphibian declines worldwide. The effect of these two diseases on the survival of gopher frogs is unknown. In close proximity to Glen’s Pond is a 4,000 acre residential development project on private land. Urban and commercial development of the surrounding area, including several highway projects, has the potential to further degrade this habitat and possibly increase mortality. Drought has also resulted in complete reproductive failure in some years.

Mississippi Gopher Frog Responses to Threats

The National Forests in Mississippi along with several cooperators have been involved in research, monitoring, habitat management, acquiring land and captive propagation programs. These cooperators include the US Fish and Wildlife Service, Mississippi Museum of Natural Science, University of New Orleans, Southeastern Louisiana University, USGS National Wildlife Health Center, University of Southern Mississippi Gulf Coast Research Lab, USDA Natural Resource Conservation Service, Harrison County Soil and Water Conservation District, The Nature Conservancy, Dr. Steven Richter, Mississippi Department of Transportation, Mississippi Army National Guard, Memphis Zoo and Detroit Zoo.

Glen's Pond has been monitored for the presence of gopher frog egg masses since 1988. A drift fence completely encircling Glen's Pond was established in December of 1995. Both egg mass surveys and drift fence monitoring are currently being used to assess population status. Movements of adult and metamorphic gopher frogs into and out of the pond are monitored by capturing them as they enter and exit the breeding pond. Gopher frog tadpoles were collected at each breeding event since 2002 and raised in cattle tanks as a hedge against pond drying or other catastrophic events at the pond.

Prescribed burning Glen's Pond basin and the surrounding upland habitat has been a priority for the Forest Service. Frequent fires are necessary to maintain the mid-story and groundcover vegetation in the aquatic and terrestrial habitats. The Forests' focus is habitat restoration and management and maintaining a 1-3 year burning regime.

The National Forests in Mississippi currently has a Memorandum of Understanding with the US Fish and Wildlife Service and Mississippi Department of Wildlife, Fisheries, and Parks which states that the Forest Service shall (1) cooperate in the monitoring of the breeding population of the frog and its habitat on forest lands, (2) manage timber stands within a 2 km radius of Glen's Pond in a manner appropriate for the protection of the frog and management emphasis will focus on maintenance and restoration of longleaf pine ecosystem, (3) cooperate on the development of a plan to create additional ponds for the purpose of introduction and (4) cooperate on the development of a long-term adaptive management plan for the recovery of the Mississippi gopher frog. Once a recovery plan has been established for the Mississippi gopher frog, the Forests will follow the most current recovery plan guidance and the best available science in order to recover this species.

Mississippi Gopher Frog Cooperative Management Unit (CMU)

The Mississippi gopher frog is listed as federally endangered and is distributed across three localities. The largest and best known population, of approximately 100 adult frogs, breed at a pond (Glen's Pond) located in Harrison County, Mississippi on the De Soto Ranger District of De Soto National Forest.

Glen's Pond is an ephemeral pond, typically dry during the summer. The frogs come to the pond to breed in the fall and winter in years when there has been adequate rainfall. The adults subsequently leave the pond after breeding. Metamorphosed juveniles leave the pond in the summer. A water well and pump is in place to supplement water levels in the pond due to inadequate rainfall in recent years.

Gopher frog habitat includes both upland foraging sites with a subterranean refuge and isolated temporary wetland breeding sites embedded within the forested landscape. This species is associated with longleaf pine habitat and utilizes burrows of the gopher tortoise and small mammals as a refuge from heat and predators. Frequent fires are necessary to maintain the open canopy and groundcover vegetation in the aquatic and terrestrial habitats.

A 1,655 acre Mississippi gopher frog cooperative management unit has been designated in all alternatives except the no-action alternative in the southern portion of De Soto Ranger District which encompasses

Glen's Pond and surrounding habitat (Figure 10). This area of the district contains the only known breeding population of the Mississippi gopher frog. The establishment of this cooperative management unit would assist in further management of this species by creating a focus point for management needs including restoration of longleaf pine, protection of Glen's Pond and its hydrology, invasive species management, and prescribed fire. The continuity of habitat over a large area should focus management, preclude isolation and allow for dispersal of the species across the landscape.

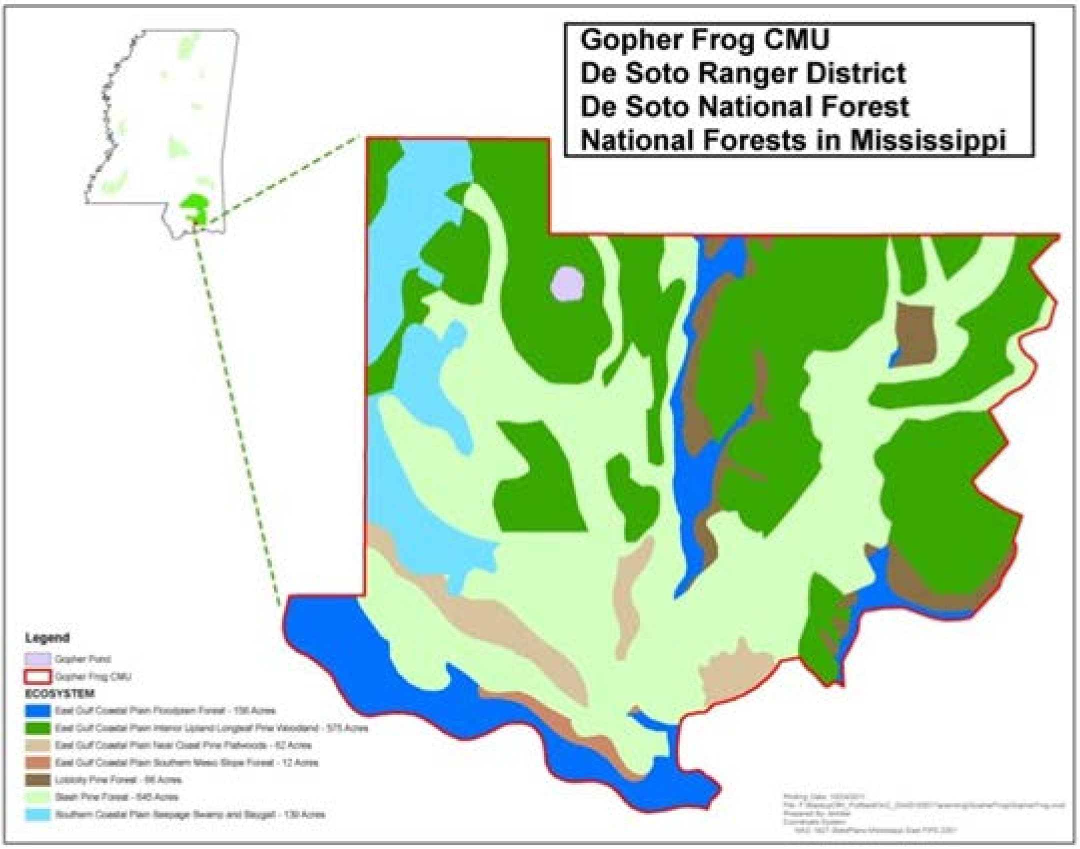

Figure 10. Mississippi gopher frog cooperative management unit

Mississippi Sandhill Crane

The Mississippi sandhill crane, the most endangered North American crane, is listed as federally endangered has declined in range where it once occurred along most of the northern Gulf of Mexico coast. A small population of 110-120 Mississippi sandhill cranes exists in southern Jackson County, MS from the Pascagoula River west to the county line and from 4 miles north of Vancleave, MS, south to Simmons Bayou which is located on the Mississippi Sandhill Crane Refuge (US Fish and Wildlife Service 1991). Sightings of this species on the southeastern portion of De Soto Ranger District of the De Soto National Forest are not uncommon as they use existing habitat for foraging. Currently, there are no nests known to occur on the National Forests in Mississippi.

The Mississippi sandhill crane inhabits pine savannahs as well as associated bay-heads, swamps, and marshes. These areas are seasonally wet, open to semi-open herbaceous communities dominated by grasses and sedges with poorly formed shrubs and trees. Frequent growing season fire is required to maintain this habitat. This bird uses the wet pine savannas for nesting during the summer breeding season. The ground cover is composed of grasses, sedges, and an array of wet-acid-soil plants. Water at the nest sites may range from none to a foot deep. The nests vary from token piles of grass laid on top of grasses or sedges, to large structures constructed from local vegetation. The nests are built at ground level. The cranes feed on the breeding grounds in savannas, swamps, and open fields in the spring, summer, and fall. During the winter they often feed in the small cornfields and pastures in the northern part of their range (US Fish and Wildlife Service 1991).

Mississippi Sandhill Crane Current Threats

The greatest threat to Mississippi sandhill crane its small population numbers and its current restriction to a small area of lower coastal plain pine savanna in Jackson County, MS. The wet pine savanna is critical to the crane's habitat needs, but most of the original savanna habitat has been altered by human practices. Wild flocks have also been slow to increase due to abnormally high mortality of nestlings and first-year birds. There are no known imminent dangers, but projected environmental disruptions include possible tourist, commercial, and industrial developments in the marsh and waterways.

Mississippi Sandhill Crane Response to Threats

The National Forests in Mississippi recognizes that the Mississippi sandhill crane's habitat needs must be met in order for species survival. The Forests' focus is to restore and maintain wet pine savanna to increase habitat availability for this species. A sandhill crane cooperative management unit, as described previously, will be designated in all alternatives except Alternative B. This unit will allow for accelerated restoration of habitat needed for the expansion of this species at a landscape scale.

Mississippi Sandhill Crane Cooperative Management Unit (CMU)

A 3,357 acre Mississippi sandhill crane cooperative management unit has been designated in all Alternatives except the no-action alternative in the southeast corner of De Soto Ranger District which encompasses part of Harrison and Jackson counties and lies within 10 miles of the coastline of southern Mississippi (Figure 11). This area of the District once contained suitable Mississippi sandhill crane habitat, as evidenced by records of crane sightings and nests on National Forest System land. The nearly 20,000 acre Mississippi Sandhill Crane Wildlife Refuge is located only a few miles from this area. The establishment of a cooperative management unit in this southeast corner would assist in further management of this species by increasing the spatial extent of the species' range including increased nesting and foraging habitat and creating habitat through ecosystem restoration of wet pine savannah, seeps, springs, and seepage swamps, and creation of ephemeral ponds and wetlands. Cooperative management unit size and location was dependent on the amount of potential wet pine savanna in contiguous blocks and distance from the Mississippi Sandhill Crane Refuge. The continuity of crane habitat over large areas should preclude isolation and allow for dispersal of the species across the landscape.

The dense pine woods currently found in the southeast corner of the De Soto Ranger District are unacceptable nesting and feeding habitat for cranes. Fire suppression, pine plantations, draining of land and nearby development have changed the historic vegetation structure. Stands of pine trees and thick underbrush now occupy what was once open savanna. Prescribed burning, mechanical clearing, thinning, and restoration of habitat and hydrology will effectively restore and maintain open savanna.

Restoration of Mississippi sandhill crane habitat on the De Soto Ranger District will promote recovery of the species and ensure effective collaboration with the US Fish and Wildlife Service as they work to maintain crane habitat on the nearby refuge.

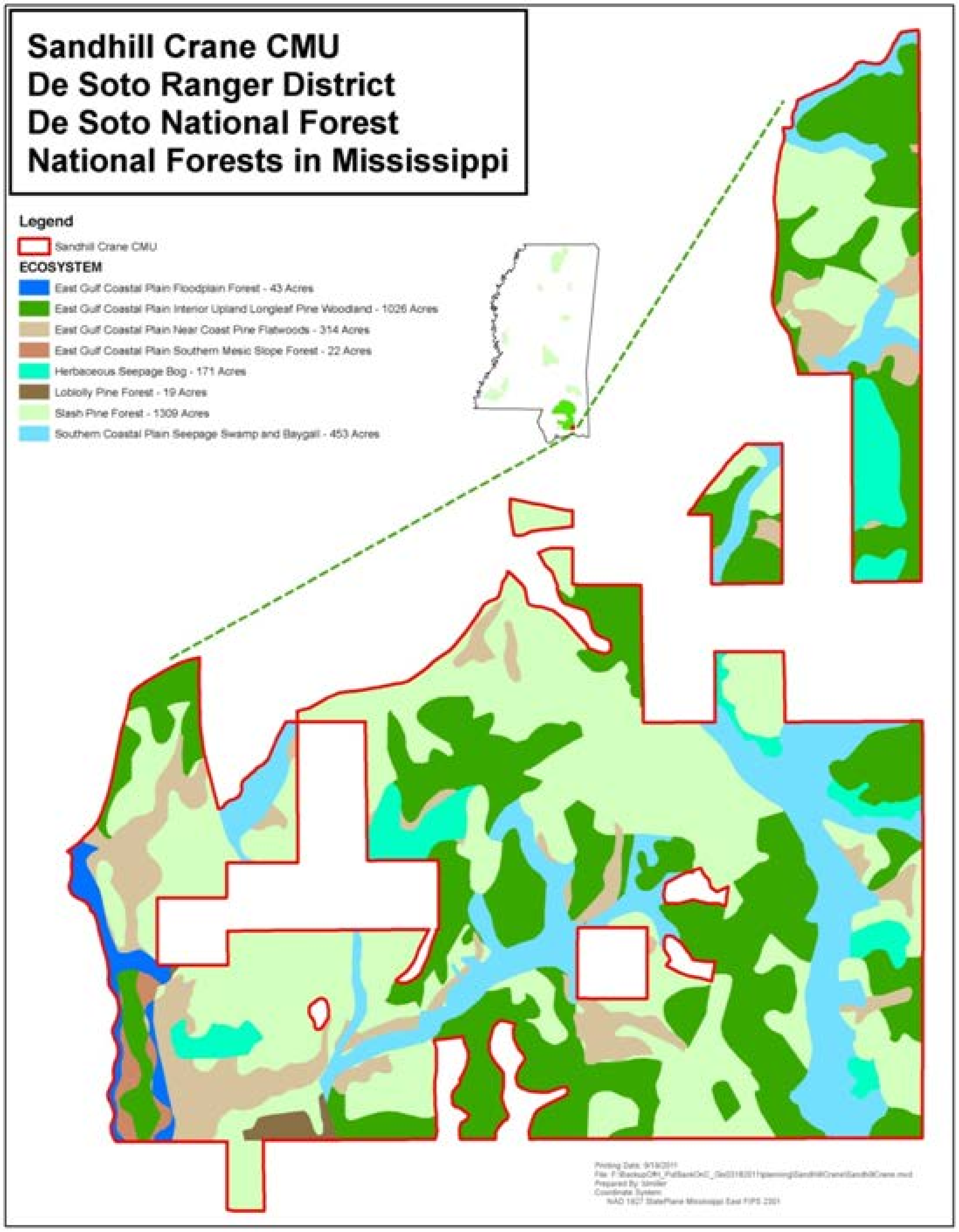

Figure 11. Mississippi sandhill crane cooperative management unit

Red-cockaded Woodpecker

The red-cockaded woodpecker is a medium-sized woodpecker adapted to the historic fire maintained mature pine forest ecosystems of the southeastern United States. The range of the red-cockaded woodpecker has been reduced to approximately 1 percent of its historic range. It is currently listed as endangered by the US Fish and Wildlife Service throughout its range. The red-cockaded woodpecker is native to the open, fire-maintained pine forests of the southeastern United States. This species required large areas of mature pine forest with open under-stories to meet both foraging and nesting requirements. They excavate nesting and roosting cavities in live mature pines, 60 years old or older, and forage mainly in pines greater than 30 years of age within a half mile of the colony site and contiguous to the colony.

Species recovery is dependent on land management practices that mimic historical regimes that resulted in open stands of mature pine with under-stories dominated by forbs and grasses. Presently, 56 percent of all active red-cockaded woodpecker groups (known as clusters) reside on National Forest System land (US Fish and Wildlife Service 2003b). Thus, the Forest Service plays a crucial role in the conservation and recovery of the red-cockaded woodpecker.

Red-cockaded Woodpecker Threats

Fire suppression and past large-scale timber harvests have resulted in loss of habitat for red-cockaded woodpeckers. One of the primary threats to red-cockaded woodpeckers, described in the recovery plan (US Fish and Wildlife Service 2003b), is a bottleneck in the number of pines available as cavity trees. A second impact on the viability of red-cockaded woodpeckers is demographics or the factors associated with the isolation and expansion of small populations. Other threats include the lack of suitable foraging habitat and the lack of mid-story control.

Red-cockaded Woodpecker Response to Threats

The US Fish and Wildlife Service has determined that recovery populations of the endangered red-cockaded woodpecker will be accomplished only within large expanses of mature and over-mature pine forests managed for the special nesting and foraging habits of this species. Four districts within National Forests in Mississippi have been identified by the US Fish and Wildlife Service and the US Forest Service as support units for this species. Two are primary core populations, known to hold at least 350 potential breeding groups at the time of and after delisting – the Bienville National Forest and the Chickasawhay Ranger District of the De Soto National Forest. Two others are secondary core populations which will hold at least 250 potential breeding groups at the time of and after delisting – the Homochitto National Forest and the De Soto Ranger District of the De Soto National Forest (U.S. Fish and Wildlife Service 2003b).

In 1995, the regional red-cockaded woodpecker FEIS provided direction to National Forests in the Southern Region with red-cockaded woodpecker population and habitat management objectives. In January 2003, the red-cockaded woodpecker recovery plan second revision was released (USDA Forest Service 1995, US Fish and Wildlife Service 2003b). The National Forests in Mississippi have incorporated these two sources to maximize red-cockaded woodpecker opportunities within existing forest conditions, current political management realities, and the Forests' planning land allocation decisions. The FEIS was used to define the habitat management areas strategy; while the most current US Fish and Wildlife Service recovery plan will be implemented to define habitat management strategy, population management guidance and goals, and monitoring guidance.

Current understanding of this species' biology is sufficient to work towards red-cockaded woodpecker population goals. The National Forests in Mississippi should continue to improve and maintain favorable habitat conditions for this endangered species. Multiple techniques are available and effective, and strategies have been tailored to individual populations and habitat conditions. It is the implementation of these strategies, carefully designed to meet the conditions of each of four very different populations and habitat, which will continue to enhance red-cockaded woodpecker recovery on the National Forests in Mississippi.

Red-cockaded Woodpecker Habitat Management Areas

Tentative Red-cockaded Woodpecker Habitat Management Areas (Alternative B)

Three National Forests in Mississippi; the Bienville, the Homochitto, and the De Soto (comprised of the De Soto and Chickasawhay Ranger Districts), currently support populations of red-cockaded woodpecker and have been identified as playing significant roles in species recovery by the Recovery Plan for the Red-cockaded Woodpecker (*Picoides borealis*): Second Revision (US Fish and Wildlife Service 2003). Tentative habitat management areas were identified as part of the Final Environmental Impact Statement for the Management of Red-cockaded Woodpecker and its Habitat on National Forests in the Southern Region (USDA Forest Service 1995) and incorporated into the Land and Resource Management Plan for the National Forests in Mississippi (U.S. Forest Service 1985) through amendment #14. The determination of habitat management areas and population objectives for red-cockaded woodpecker was needed to insure population objectives could be met for the species' recovery in the long term and to conform to regional direction.

Red-cockaded woodpecker habitat management areas, as described in the FEIS, have been designated for each national forest where birds are currently found. Habitat management area designation involves the delineation of an area that represents the desired future demographic configuration of a red-cockaded woodpecker population. It is a strategy of management at a landscape scale. The intent is to manage an area large enough to avoid or overcome the adverse effects of fragmentation and to reduce the risks involved with small populations and environmental stochasticity. The area within habitat management areas and outside of cluster, recruitment stand, and replacement stand boundaries should be managed for a full range of multiple uses, but would emphasize the sustainable production of red-cockaded woodpecker foraging and future nesting habitat.

Revised Habitat Management Areas (Alternatives A, C, D, and E)

Delineation of habitat management area boundaries was based on the distribution of existing active and inactive clusters, therefore a habitat management area may contain more acres of suitable and potentially suitable habitat than needed to support the minimum required population. Population objectives for each habitat management area are based on red-cockaded woodpecker density objectives which vary by physiographic province and ecosystem. Variability in habitat capability exists among physiographic provinces based on ecological factors associated with individual landscapes. This variability was the determining factor allowing each national forest to refine the tentative population objectives established in the FEIS for each habitat management area.

It has been over 10 years since the FEIS was created, thus acreage changes within the tentative habitat management area boundaries were expected due to land exchanges, acquisitions, natural succession of ecosystems, and decisions made through the years. All tentative habitat management area boundaries have been reexamined to insure that present conditions meet red-cockaded woodpecker recovery objectives both spatially and temporally (Table 13).

Table 13. Objectives, goals, and designations of red-cockaded woodpecker habitat management areas (HMAs) in the National Forests in Mississippi

	Bienville	De Soto	Black Creek	Biloxi	Chickasawhay	Homochitto	Totals
Tentative HMA acres	125,160		35,467	38,293	100,494	67,755	367,196
Tentative Population Objective	500		177	191	502	225	1,595
Management Intensity Level	3		4	4	4	3	
USFWS Designation	Primary core	Secondary core			Primary core	Secondary core	
USFWS Size at Delisting (PBG[a])	350	250			350	250	1,200
Revised Tentative HMA Acres[b]	140,520		30,436	43,888	102,426	93,502	390,886
Revised HMA Population Objective	500		152	219	502	276	1,649

a – PBG – potential breeding group

b - Suitable and potentially suitable red-cockaded woodpecker Management Intensity Level habitat acres

Tentative habitat management area boundaries on all districts have been revised based soundly on ecology that addresses the habitat requirements of the red-cockaded woodpecker necessary for population conservation and recovery. Chickasawhay Ranger District changed its habitat management areas boundary to remove hardwood dominated ecosystems and replaced them with suitable and potential suitable pine dominated ecosystems in a surplus of approximately 2000 acres (Figure 12). Since the FEIS was written, Biloxi and Black Creek Ranger Districts were combined into De Soto Ranger District; however, two separate habitat management areas remain (Figure 13 and Figure 14). Because these habitat management area boundaries are separated by approximately 12.5 miles, they should still be considered separate habitat management areas, while the combination of both will meet the US Fish and Wildlife Service red-cockaded woodpecker population objectives for the De Soto Ranger District. Some of the areas inside of the habitat management areas that were historically pitcher plant bogs and treeless savannahs were excluded from suitable and potentially suitable red-cockaded woodpecker habitat and will not be managed for red-cockaded woodpecker. Homochitto Ranger District revised its tentative boundary to increase the proportion of acres per cluster of suitable and potential suitable pine dominated ecosystems in a surplus of approximately 25,000 acres [100 acres per cluster] (Figure 16). This allows the district to increase its original FEIS habitat management area population objective in order to satisfy US Fish and Wildlife Service recovery standards. Bienville National Forest's habitat management area boundary was also increased to incorporate the entire district excluding hardwood dominated systems allowing for more than 14,000 additional suitable acres. While acres of suitable and potentially suitable habitat within the boundary changed due to ecosystem changes over time and as data became more reliable through better science and data management (Figure 15), habitat management area population objectives did not change. Although the majority of the pine dominated ecosystems are primarily loblolly, longleaf dominated systems do exist on Bienville National Forest accounting for more than 5,000 acres.

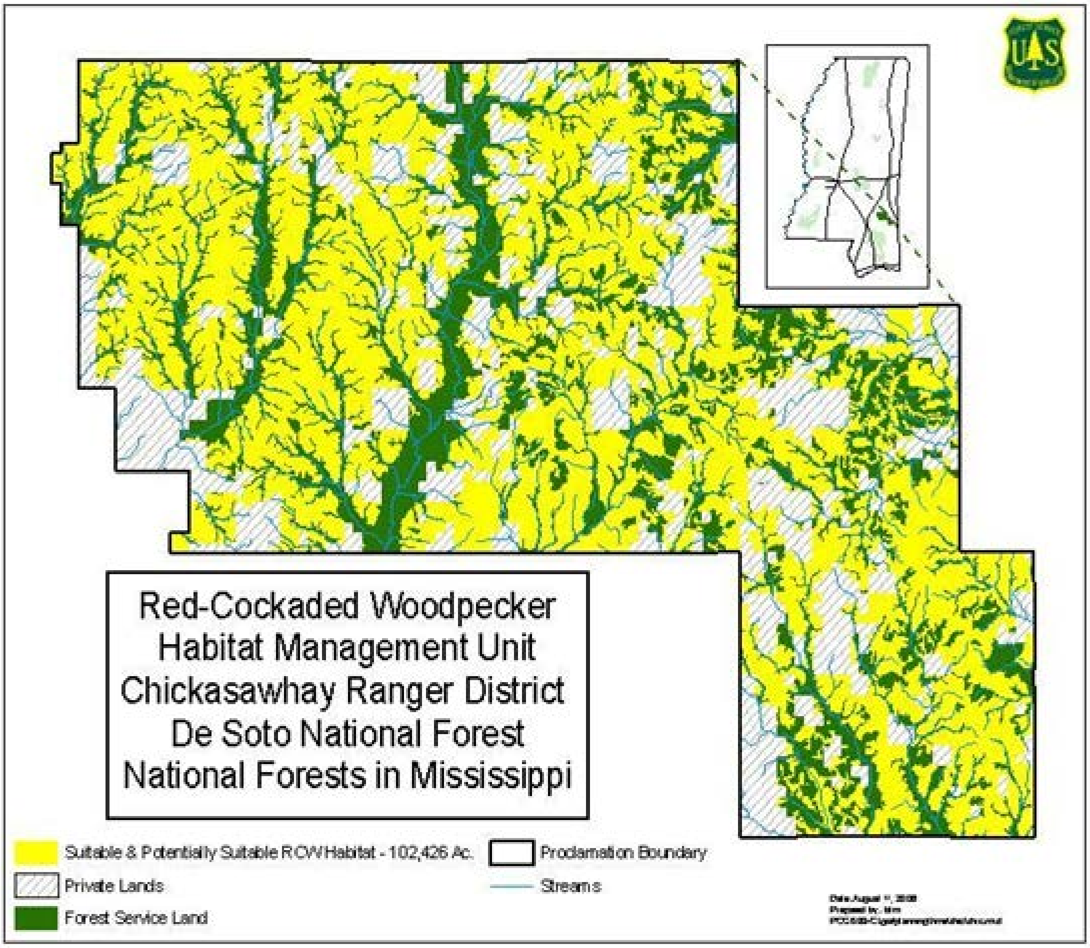

Figure 12. Chickasawhay Ranger District revised habitat management area

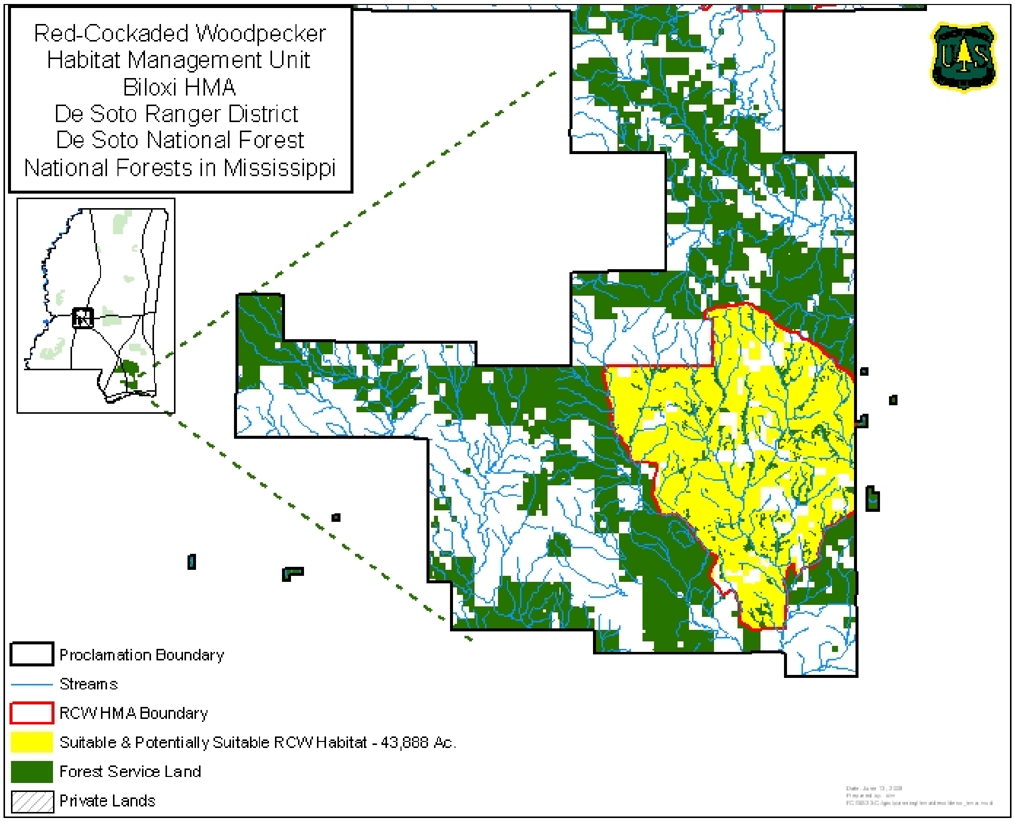

Figure 13. De Soto Ranger District revised Biloxi habitat management area

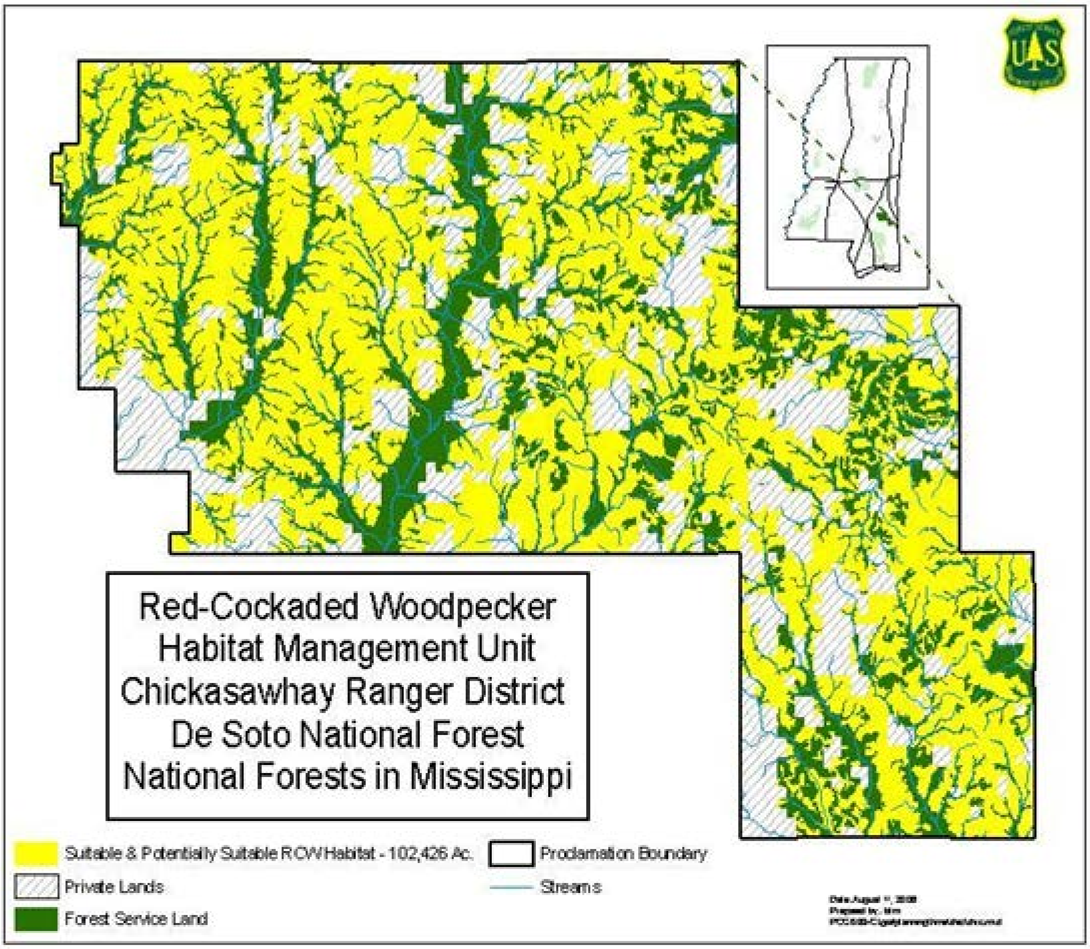

Figure 14. De Soto Ranger District revised Black Creek habitat management area

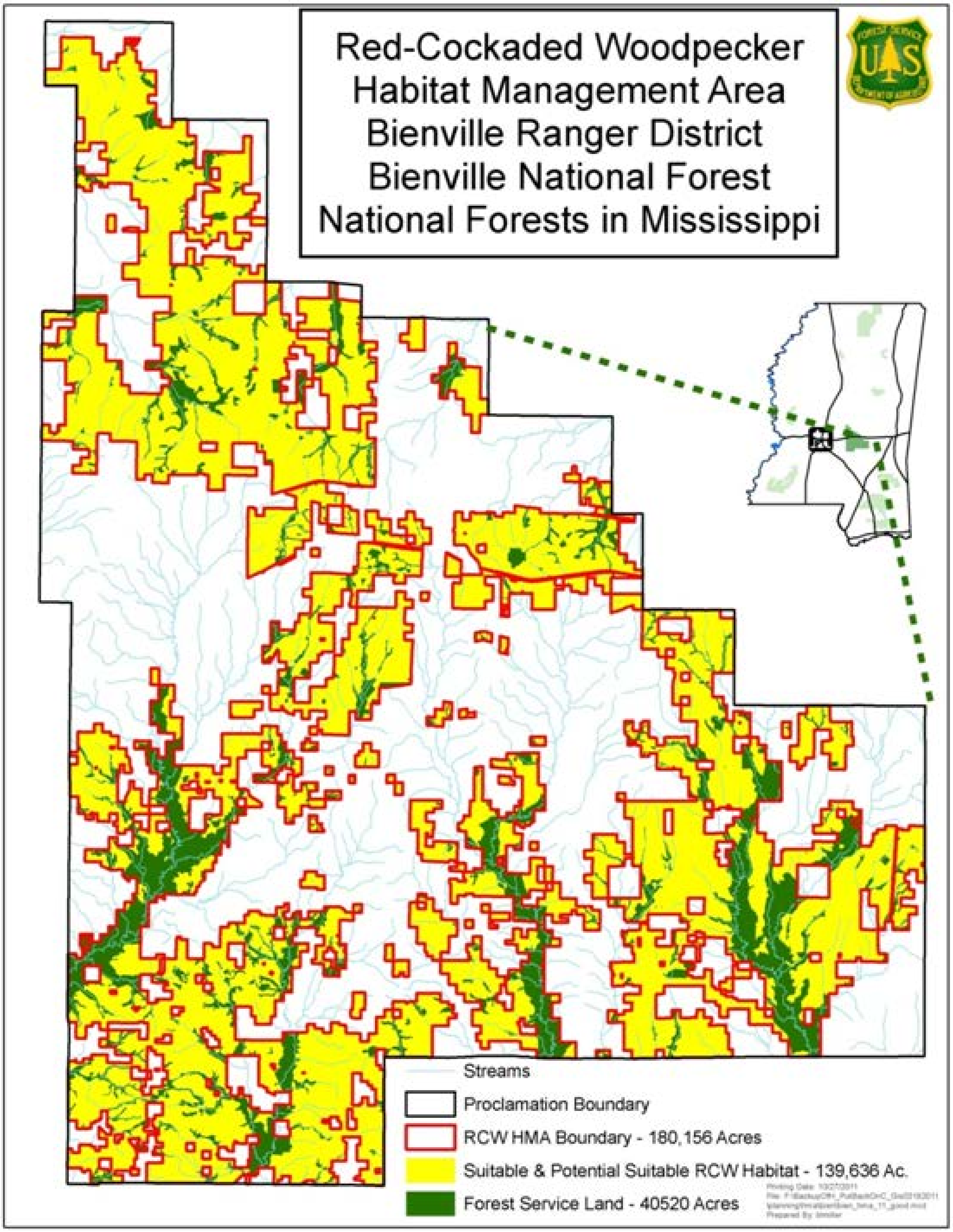

Figure 15. Bienville National Forest revised habitat management area

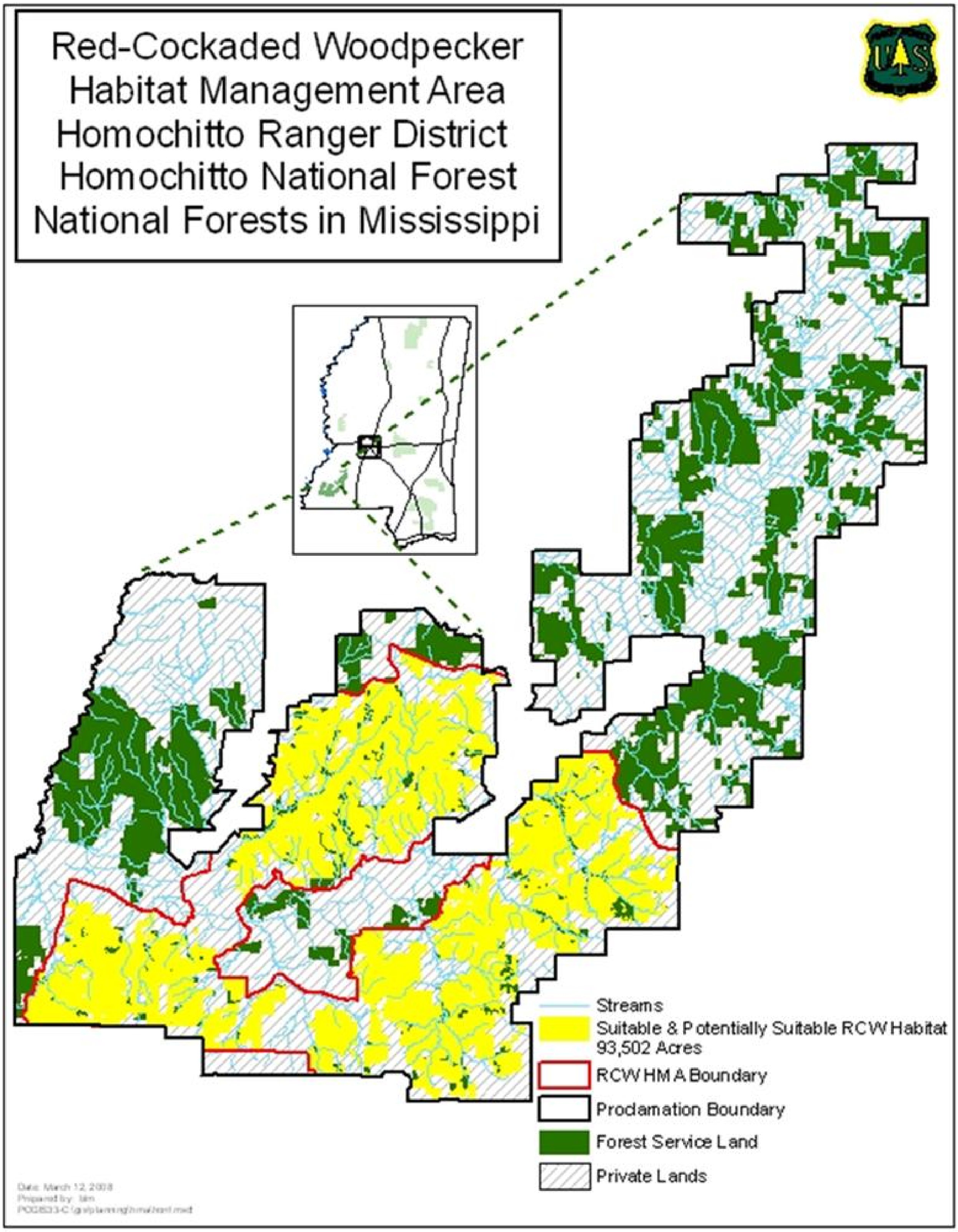

Figure 16. Homochitto National Forest revised habitat management area

Gulf Sturgeon

Gulf sturgeon was once widely distributed throughout coastal rivers of the northeastern Gulf of Mexico primarily from the Mississippi River east to the Suwannee River. The Suwannee may support the only remaining population known to spawn successfully in the wild. This fish is anadramous, with adults migrating between fresh water spawning areas and salt water non-spawning areas. It may migrate as far as 140 miles upstream in early spring for spawning, with sub-adults and adults returning to the Gulf of Mexico in late fall, remaining there through winter (Heise et al. 2004). Young generally stay in the mouth of the river in winter and spring, where they spend the first two years of their lives. The substrate in spawning areas in freshwater (sometimes tidal) usually is hard clay, gravel, or shell, and may occur in brackish water. Spawning probably occurs in the natal river, with offspring returning to areas where they were born.

In Mississippi, the Gulf sturgeon has been collected in the Pearl River and in the Pascagoula watersheds. The closest recorded occurrence location to the Chickasawhay Ranger District of the De Soto National Forest in suitable waterway corridors for adults is the confluence of the Leaf River and Chickasawhay River well below the forest boundary. While there is a possibility that juveniles may move up into smaller tributaries, no confirmed collections have occurred on the district. The largest creek with water year round on National Forest System lands that flows directly into the Chickasawhay River on the east side of the district is Big Creek, approximately 6 miles from the forest boundary to the river. Areas that contain Gulf sturgeon critical habitat on the De Soto Ranger District of the De Soto National Forest include: the Leaf River from MS Hwy 588 to its confluence with the Chickasawhay River, the Pascagoula River from the confluence with the Leaf and Chickasawhay Rivers to Pascagoula Bay, and Big Black Creek from the confluence Black and Red Creeks to the confluence with the Pascagoula River (US Fish and Wildlife Service 2003a). There are several creeks on the De Soto Ranger District that drain into these areas.

Gulf Sturgeon Threats

Gulf sturgeon numbers declined due to overfishing throughout most of the 20th century. Dams or sills that are barriers to upstream fish migration during low-water conditions further exacerbated their decline. Other threats and potential threats included modifications to habitat associated with dredged material disposal, desnagging and other navigation maintenance activities; incidental take by commercial fishermen; poor water quality associated with contamination by pesticides, heavy metals, and industrial contaminants; aquaculture and incidental or accidental introductions; land uses that cause excessive sedimentation, loss of spawning habitat, and the Gulf sturgeon's slow growth and late maturation (US Fish and Wildlife and Gulf States Marine Fisheries Commission 1995).

Gulf Sturgeon Response to Threats

The National Forests in Mississippi recognize that the Gulf sturgeon’s habitat needs must be met in order for species survival. The Forests also realize that many issues are outside Forest Service control such as sediment loading, head-cutting of streams, upstream discharges, and past channelization practices. To address these issues, the Forests work with other agencies, research institutions, and interested partners to collectively try to address solutions. Emphasis is placed on incorporating forest plan components during project planning that would seek to address watershed and aquatic systems with emphasis placed on the stressors for which the agency has control or jurisdiction by establishing streamside buffer zones, restricting vegetation management activities in riparian zones, and employing erosion control measures.

Pallid Sturgeon

The endangered pallid sturgeon, with a historical range of over 3,500 miles in the Missouri and Mississippi Rivers, has been described as one of the rarest fish in North America. This perceived rarity and status have placed the pallid at the center of major conflicts over water and river use in the Missouri and Mississippi Rivers. At the time the pallid sturgeon was listed as an endangered species (1990), most information on the species came from the upper Missouri River (~800 historical capture records). The pallid sturgeon looks very similar to the shovelnose sturgeon and has only been recognized as a separate species since 1905, but is believed to have been rare historically throughout its entire range. Consequently, records kept of total harvest prior to 1905 did not separate the two species. Today, it is essentially restricted to the Lower Yellowstone River, the Missouri River, and the lower Mississippi River. In the state of Mississippi there have only been three reported captures of pallid sturgeon. Two were captured in the Mississippi River and one in the Big Sunflower River of Sharkey County near the Delta National Forest. The latter was caught on 23 November 1987, 12 miles northwest of Satartia, Mississippi (US Fish and Wildlife Service 1993a).

Pallid sturgeon habitat preferences are not well known, but it is believed that they prefer to dwell in sandy or rocky bottoms of large, turbid, free-flowing rivers. Pallid sturgeons feed on the bottom of the river and typically consume aquatic insects, crustaceans, mollusks, marine worms, fish, and the eggs of other fish. They are generally long-lived, possibly living as long as 41 years. Males reach sexual maturity at 5 to 7 years. Females are believed to first spawn at 15 to 20 years. Very little is known about the reproductive behavior of this species. Spawning behavior is thought to occur April through mid-June, when water temperatures reach a range between 55 and 70°F (US Fish and Wildlife Service 2007).

Pallid Sturgeon Threats

The pallid sturgeon was probably never a common species throughout its range, and is now considered one of the rarest inhabitants of the Mississippi and Missouri Basins. During the past several decades, populations of the pallid sturgeon have drastically declined. Overharvesting may have been an initial cause of this. However, they are currently threatened primarily by habitat modifications from channelization, dam construction, and other navigation maintenance activities of major rivers. These changes destroy spawning areas, reduce food supply or access to food, and impede the sturgeon’s ability to move within the river. Dams decrease flow rates and produce cooler water temperatures, making rivers less desirable for pallid sturgeon. Sturgeon can live and grow in reservoirs, but they cannot reproduce there. Water pollution from rural and urban development along rivers may also be a problem for pallid sturgeons. A more recent problem that will affect the future status of the pallid sturgeon is hybridization with shovelnose sturgeon, which is occurring likely because of a lack of spawning sites for both of these species (US Fish and Wildlife Service 2007).

Pallid Sturgeon Response to Threats

The National Forests in Mississippi recognize that the pallid sturgeon’s habitat needs must be met in order for species survival. The Forests also realize that many issues are outside Forest Service control such as sediment loading, head-cutting of streams, upstream discharges, and past channelization practices. To address these issues, the Forests work with other agencies, research institutions, and interested partners to collectively try to address solutions. Emphasis is placed on incorporating forest plan components during project planning that would seek to address watershed and aquatic systems with emphasis placed on the stressors for which the agency has control or jurisdiction by establishing streamside buffer zones, restricting vegetation management activities in riparian zones, and employing erosion control measures.

Louisiana Black Bear

It is estimated that only 50 to 100 black bears still remain in the state. The range for Louisiana black bear described for Mississippi when the Louisiana black bear was listed as threatened in 1992 was the area lying west of the Mississippi river levee and south of Washington County (US Fish and Wildlife Service 1995). Black bears, including those that are not Louisiana black bears, are protected in Mississippi due to similarity in appearance. Louisiana black bears in Mississippi, in general, are found in three areas within the state: the Gulf coast, the loess bluffs of southwest Mississippi, and the Mississippi River Delta. These three areas include the De Soto, Homochitto, and Delta National Forests respectively. Mississippi Department of Wildlife, Fisheries, and Parks compiles statewide sightings data for black bears in Mississippi. The largest numbers of reported sightings of the Louisiana black bear are located along the Mississippi River basin, mainly Issaquena and Sharkey counties. Over the last five years, the numbers of sightings of bears on or around Delta National Forest has also increased and is believed to be due to habitat afforded by the Delta National Forest, the only bottomland hardwood national forest in the United States (Mississippi Department of Wildlife, Fisheries and Parks 2006).

Louisiana black bears exist primarily in bottomland hardwood and floodplain forest, although use of upland hardwood, mixed pine and hardwood, and coastal flat-woods and marshes has been documented. Normal forest management activities that support a sustained yield of timber products and wildlife are considered compatible with Louisiana black bear needs (US Fish and Wildlife Service 1995). Black bears are adaptable and opportunistic, and can survive in the proximity of humans if afforded areas of retreat that ensure little chance of close contact with humans. Black bears eat a wide variety of foods, but the diet includes vegetable matter, including grasses, fruits, seeds, nuts and roots. Insects, fish, carrion and small rodents are also eaten. Blackberries, hardwoods that produce acorns and other hard mast, shrubs, fallen logs, and brush-piles are part of the black bear's habitat (Black Bear Conservation Committee 2005).

Louisiana Black Bear Threats

Black bears, once common in Mississippi, have seen their habitat significantly reduced or eliminated throughout much of the state. The main reason for this reduction of habitat was the conversion of bottomland timber areas to agricultural farmlands. Habitat fragmentation, vehicle collisions, unrestricted harvests and illegal harvest are among the reasons for their reductions (Black Bear Conservation Committee 1997).

Louisiana Black Bear Response to Threats

Bear management should focus on providing suitable habitat and habitat linkages, abundant natural food supplies, denning sites, escape cover, and lots of work fostering public acceptance of black bears (Weaver 2000). The National Forests in Mississippi recognize that the Louisiana black bear’s habitat needs must be met in order for species protection and recovery. The Forests’ focus is to restore and maintain habitat and retain and protect den sites to increase habitat availability for this species. The Forests are also currently cooperating with the Bear Education and Restoration Group of Mississippi (BEaR) in relation to Louisiana black bear conservation, restoration, management, and public education.

Gopher Tortoise

The gopher tortoise is a terrestrial turtle found in South Carolina, Florida, Georgia, Alabama, Mississippi, and Louisiana, but is most abundant in northern central Florida and southern Georgia. Within this range, tortoises occur on the Ocala, Osceola and Apalachicola National Forests (Florida), the Conecuh National Forest (Alabama), and the De Soto National Forest (Mississippi). The "western population” of the gopher tortoise, which consists of those tortoises inhabiting the area west of the Mobile and Tombigbee Rivers in Alabama to southeastern Louisiana, has been listed as federally threatened (US Fish and Wildlife Service 1987). This includes all gopher tortoises occurring on the De Soto National Forest.

This species is native to the open, fire-maintained, pine forests of the southeastern United States. Dry habitats ranging from pine-scrub oak to oak hammocks and coastal dunes are favored by this species. Favored soils are deep sands occurring on ridgetops and sideslopes in which tortoises can easily excavate burrows. On the De Soto National Forest, the majority of gopher tortoises are found in longleaf pine stands of various ages and condition classes or along road edges that occur in longleaf or other pine stands. However, gopher tortoise also inhabits sites with relatively tight, clayey soils. Other trees and shrubs tend to be xerophytic scrub oaks and associated species such as wiregrass, legumes, and blackberries with broadleaf grasses. In preferred habitats the canopy is relatively open allowing for development of the diverse herbaceous ground flora on which gopher tortoises feed, and sunny areas for nesting. The gopher tortoise digs an extensive burrow with adult burrows generally about 15-20 feet in length and 6-10 feet deep, but may be up to 47 feet long and 12 feet deep.

Gopher Tortoise Threats

Currently, the primary threat to the gopher tortoise is habitat loss, either through direct means, such as conversion to pine plantations, agriculture or development; or through indirect means, such as fire suppression that changes the understory rendering the habitat unsuitable for tortoises. Direct threats to habitat could possibly cause immediate mortality in tortoises or result in displacement of tortoises into unsuitable habitats. There is also evidence that past human activities associated with widespread conversion of longleaf pine habitat to unsuitable pine plantations may still be impacting current gopher tortoise populations. Although gopher tortoise populations were not completely extirpated from these degraded lands, slow growth and late maturation caused by tortoises forced into unsuitable habitat may contribute to long-term declines (Aresco and Guyer 1999). Other threats include genetic bottlenecking through population isolation, take or harvest, disease, and predation.

Gopher Tortoise Response to Threats

The National Forests in Mississippi contribute to the conservation and recovery of gopher tortoise populations through implementation of conservation measures consistent with the most recent US Fish and Wildlife Service gopher tortoise recovery plan (US Fish and Wildlife Service 1990). Intensive management practices associated with the ecosystem, fire, and species diversity objectives in the forest plan have a potential to facilitate population expansion because more areas could be maintained in suitable habitat conditions.

Habitat management techniques such as longleaf pine and woodland ecosystem restoration, stand thinning, prescribed growing season burning, and reestablishing native ground cover should increase the chance of gopher tortoise population recovery on De Soto National Forest by improving foraging quality and thermal characteristics, thus producing faster-growing tortoises that mature sooner (Aresco and Guyer 1999).

Surveying and then periodically resurveying gopher tortoise burrows helps determine trends in gopher tortoise populations. The National Forests in Mississippi presently conduct surveys of gopher tortoise at five year intervals. In addition to these formal surveys, Forest Service employees document gopher tortoise burrows observed during a variety of field activities, including focused surveys designed to locate burrows for protection prior to implementation of ground disturbing activities. These surveys determine population numbers and provide a valuable “baseline” against which to judge recovery. This ‘baseline” enables biologists to determine the effectiveness of recovery activities by comparing data from subsequent surveys carried out at five year intervals, as recommended in the recovery plan.

Louisiana Quillwort

The Louisiana quillwort is a semi-aquatic, primitive, seedless plant related to ferns. Evergreen or semi-evergreen amphibious plants resembling small onions with linear, pointed leaves that at first are erect and eventually curve downward or recline; not producing flowers but instead two types of spores in cavities at the bases of -the underground portion of the leaves. Where the soil has been scoured and a fresh soil substrate is present, new plants can develop roots and continue growth (US Fish and Wildlife Service 1996).

The Louisiana quillwort occurs predominantly on sandy soils and gravel bars on small to medium-sized streams. Plants are regularly submerged as much as 50 cm following rains, and may remain submerged for long periods in wet seasons. It is predominately found in riparian woodland and bayhead forests of pine flat-woods and upland longleaf pine (US Fish and Wildlife Service 1996). This species is listed as federally endangered (US Fish and Wildlife Service 1996) because of its restricted geographic range and small total population size. It occurs in the East Gulf Plain physiographic province in Louisiana and Mississippi. In Mississippi, Louisiana quillwort is found on De Soto National Forest in Wayne, Stone, Perry, Jones, Jackson, Harrison, Greene, Forrest, Hancock, and Pearl River Counties.

Louisiana Quillwort Threats

Natural threats to Louisiana quillwort colonies are principally damming of free-flowing intermittent streams by beavers. Disease and insect pests are not known to threaten the plants. Browse by marsh rabbits and whitetail deer occur as well as damage from rooting and wallowing by feral hogs, and some species of quillworts are eaten by waterfowl. More serious threats may come from sedimentation from land clearing activities on nearby uplands, soil-laden runoff from unpaved roads entering streams downstream from wetland crossings, off-highway vehicle recreational traffic through wetlands, vehicular disturbance by hunters, logging activities, and unauthorized military traffic through quillwort colonies. In addition to threatening activities within the colonies themselves, various activities on adjacent uplands or upstream in the watershed can be potentially damaging to quillworts.

Louisiana Quillwort Response to Threats

Extensive stream surveys by Forest Service personnel to locate quillwort colonies, in compliance with the most current Louisiana quillwort recovery plan in forest maintenance and ecosystem restoration operations, and prohibition of tracked vehicle maneuvers in wetlands by the military are positive steps to protect Louisiana Quillwort on National Forest System lands.

Surveys of areas proposed for vegetation management activities are conducted when these activities are proposed in areas containing intermittent streams, along muddy shores, in floodplains, scour channels and depressions, usually lined with Titi in hardwood strands and mixed pine-hardwood bottomlands. Groups and individuals of Isoetes louisianensis located during these surveys will be marked. Forest management activities should avoid direct impact to these individuals by keeping activities well away from stream banks.

Present distribution data suggest that long-term survival of the species at the global level is more certain than when the species was listed as endangered by the US Fish and Wildlife Service. Intensive survey efforts have been made by Steve Leonard and the Forest Service on the National Forests in Mississippi. On two ranger districts they discovered populations of several thousand individuals in over 50 stream locations, approximately half of which are geographically distinct populations exceeding US Fish and Wildlife recovery plan goals. Annual monitoring indicates populations are stable.

Compliance with the current recovery plan and proactive conservation of known populations will insure survival of the species. The great majority of known populations are on the National Forests in Mississippi and the survival of the species is largely dependent upon the actions of the Forest Service and the Mississippi Military Department overseen by the US Fish and Wildlife Service.

Pondberry

This endangered deciduous, aromatic shrub is found in the southeastern United States. At present, there are populations in Georgia, Mississippi, Missouri, Arkansas, North Carolina, and South Carolina (US Fish and Wildlife Service 1993b). While the recovery plan identifies 36 extant populations (US Fish and

Wildlife Service 1993b), new colonies have been discovered; with some near enough to known populations, (as on the Delta National Forest), that there may be interbreeding (Devall and Schiff 2001).

In Mississippi, pondberry is found in bottomland hardwood forests located in Sharkey, Bolivar, and Sunflower Counties with the majority of populations found on the Delta National Forest. Pondberry is found in or at the edges of low, wet depressions that are usually within or near more extensive ridge-bottom forest within the Lower Mississippi bottomland and floodplain forest. The species grows in dense clumps of numerous, usually branched stems. Both male and female plants produce small yellow flowers. The fruit is a bright red berry. Leaves produce a strong, sassafras-like odor when crushed. The recovery plan (1993b) states that growth is vigorous if overstory canopy is reduced. However, a recent study has shown that canopy conditions at levels below 40 percent sunlight are optimal for plant growth and should be considered in management efforts for the species (Aleric and Kirkman 2005).

Pondberry Threats

Threats to the species include timber harvesting, wetland drainage, road construction and conversion of its habitat to agricultural use. A lack of seedling establishment may also be a reason for decline or lack of expansion. Most colonies found have been clonal and consist primarily of males (US Fish and Wildlife 1993b).

Pondberry Response to threats

Protection and maintenance of sites is key to the survival of this species. The hydrology and canopy coverage of sites should be kept intact. The National Forests in Mississippi should continue to conduct surveys for new populations and improve and maintain favorable habitat conditions for this endangered species.

3.5.4 Management Indicator Species

Management indicator species (MIS) are analyzed separately from the threatened, endangered, sensitive, and locally rare species. Some species were included in the ecological sustainability evaluation model and as management indicator species, for example, red-cockaded woodpecker was previously discussed in the terrestrial endangered species section.

National Forest Management Act regulations, adopted in 1982, require selection of management indicator species during development of forest plans (36 CFR 219.19(a)). Reasons for their selection must be stated. The Management Indicator Species (MIS) Review (DEIS appendix F) describes the process and rationale used to select management indicator species for this cycle of forest plan revision.

Management indicator species are to be selected “because their population changes are believed to indicate the effects of management activities” (36 CFR 219 (a)(1)). They are to be used during planning to help compare effects of alternatives (36 CFR 219.19(a)(2)), and as a focus for final environmental impact statement 165 monitoring (36 CFR 219.19(a)(6)). Where appropriate, management indicator species shall 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
- Species selected to indicate effects on other species of selected major biological communities

Since adoption of these regulations, the management indicator species concept has been reviewed and critiqued by the scientific community. These reviews identify proper uses and limitations of the indicator species concept. They generally caution against overreaching in the 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 management indicator species. The management indicator species 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 guidelines 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 forest plan implementation on plant and animal diversity include monitoring, where appropriate:

- 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.

Six species have been selected as management indicator species for the revised forest plan (Table 14). They will be used to assess effects of alternatives and to help monitor effects of implementing the selected alternative.

Table 14. Management indicator species for the National Forests in Mississippi

Species Common Name	Category (s)
Red-cockaded Woodpecker	Threatened and Endangered Species, Special Habitat Indicator, Biological Community Indicator
Pileated Woodpecker	Special Habitat Indicator, Biological Community Indicator
Wood Thrush	Biological Community Indicator
Longleaf Pine	Biological Community Indicator
Largemouth Bass	Game Species, Biological Community Indicator
Southern Pine Beetle	Biological Community Indicator

Red-cockaded Woodpecker (*Picoides borealis*)

This species was selected as a management indicator species to represent open mature longleaf and yellow pine forest. The red-cockaded woodpecker is listed as federally endangered throughout its range and is dependent on national forest management for its recovery and survival. Many management practices on the National Forests in Mississippi are focused on improvement of red-cockaded woodpecker habitat (e.g. prescribed burning, mid-story removal, forest thinning, etc.). There is a direct correlation between management activities and red-cockaded woodpecker population levels.

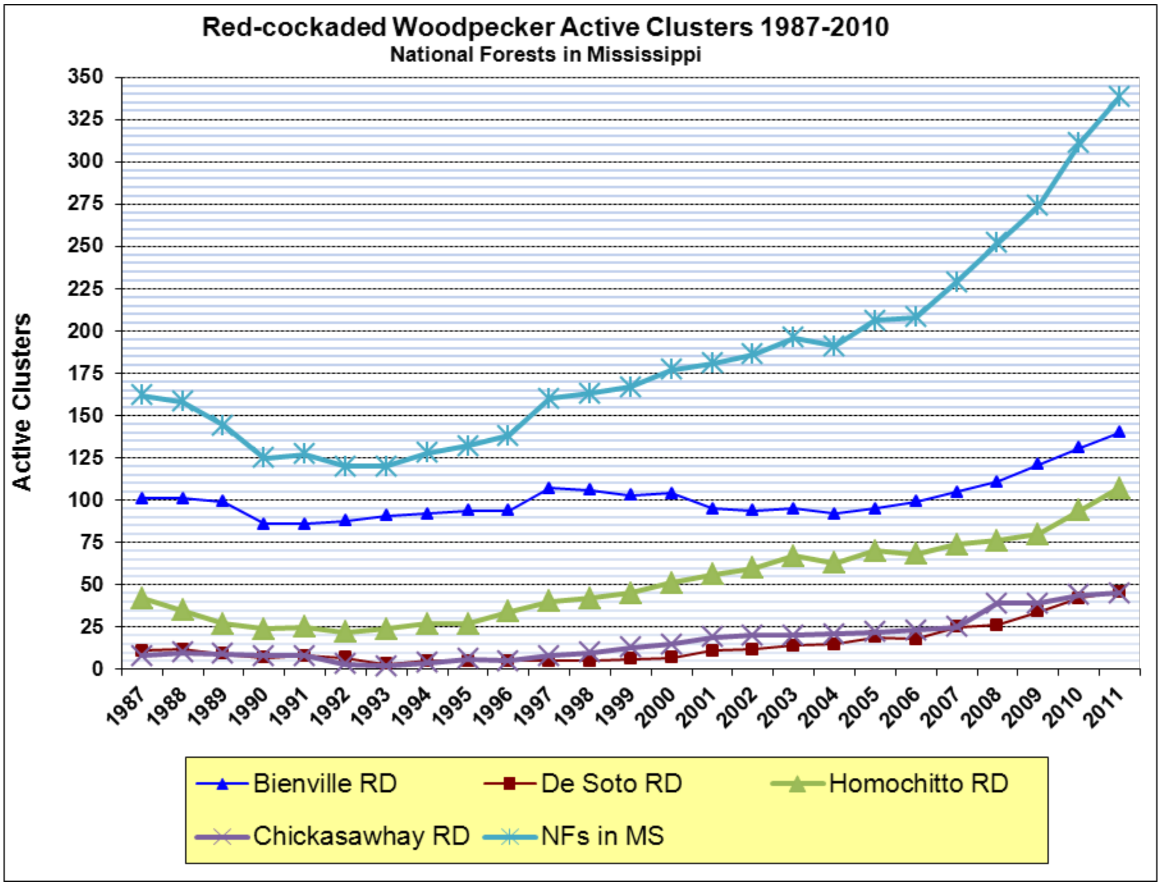

Figure 17. Red-cockaded woodpecker forest trends

Although still far short of current population objectives of active clusters, populations have increased during the past 20 years (Figure 17). Red-cockaded woodpecker translocations have helped increase populations. The forest should continue to improve and maintain favorable habitat conditions for this species. Multiple techniques are available and effective, and strategies must be tailored to individual populations and habitat conditions. It is the implementation of these strategies, carefully designed to meet the conditions of each of four very different populations and habitat, which will continue to enhance red-cockaded woodpecker recovery and open mature longleaf and yellow pine forest on the National Forests in Mississippi.

Pileated Woodpecker (*Dryocopus pileatus*)

The pileated woodpecker was selected as a management indicator species because it requires large snags for nesting and feeding. The occurrence of this species may be correlated with forested habitats containing abundant large dead trees and fallen logs (Hamel 1992), which also are used by other woodpeckers, owls, and numerous other birds, mammals, and amphibians. This species is selected to help indicate the effects of management activities on the availability of forests with desired abundance of snags. Monitoring will be by breeding bird survey and FSVEG database in conjunction with geographic information system (GIS) analysis of mature forest stands to provide a full picture of management effects on this species and other snag-dependent wildlife.

Annual bird point counts for the National Forests in Mississippi were begun in 1994 and are now conducted annually on each district. From 1994 to July 2011; 135,959 individual birds of 153 species from 10,360 bird point counts have been recorded on the National Forests in Mississippi. This data indicates a stable to increasing population trend of pileated woodpeckers on the National Forests in Mississippi.

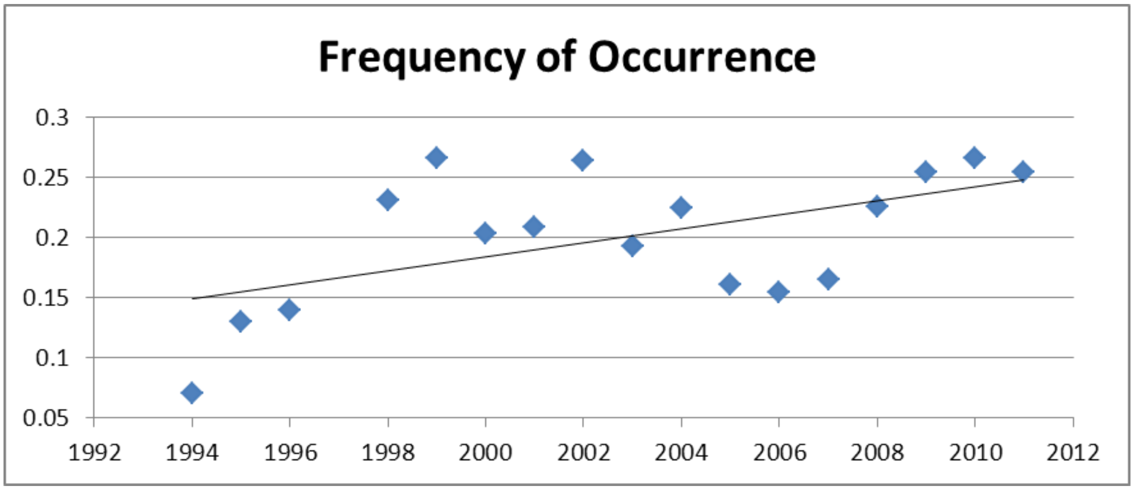

Figure 18. Pileated woodpecker forest trends

Pileated woodpeckers generally prefer mature forests. This species is a primary cavity nester and excavator, requiring large snags for nesting cavities and large dead trees for feeding. Generally, this species require trees greater than 15 inches d.b.h. for cavities, but prefers trees greater than 20 inches d.b.h. Based on the results of monitoring data and habitat evaluation, this species is showing stable and increasing population trends on the National Forests in Mississippi. Pileated woodpeckers have the abundance and distribution across the Forests that will provide for its persistence into the foreseeable future.

Wood Thrush (Hylocichla mustelina)

This species is known to require large tracts of unbroken forest interior for successful breeding to occur. This species was selected to measure effectiveness of minimizing "edge" in the implementation of vegetation management program and to measure management effects on interior forest habitats. Monitoring will be by breeding bird survey and FSVEG database in conjunction with geographic information system (GIS) analysis of mature forest stands as compared to open areas.

Forest Trends

Annual bird point counts for the National Forests in Mississippi were begun in 1994 and are now conducted annually on each district. From 1994 to July 2011, 135,959 individual birds of 153 species from 10,360 bird point counts have been recorded on the National Forests in Mississippi. This data indicates a declining population trend of woodthrush on the National Forests in Mississippi.

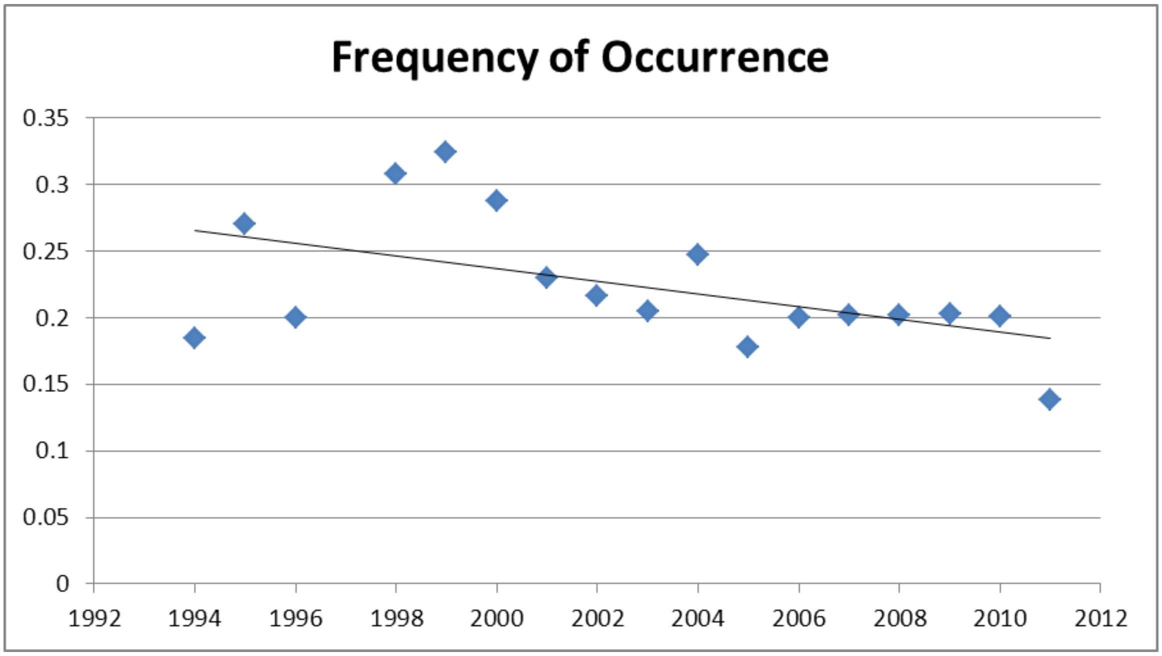

Figure 19. Wood thrush forest trends

Trend estimates for this species indicate moderately declining populations across the southern region (La Sorte 2007). Habitat management for the wood thrush centers on maintaining large tracts of deciduous forest habitat. Relative abundance of mature forest is a key factor for this species, as is tree age diversity. Restoration and maintenance of mature and old-growth forest will help to sustain associated species.

Longleaf Pine (*Pinus palustris*)

This species was selected to measure the effectiveness of management to restore the longleaf pine ecosystem. Abundance of the longleaf pine forest ecological system on the landscape is the most important characteristic of the system due to its widespread conversion to other forest types over the past century as a result of agricultural clearing, forest management, and fire suppression. The longleaf pine forest ecological system supports populations of associated threatened and endangered, regional forester's sensitive, locally rare, and game species along with several rare communities that are typically embedded within this larger system including herbaceous seepage bogs, xeric sandhills, and depression ponds. Measure of effectiveness is by acres of longleaf pine planted by year and number of acres of longleaf pine classified in the Forest Service Vegetation Management Database (FSVEG).

Fiscal year 2010 forest type data from the vegetation database (FSVEG) queries were analyzed to determine acreage by broad forest cover types. The acreages are compared to similar figures compiled from the 1985 forest plan to determine the magnitude and direction of change in forest cover types and longleaf in particular.

Since the 1985 forest plan, there has been an increase in acreage of pine-hardwood and longleaf, and a decrease in the yellow pine, slash pine and hardwood forest types (note: yellow pine included shortleaf and loblolly pine). Conversion of the loblolly and slash pine forest ecological systems to appropriate ecological systems is the highest priority for long-term sustainability of the forest. Restoration remains a long-term goal for longleaf pine forests on the National Forests in Mississippi, but the rate of progress will be slow given current program levels and competing forest plan needs.

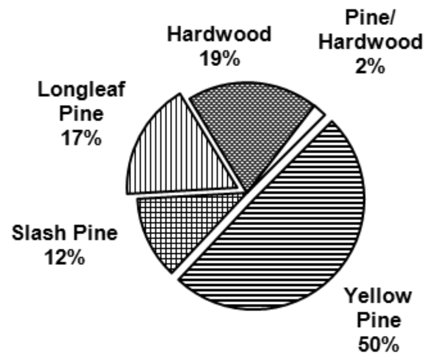

Figure 20. Forest cover types in 1985

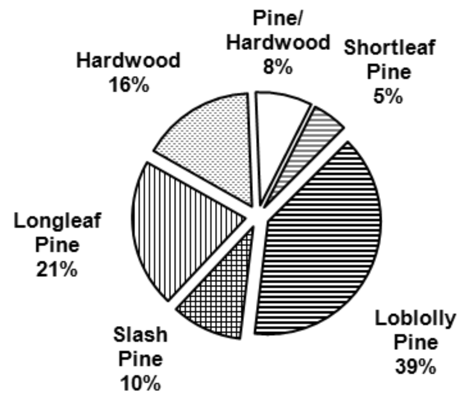

Figure 21. Forest cover types in 2010

Southern Pine Beetle (*Dendroctonus fontalis*)

This species was selected to measure the effects of forest management aimed at promoting forest health (e.g., site and soil based species selection, appropriate fire cycles, and preventing or thinning of overstocked stands). Monitoring will be conducted using a southern pine beetle pheromone trapping survey. Increased index numbers will be evidence for decreased forest health.

Southern pine beetle spots (multi-tree infestations) detected over the course of the year have decreased since 2002. Southern pine beetle populations have been at record lows the last few years not only on the National Forests in Mississippi but throughout the state as well. Southern pine beetle seem to be remaining static while outbreaks could still become a problem at any time. Fall surveys are being explored as a potential early warning tool to predict outbreaks or elevated activity and populations in the following year.

Table 15. Recent southern pine beetle (SPB) pheromone trapping survey results, spot activity and predictions for the National Forests in Mississippi

	Bienville				Homochitto				Tombigbee			
		SPB	**Trend[d]**	**CY**		**SPB**	**Trend[d]**	**CY**		**SPB**	**Trend[d]**	**CY**
Date	**%SPB**	**trap/day[c]**	**Level[e]**	**Spots**	**%SPB**	**trap/day[c]**	**Level[e]**	**Spots**	**%SPB**	**trap/day[c]**	**Level[e]**	**Spots**
Spring 2002[a]	12%	10.7	D/L	331	55%	38.5	I/H	299	7%	1.3	S/L	0
Spring 2003[a]	28%	7.6	D/L	47	17%	6.9	D/L	1	27%	3.6	I/L	9
Fall 2003[b]	14%	4.0	D/L		10%	2.7	D/L		42%	24.0	I/M	
Spring 2004[a]	26%	25.5	I/L-M	7	36%	13.3	I/L	3	39%	13.9	I/M	0
Fall 2004[a]	3%	0.1	D/L		51%	6.9	D-S/L-M		27%	2.5	D/L	
Spring 2005[a]	26%	6.0	D/L	10	86%	52.7	I/H	61	56%	9.9	I/L	0
Fall 2005[a]	2%	0.1	D/L		26%	4.5	D/L		24%	0.9	D/L	
Spring 2006[a]	30%	12.4	I/M		32%	7.0	D/L-M					
Spring 2006[a]	36%	14.5	I/M	2	35%	10.2	D/L-M	0	22%	1.7	S/L	0
Fall 2006[a,f]	54%	2.9	I/L		74%	17.4	I/M		44%	2.4	S/L	
Spring 2007[a,f]	37%	7.0	S/L	106	78%	68.9	I/M-O	91	61%	37.8	I/L-H	0
Fall 2007	19%	1.5	D/L		16%	0.9	D/L		31%	1.2	S/L	
Spring 2008[a,g]	12%	3.0	D/L	5	17%	3.4	D/L	0	10%	1.9	D/L	0
Fall 2008[a,g]	0%	0.0	S/L		0%	0.0	S/L		0%	0.0	S/L	
Spring 2009[a,g]	2%	0.1	S/L	0	9%	0.9	S/L	0	6%	0.3	S/L	0
Fall 2009[a,g]	0%	0.0	S/L		0%	0.0	S/L		9%	0.1	S//L	
Spring 2010[a,g]	0%	0.0	S/L	0	10%	1.0	S/L	0	60%	1.9	S/L	0
Fall 2010[a,g]	NA	NA	NA		2%	0.0	S/L		4%	0.0	S//L	
Spring 2011[a,g]	20%	2.1	I/L	0	23%	6.7	I/L	0	38%	1.8	S/L	0
Fall 2011[a,f]	23%	0.9	I/L		55%	9.8	I/L		79%	5.4	I/L	
Spring 2002	2%	1.1	S/L	0	30%	40.7	I/M	1	14%	2.2	S/L	0
Spring 2003[a]	23%	5.8		0	39%	4.1		6	21%	0.9		0
Spring 2004[a]	49%	32.8	I/M	99	60%	65.8	I/O	15	44%	5.1	I/L	0
Fall 2004[a]	55%	10.3	D-S/L-M		25%	3.7	D/L		5%	0.3	D/L	
Spring 2005[a]	27%	14.2	D/L-M	12	33%	9.4	D/L	0	56%	12.4	I/L-M	0
Fall 2005[a]	4%	0.5	D/L		11%	0.7	D/L		6%	0.2	D/L	

	Bienville				Homochitto				Tombigbee			
		SPB	Trend[d]	CY		SPB	Trend[d]	CY		SPB	Trend[d]	CY
Date	**%SPB**	**trap/day[c]**	**Level[e]**	**Spots**	**%SPB**	**trap/day[c]**	**Level[e]**	**Spots**	**%SPB**	**trap/day[c]**	**Level[e]**	**Spots**
Spring 2006[a]	10%	2.3	D/L		6%	3.4	S/L					
Spring 2006[a]	2%	0.3	D/L	0	17%	5.5	S/L	0	42%	2.1	S/L	0
Fall 2006[a,f]	0%	0	D/L		1%	0.2	D/L		44%	1.6	S/L	
Spring 2007[a,f]	4%	1	S/L	0	6%	2.5	S/L	0	69%	8.8	I/L	0
Fall 2007[a,g]	0%	0	S/L		0%	0.0	S/L		4%	0.0	S/L	
Spring 2008[a,g]	0%	0	S/L	0	1%	0.1	D/L	0	6%	0.3	D/L	0
Fall 2008[a,g]	0%	0	S/L		0%	0.0	S/L		5%	0.2	S/L	
Spring 2009[a,g]	0%	0	S/L	0	1%	0.0	S/L	0	25%	0.3	S/L	0
Fall 2009a,g	0%	0.0	S/L		0%	0.0	S/L		17%	0.6	S/L	
Spring 2010[a,g]	0%	0.0	S/L	0	0%	0.0	S/L	0	25%	1.6	S/L	0
Fall 2010[a,g]	0%	0.0	S/L		0%	0.0	S/L		0%	0.0	S/L	
Spring 2011[a,g]	1%	0.0	I/L	0	0%	0.0	S/L	0	0%	0.0	S/L	0

a) Based on 3 traps per District/Forest, except for 6 traps on the Homochitto.

b) Based on 6 traps per District/Forest, except for 12 traps on the Homochitto.

c) Unless noted otherwise, Hercules steam-distilled pine turpentine used in all surveys.

d) D=Declining, S=Static, I=Increasing

e) L=Low, M=Moderate, H=High, O=Outbreak

f) Trap lures consisted of sandard frontalin pouch + 100g polysleeve of 70 percent alpha-pinene and 30 percent beta-pinene, and endo-brevicomin bubble cap. Traps placed in hardwood stands.

g) Trap lures consisted of sandard frontalin pouch + 100g polysleeve of 70 percent alpha-pinene and 30 percent beta-pinene, Factors that determine southern pine beetle hazard include the proportion of the stand in susceptibility host trees and the radial growth of those trees over a 5 year period. Trees with a relatively high radial growth are less susceptible to southern pine beetle-related mortality. While we do not have individual tree growth data to estimate susceptibility, we can use Culmination of Mean Annual Increment (CMAI) as a proxy for radial growth. Trees within stands that have passed beyond CMAI are growing relatively slower and radial growth should be slower. CMAI for pine ranges from 35 to 50 years old depending upon site productivity (Farrar 1982), (Sullivan and Williston 1977), (Baldwin and Feduccia 1987), (Bennett 1963). Once stands have reached 60 years old, they tend to be more susceptible to southern pine beetle infestations. Management of these stands by thinning or regeneration harvests can increase radial growth and reduce susceptibility.

Largemouth Bass (Micropterus salmoides)

Many management practices such as liming, fertilizing, and spawning habitat improvement are focused on providing recreational fishing opportunities on the National Forests in Mississippi. Largemouth bass is the principal predator in most of the Forests' lakes and is also a demand species. Population structure of this species has been a good indicator of the effectiveness of Forest Service management activities.

Data on largemouth bass are most relevant to management when addressed on a lake-by-lake basis. The National Forests in Mississippi contain over 50 man-made lakes and ponds totaling more than 3,100 acres of water. These impoundments range in size from 1 to 1075 acres. The relatively small size of these impoundments makes them ideal for recreational fisheries management. During the 1960s and early 1970s, 45 of these impoundments were constructed by the Soil Conservation Service under Public Law 534 and Public Law 566. The original purpose for the construction of these impoundments was for flood prevention and erosion control. However, these impoundments were also stocked with largemouth bass, bluegill, and redear sunfish and now provide recreational fishing benefit. Initially, these bodies of water received very little attention with regard to fisheries management. Recent efforts, however, have improved the fishing opportunities on many of them.

Various methods to enhance recreational fishing opportunities have included: liming and fertilizing, spawning bed improvement, fish attractors, aquatic weed control, stocking, length and creel limits, and angler access improvement. Nine of the lakes on the Forests are located on or near recreational areas that have developed camping facilities, swim sites, and picnic grounds. These lakes not only receive the most recreational use on the Forests, but they receive the most fishing use also. These lakes have been identified to receive intensive management and thus are the ones that will be used to describe fish populations and their response to management.

3.5.5 Special Areas Status, Trends

There a number of different special areas located in the National Forests in Mississippi. The special area designation includes administratively-recognized, specific geographic locations within the Forests such as botanical areas, scenic areas, archeological areas and research natural areas that have special management restrictions. There are research natural areas which have been officially designated since shortly after the National Forests in Mississippi were created as well as recently proposed areas which have been evaluated but need to be officially designated or dropped from consideration. There are also a number of existing botanical areas as well as additional areas proposed for designation. Appendix D – Special Areas contains a complete listing of the designated and proposed areas.

Designated Special Areas

The designated special areas on the National Forests in Mississippi include a variety of distinctive settings with exceptional or uncommon botanical, scenic, research, wilderness, recreational, or archaeological values. Special areas contribute a variety of desired conditions including providing sites for native ecosystems, habitats for species diversity, refuge areas for aquatic and terrestrial wildlife and threatened and endangered species, mid-sized to large patches of old-growth forest communities, experimental sites for vegetation management practices, unique recreational opportunities, and desirable scenic conditions. Designating and managing these areas for their special characteristics contribute to our strategy for moving toward desired conditions. Specific guidance for managing the various categories of special areas are identified in Forest Service policies and directives, national requirements, or individual management plans.

Some designated special areas are mature examples of desired ecosystems and serve as some of the best locations of mid-sized or larger expanses of old-growth conditions on the National Forests in Mississippi. Designated botanical special areas are generally good representatives of native ecological systems such as longleaf pines, floodplain hardwoods, prairies, or southern mesophytic forests. These sites provide habitats for threatened and endangered, sensitive and locally rare species as well as habitat for an array of characteristic and popular demand species. Other locations such as the two designated wilderness areas are also protected, and monitored to preserve their natural conditions and provide habitat for sustaining a diversity of species.

Desired conditions for healthy and resilient forests are supported by experimental forests and research natural areas that serve as sites for a broad range of studies such as stand management, watershed management, restoration of wildlife and plant populations, maintenance of biological diversity, and effects of disturbances such as climate change. Some special areas are less disturbed than is typical for this region and provide a valuable baseline for monitoring changes in natural conditions on National Forest System lands.

Scenic areas contribute to the desired naturally appearing character of the National Forests in Mississippi, including the old-growth loblolly-shortleaf pine forests on the Bienville Pines Scenic Area and the picturesque river setting along the Black Creek Wild and Scenic River. The Unmanaged Forty recreational special area is part of the Gavin Auto Tour of southern Mississippi's pine forests and contributes to recreation management strategies, while the Owl Creek Mounds and the Dowling Bayou archaeological sites protect Indian mounds and village sites and support the desired conditions for cultural resources.

Table 16 displays a list of existing designated special areas, their sizes, and the district on which they occur. Following the table are brief descriptions of these designated special areas.

Table 16. Designated special areas of the National Forests in Mississippi

Area Name	Designation	District	Acres
Bienville Pines Scenic Area	Scenic Area	Bienville	189
Harrell Prairie Botanical Area	Botanical Area	Bienville	153
Unmanaged Forty	Recreation Area	Chickasawhay	41
Tiger Creek Botanical Area	Botanical Area	Chickasawhay	375
Red Hills Botanical Area	Botanical Area	De Soto	194
Harrison Experimental Forest	Experimental Forest	De Soto	4066
Black Creek Wild and Scenic River	National Scenic River	De Soto	21 miles
Black Creek Corridor	Scenic Area	De Soto	9,149
Harrison Research Natural Area	Research Natural Area	De Soto	113
Black Creek Wilderness Area	Wilderness Area	De Soto	5,052
Leaf River Wilderness Area	Wilderness Area	De Soto	994
Dowling Bayou Archaeological Site	Archaeological Area	Delta	10
Red Gum Research Natural Area	Research Natural Area	Delta	40
Overcup Oak-Water Hickory Research Natural Area	Research Natural Area	Delta	40
Green Ash – Sugarberry Research Natural Area	Research Natural Area	Delta	67
Tallahatchie Experimental Forest	Experimental Forest	Holly Springs	3,502
Owl Creek Mounds Archaeological Site	Archaeological Area	Tombigbee	29
Noxubee Crest Research Natural Area	Research Natural Area	Tombigbee	552
Chuquatonchee Bluffs Research Natural Area	Research Natural Area	Tombigbee	218

Bienville Pines Scenic Area (Bienville National Forest):

The Bienville Pines Scenic Area is a designated national natural landmark and was established to showcase the original old-growth loblolly pine – shortleaf pine forest that was typical of the area before logging. The mill owner kept the site from being logged as a monument to what was, and it was passed on to the Forest Service intact. The Bienville Pines Scenic Area continues to provide visitors the opportunity to witness trees that were once part of the original forest before logging and to witness the effects of change as these old trees are dying of natural causes and being replaced.

Harrell Prairie Botanical Area (Bienville National Forest):

Harrell Prairie Hill comprises the largest and best example of native tall grass prairie from the Jackson Prairie and is designated as a national natural landmark. It has been the focus of restoration work dating back to the mid-1980s and is further along in restoration than any other known relict of this type in Mississippi. The Jackson Prairie is healthy and provides the necessary habitat conditions to support a full array of native prairie species such as indiangrass, bluestem grasses, rosinweeds, prairie-clovers, yellow-puffs, prairie cone-flowers, and others.

Unmanaged Forty Recreation Area (Chickasawhay Ranger District, De Soto National Forest):

The Unmanaged Forty is part of the 1935 Gavin slash pine plantation and has been withdrawn from timber and fire management activities by forest supervisors since 1945. It is part of the Gavin Auto Tour. This auto tour uses interpretive signs to inform visitors about south Mississippi's beautiful pine forests, and the practices used to manage these renewable resources. Sites along the 11-mile tour include mature pine timber; natural and artificial regeneration areas; game forage plots; prescribed burn areas; and this unmanaged 40 acres of timber. This site continues to be managed so that scenic and recreational experiences for visitors are maintained or improved.

Tiger Creek Botanical Area (Chickasawhay Ranger District, De Soto National Forest):

This site is located on a minor stream bottom. Dominant species are white oak, southern magnolia and loblolly pine. As an undisturbed representation of a floodplain forest ecological community, the area serves as an area in which natural biological diversity is conserved. This area was located, delineated and moved through the designation process by the district staff as a replacement for Thompson Creek Bottom Botanical Study Area listed in the 1985 Forest Plan for the National Forests in Mississippi. This was done because there were not good records on the intended location of the Thompson Creek Bottom Botanical Study Area. It was also evident the Thompson Creek location had been damaged by wind.

Red Hills Botanical Area (De Soto Ranger District, De Soto National Forest):

The Red Hills are an area of deeply dissected terrain overlooking Black Creek. The ridgetops, moist slopes, and ravines support a rich flora typical of the forest commonly called beech-magnolia. The southern mesophytic forest is intact and the hydrologic function of associated springs and seeps is intact.

Harrison Experimental Forest (De Soto Ranger District, De Soto National Forest):

Scientists in Forest Service research work units use the Harrison Experimental Forest as a site for their studies and demonstration projects in conjunction with the National Forests in Mississippi and the De Soto Ranger District. Among the experiments conducted on this forest are studies on stand management and regeneration; restoration of wildlife and plant populations; watershed management; and the effects of pollution, climate change, and timber harvest.

Black Creek Wild and Scenic River (De Soto Ranger District, De Soto National Forest):

Black Creek is the only congressionally designated wild and scenic river in the state. It is a tributary of the Pascagoula River, which flows into the Gulf of Mexico. Twenty-one miles of Black Creek within the De Soto Ranger District (between Moody's Landing and Fairley Bridge Landing) are designated scenic. Generally, Black Creek has been described as having outstanding scenery due to the highly varied terrain, wide sandbars, overhanging vegetation and steep bluffs. Moss-covered banks and colorful vertical bluffs add to the picturesque setting. Little evidence of man is noticeable along the designated river except where Highway 29 crosses near Janice Landing. The outstandingly remarkable values are the scenery and recreational attributes which make the river corridor a popular destination for canoeing, fishing, and other water based recreation. Black Creek is also potential habitat for the federally threatened Gulf sturgeon. A system of trails provides access along the Black Creek corridor. The Black Creek Trail is a designated national recreation trail.

A total of 41 miles of Black Creek were studied for wild and scenic river suitability and only 21 miles were deemed eligible and hence became the congressionally designated Black Creek Wild and Scenic River in 1986. The density of private land in these un-designated sections of the creek was a key issue in why these segments were not included in the congressional designation. As lands are acquired within the designated or undesignated portions of Black Creek they will be evaluated for annexation and expanding the scenic river corridor.

Black Creek Corridor (De Soto Ranger District, De Soto National Forest):

This area consists of a ¼-mile wide corridor on either side of Black Creek, beginning at the Big Creek landing and ending at Alexander Bridge; a distance of about 41 miles. It includes the Black Creek Scenic River and all portions of the corridor are managed the same as the scenic river section.

Harrison Research Natural Area (De Soto Ranger District, De Soto National Forest):

This area (part of the Harrison Experimental Forest) contains an extensive and high quality xeric longleaf pine forest with saw palmetto and other characteristic species. The sand ridge is surrounded by more typical mesic longleaf forest and several drainages. This xeric sandhill community remains a healthy example of its type. As an established research natural area, this area provides undisturbed base line areas to monitor changes in natural conditions associated with management of similar areas. As an undisturbed representation of an ecological community it serves as an area in which natural biological diversity is conserved.

Black Creek Wilderness Area (De Soto Ranger District, De Soto National Forest):

The Black Creek Wilderness (5,052 acres) is named after its dominant feature—Black Creek, which bisects the wilderness, creating a large hardwood floodplain containing oxbow lakes and stands of sweetgum, loblolly pine, spruce pine, willow oak, baldcypress, sweetbay and red maple. Under provisions of the Clean Air Act, this wilderness is classified as a Class II area, the same as all other National Forest System land in Mississippi.

Most of the Black Creek Wilderness occupies part of the broad valley of Black Creek. Relief is fairly gentle with elevations ranging from 100 to 130 feet above sea level within the creek valley, and up to 270 feet above sea level on the adjoining uplands. This area is predominately pine and pine hardwood, with hardwoods along the drainages. The Black Creek Wilderness is potential habitat for the federally endangered Louisiana black bear. The only development in the area is the Black Creek Trail; no other facilities are provided. This area offers semi-primitive recreation opportunities and moderate levels of solitude.

Leaf Wilderness Area (De Soto Ranger District, De Soto National Forest):

The Leaf Wilderness (994 acres) lies almost entirely on the floodplain of the west-to-east flowing Leaf River. Except for a small upland area on the extreme western edge of the wilderness, the area primarily consists of meandering sloughs, oxbow lakes and level terrain with spruce-pine forest or oak-gum-cypress river bottom types. The upland is covered in loblolly and shortleaf pines. Elevations average 50 feet mean sea level. The Leaf Wilderness area offers semi-primitive recreation opportunities and moderate levels of solitude.

Black Creek Wilderness and Leaf Wilderness are the only two designated wilderness areas in the National Forests in Mississippi. Both the Black Creek and Leaf Wilderness Areas (along with the Black Creek Wild and Scenic River Corridor) were studied in depth during an extensive limits-of-acceptable-change analysis completed in April 1994.

Dowling Bayou Archaeological Site (Delta National Forest):

Dowling Bayou Archaeological Site is an Indian mound and village site on the Delta National Forest. It dates from the late woodland period (A.D. 800) and is a classic example of the mounds of this period. The cultural resources are protected and available for research.

Red Gum Research Natural Area (Delta National Forest):

The Red Gum Research Natural Area is a stand of huge sweet gum trees, some of them over 300 years old. This is a ridge bottom delta forest with dense understory of dwarf palmetto and switchcane. This relatively undisturbed Mississippi River Delta bottomland hardwood forest has never been logged.

This example of Mississippi River bottomland hardwood forest is intact and properly functioning hydrologically. As an established research natural area, this area provides undisturbed base line sites on which to monitor changes in natural conditions associated with management of similar areas. As an undisturbed representation of an ecological community it serves as an area in which natural biological diversity is conserved.

Overcup Oak – Water Hickory Research Natural Area (Delta National Forest):

The Overcup Oak – Water Hickory Research Natural Area is remnant of virgin bottomland forest in the Mississippi River Delta Region. The forest is dominated by large overcup oaks and water hickories estimated to be about 200 years old. This example of Mississippi River bottomland hardwood forest is intact and properly functioning hydrologically. As an established research natural area, this area provides undisturbed base line sites on which to monitor changes in natural conditions associated with management of similar areas. As an undisturbed representation of an ecological community it serves as an area in which natural biological diversity is conserved.

Green Ash – Sugarberry Research Natural Area (Delta National Forest):

The Green Ash – Sugarberry Research Natural Area is a remnant of the virgin bottomland hardwood forest that once covered the Mississippi River Delta. The research natural area has huge green ash trees that are in excess of 250 years old. This example of Mississippi River bottomland hardwood forest is intact and properly functioning hydrologically. As an established research natural area, this area provides undisturbed base line sites on which to monitor changes in natural conditions associated with management of similar areas. As an undisturbed representation of an ecological community it serves as an area in which natural biological diversity is conserved.

Tallahatchie Experimental Forest (Holly Springs National Forest):

Scientists in research work units use the Tallahatchie Experimental Forest as a site for their studies and demonstration projects in conjunction with the National Forests in Mississippi. Among the experiments conducted on these forests are studies on stand management and regeneration; restoration of wildlife and plant populations; watershed management; and the effects of pollution, climate change, and timber harvest.

Owl Creek Mounds Archaeological Site (Tombigbee National Forest):

Owl Creek Mounds Archaeological Site is an Indian mound and village site on the Tombigbee National Forest. It dates from the late woodland period (A.D. 800) and is a classic example of the mounds of this period. This site is listed on the National Register of Historic Places. The cultural resources are protected and available for research.

Noxubee Crest Research Natural Area (Tombigbee National Forest):

The Noxubee Crest Research Natural Area encompasses the headwaters of a branch of the Little Noxubee River. Much of the uplands are old field areas that were abandoned in the 1930s, but the steep side slopes and creek bottoms contain fine examples of 120 year-old and older shortleaf pine-oak-hickory forest. Noxubee Crest continues to provide habitat for wooded spring seep and dry-mesic mixed oak forest. Hydrological function of associated seeps and springs is intact. As a research natural area, this area provides undisturbed base line sites on which to monitor changes in natural conditions associated with management of similar areas. As an undisturbed representation of an ecological community it serves as an area in which natural biological diversity is conserved.

Chuquatonchee Bluffs Research Natural Area (Tombigbee National Forest):

This bluff area is on a steep north-facing mesic slope overlooking the floodplain of Chuquatonchee Creek. This is an old-growth Pontotoc ridge forest. Aerial photographs dated 1937 show trees in the area with large crowns. The area supports a rich flora.

The bluff area continues to support healthy examples of the Pontotoc ridge forest type. Hydrological function of associated seeps and springs is intact. As a research natural area, this area provides undisturbed base line sites on which to monitor changes in natural conditions associated with management of similar areas. As an undisturbed representation of an ecological community it serves as an area in which natural biological diversity is conserved.

Proposed New Special Areas

In addition to the previously designated areas listed above, the National Forests in Mississippi also contain a number of distinctive locations that have been evaluated and proposed for special area designation. As shown in Table 17, 20 proposed areas located across the 7 ranger districts have been identified for evaluation and designation as botanical areas, research natural areas, or other appropriate administrative designations. These proposed special areas have been managed for their identified special characteristics and are at various stages of consideration and study for special area designation. Two areas have been reviewed and dropped from consideration – the proposed Singleton Prairie Botanical area, and the Lee Creek Research Natural Area. Detailed descriptions of individual proposed areas follow Table 17. These descriptions contain rationale for dropping two areas from special area consideration.

Table 17. Proposed new special areas of the National Forests in Mississippi

Area Name as Proposed	Area Designation Recommendation	District	Acres
Singleton Prairie Botanical Area	Drop Consideration	Bienville	80
Nutmeg Hickory Research Natural Area	Research Natural Area	Bienville	307
Laurel Oak Research Natural Area	Botanical Area	Chickasawhay	277
Railroad Creek Titi Botanical Area	Botanical Area	De Soto	451
Little Florida Botanical Area	Botanical Area	De Soto	121
Pitcher Plant Botanical Area	Botanical Area	De Soto	251
Buttercup Flat Botanical Area	Botanical Area	De Soto	164
Loblolly Bay Research Natural Area	Botanical Area	De Soto	93
Ragland Hills Research Natural Area	Botanical Area	De Soto	237
Granny Creek Bay Research Natural Area	Research Natural Area	De Soto	127
Wyatt Hills Botanical Area	Botanical Area	De Soto	100
Cypress Bayou Botanical Area	Botanical Area	Delta	262
LA-2 Botanical Area C117S17	Botanical Area	Holly Springs	12
LA-6 Botanical Area C122S	Botanical Area	Holly Springs	158
Lee Creek Research Natural Area	Drop Consideration	Holly Springs	186
Sandy Creek Research Natural Area / Botanical Area	Botanical Area	Homochitto	300
Shagbark Hickory Botanical Area	Botanical Area	Tombigbee	109
Choctaw #4 Botanical Area	Botanical Area	Tombigbee	45
Prairie Mount Research Natural Area	Botanical Area	Tombigbee	370
Bogue Cully Research Natural Area	Botanical Area	Tombigbee	500

The following descriptions of proposed special areas on the National Forests in Mississippi provide an overview of their special characteristics and are grouped by forest or ranger district.

Proposed Singleton Prairie Botanical Area (Bienville National Forest):

Singleton Prairie is a relict Jackson Prairie, proposed under the 1985 forest plan as an area to be studied for potential botanical area designation. Prairies are greatly reduced from its historical acreage due to land conversion in the past to agricultural and forestry uses. Restored prairie furnishes habitat for typical plant and animal species once more common in this region of Mississippi. The Jackson Prairie provides the necessary habitat conditions to support a full array of native prairie species such as indiangrass, bluestem grasses, rosinweeds, prairie-clovers, yellow-puffs, prairie cone-flowers, and others.

Field inspections and reviews have been completed. On the ground observations, indicate that Singleton prairie is less than 6 acres, instead of the 80 acres listed in 1985 forest plan. Currently the existing prairie opening is less than one acre. The 1989, MS Museum of Nature Sciences' final report titled Bienville National Forest Prairie Survey (Gordon and Wiseman 1989) indicate that Singleton Prairie was ranked one of the poorest examples of Bienville prairies (48 out 54 – 11th percentile). The report also stated that Singleton Prairie was a "disturbed prairie with less than complete assemblage of prairie species, still restorable to prairie but with major efforts to manage and possibly many years for results. May also require seeding to replace species that appear to be missing". Restoration and continued maintenance would be an additional concern due to the absence of reliable access. Management access is hindered due to wetlands and Hontokalo Creek.

Singleton Prairie should be protected in a manner consistent with other prairie; however, it should not rise to the level of a botanical area. Botanical areas should be one of our better examples of rare communities, rather than one of our poorer examples. Singleton Prairie Botanical Study Area has neither a high ranking, when compared to other prairies, or reasonable access for management or the public. Singleton Prairie has been dropped from further consideration as a designated special area.

Nutmeg Hickory Research Natural Area (Bienville National Forest):

This calcareous variant of floodplain forest ecological system was proposed as a research natural area. It is a mature wet-mesic floodplain forest dominated by mature specimens of native prairie forest species such as nutmeg hickory, Durand oak, and big shellbark hickory. As a research natural area, this area provides undisturbed base line areas to monitor changes in natural conditions associated with management of similar areas and serves as an area in which natural biological diversity is conserved. The nomination and evaluation process has been completed for this research natural area. Further, a decision to dedicate this area as a research natural area was made on 09/22/2003 by the regional forester. However, final public notification was not completed previously. This area is being formally recognized through this forest plan revision process.

Laurel Oak Botanical Area (Chickasawhay Ranger District, De Soto National Forest):

As a botanical area, this area provides undisturbed base line area to monitor changes in natural conditions associated with management of similar areas and serves as an area in which natural biological diversity is conserved. The area is a minor stream bottom with stands predominated by laurel oak and loblolly pine. This area was originally proposed by district staff for research natural area designation. The botanical area designation was chosen as the best way to provide special area status for this area.

Railroad Creek Titi Botanical Area (De Soto Ranger District, De Soto National Forest):

This botanical area includes an impressive and extensive stand of 30-foot tall, 4- to 7-inch diameter buckwheat trees beneath a slash pine dominated swamp forest along a black water creek. Swamp titi is also present but is not dominant. This area provides an undisturbed base line to monitor changes in natural conditions associated with management of similar areas and serves as an area in which natural biological diversity is conserved.

Little Florida Botanical Area (De Soto Ranger District, De Soto National Forest):

Little Florida contains the most extensive and highest quality xeric sandhill community with longleaf pine forest, saw palmetto, and other characteristic species remaining in Mississippi. Several plant species such as scarlet basil and littleleaf milkpea reach the western limits of their range at this site. The sand ridge is surrounded by more typical mesic longleaf forest and several drainages.

Pitcher Plant Botanical Area (De Soto Ranger District, De Soto National Forest):

The Pitcher Plant Botanical Area consists of three distinct and rather unique quaking bogs in relatively close proximity to each other. Vegetation in these bogs floats on top of a saturated layer of peat 2 meters or more thick over an impervious sand layer. This botanical area provides habitat for a variety of bog species as well as more common and diagnostic members of this ecosystem including pitcher plants, sundews, grasses and sedges.

Buttercup Flat Botanical Area (De Soto Ranger District, De Soto National Forest):

The Buttercup Flat Botanical Area consists of a scenic pitcher plant savanna along State Highway 26. The savanna is intact hydrologically and provides habitat for a wide variety of common and diagnostic members of this system including pitcher plants, sundews, grasses, and sedges.

Loblolly Bay Botanical Area (De Soto Ranger District, De Soto National Forest):

This botanical area is a classic bayhead community with sweetbay, swamp gum and slash pine as common dominants with yellow poplar, red maple, and water oak less common. Loblolly bay is present here in good numbers. The bayhead community provides habitat for the uncommon loblolly bay. Gopher tortoises live on the adjacent uplands which support longleaf pine.

Ragland Hills Botanical Area (De Soto Ranger District, De Soto National Forest):

The Ragland Hills Area is a classic southern mesophytic forest in deeply dissected ravines separated by well drained ridgetops which support longleaf pine. National Forest System lands are flanked by land owned by the University of Southern Mississippi and the Mississippi National Guard. Together these three publicly owned tracts offer opportunity for a multi-agency natural area preserve. The endemic big-leaf witch-hazel has recently been described from this community. As a proposed botanical area, this area provides an undisturbed base line site on which to monitor changes in natural conditions associated with management of similar areas and serves as an area in which natural biological diversity is conserved.

Granny Creek Bay Research Natural Area (De Soto Ranger District, De Soto National Forest):

Granny Creek Bay is a large spring seep and associated seepage swamp of exceptional quality. It has been the focus of research conducted by biologists with the University of Southern Mississippi and the Mississippi Natural Heritage Program. As a research natural area, this area provides undisturbed base line areas to monitor changes in natural conditions associated with management of similar areas and serves as an area to conserve natural biological diversity. The nomination and evaluation process has been completed for this research natural area. Further, a decision to dedicate this area as a research natural area was made on 03/26/2002 by the regional forester. However, final public notification was not completed previously. This area is being formally recognized through this forest plan revision process.

Wyatt Hills Botanical Area (De Soto Ranger District, De Soto National Forest):

The Wyatt Hills is an area of locally high topographic relief deeply dissected into narrow ridges, ravines, and bottomland forests along small creeks. It is notable for its woody plant diversity. Over 70 species of trees, shrubs and woody vines have been recorded, including 7 species of oak, 5 species of magnolia, 4 pines, 4 hollies, 4 blueberries, and 3 cat-briers. Florida anisetree is by far the most common shrub on slopes, with mountain laurel thickets along the ridge crests.

Cypress Bayou Botanical Area (Delta National Forest):

The Cypress Bayou Botanical Area is a tract of old-growth delta bottomland hardwood forest dominated by overcup oak. Timber was established on the stand in 1874 and has not been cut since. Other dominant trees include green ash, sugarberry, bitter pecan, Nuttall oak and sweetgum.

LA-2 Botanical Area (Holly Springs National Forest):

This is an area of old-growth hardwood forest in steep topography (Compartment 117, Stand 17) that was identified as being one of the best remaining areas of old-growth forest in Mississippi’s lignite belt during a 1980s evaluation done by Dr. Frank Miller at Mississippi State University’s remote sensing laboratory under contract to Mississippi Natural Heritage Program. The character of the area has changed significantly since its nomination due to flooding caused by beavers and subsequent tree mortality.

LA-6 Botanical Area (Holly Springs National Forest):

This is an area of old-growth hardwood forest in steep topography that was identified as being one of the best remaining areas of old-growth forest in Mississippi’s lignite belt during a 1980s evaluation done by

Dr. Frank Miller at Mississippi State University's remote sensing laboratory under contract to Mississippi Natural Heritage Program.

Proposed Lee Creek Research Natural Area (Holly Springs National Forest):

This area was nominated for research natural area designation because of an approximately 10 acre area of back water cypress which is very rare condition to have undisturbed representatives of. Because of the small size of the cypress stand additional area from the alluvial floodplain adjacent to Lee Creek to the adjacent mixed shortleaf upland hardwood stand above the cypress stand was included to both buffer the cypress stand and provide research natural area representation of both minor stream bottom hardwoods and upland pine hardwood forest types in the research natural area system. The head cutting condition of Lee Creek was a negative issue found with field review of the site. But, it was determined the site should continue through the designation process. Subsequently the entire area was demolished by tornado. The damage included nearly complete breakage of all the cypress stems in the core area of interest. The area was salvaged and reforested following the storm damage. Because of the changed condition this area has been dropped from research natural area consideration.

Sandy Creek Botanical Area (Homochitto National Forest):

This is an area of mesic to dry mesic loessal forest. Dominant species are various hardwoods with scattered loblolly pine that are dropping out of the stand as the stand ages. The stand is about 70 years old. As a proposed botanical area, this area provides undisturbed baseline sites on which to monitor changes in natural conditions associated with management of similar areas and serves as an area in which natural biological diversity is conserved. This area is within the area of Sandy Creek studied through the RARE II process. This area was proposed by district staff for research natural area designation after the initial RARE II consideration. The botanical area designation was chosen as the best way to provide special area status for this area.

Shagbark Hickory Botanical Area (Tombigbee National Forest):

The Shagbark Hickory Botanical Area is an area of mesic hardwood in steep highly dissected terrain that had been utilized as outdoor classroom for many years by professors and students of Mississippi State University. This area provides educational opportunities as an outdoor classroom for future students and professors.

Choctaw #4 Botanical Area (Tombigbee National Forest):

This is an area of old-growth hardwood forest in steep topography that was identified as being one of the best remaining areas of old-growth forest in Mississippi's lignite belt during a 1980s evaluation done by Dr. Frank Miller at Mississippi State University's remote sensing laboratory under contract to Mississippi Natural Heritage Program.

Prairie Mount Botanical Area (Tombigbee National Forest):

The Prairie Mount Botanical Area represents a good example of the native tall grass prairie from the black belt region. The black belt prairie provides the necessary habitat conditions to support a full array of native prairie species such as indiangrass, bluestem grasses, rosinweeds, prairie-clovers, yellow-puffs, prairie cone-flowers, and others. As a proposed botanical area, this area provides undisturbed base line sites on which to monitor changes in natural conditions associated with management of similar areas and serves as an area in which natural biological diversity is conserved. This area was originally proposed by district staff for research natural area designation. The botanical area designation was chosen as the best way to provide special area status for this area.

Bogue Cully Botanical Area (Tombigbee National Forest):

The Bogue Cully Research Natural Area represents a good example of the native tall grass prairie from the black belt region. The black belt prairie provides the necessary habitat conditions to support a full array of native prairie species such as Indian grass, bluestem grasses, rosinweeds, prairie-clovers, yellow-puffs, prairie cone-flowers, and others. As a proposed botanical area, this area provides undisturbed base line sites on which to monitor changes in natural conditions associated with management of similar areas and serves as an area in which natural biological diversity is conserved. This area was originally proposed by district staff for research natural area designation. The botanical area designation was chosen as the best way to provide special area status for this area.

3.5.6 Forest Health and Protection

Healthy forests contain all the features and functions necessary to meet management objectives for the land area. Desired conditions associated with healthy forests involve a variety of resource areas, including vegetation, wildlife, invasive species, soils, water, air, lands, and fire management. The development of desired conditions was based on input from public stakeholders, agency directives, and regulatory requirements under NFMA (National Forest Management Act). The species diversity, ecological systems, and vegetation management portions of this EIS include the ecological basis for the desired conditions and information on the long-term sustained yields of timber products that result from achieving and maintaining these desired conditions.

Beginning about 18,000 years ago during the peak of the last major glacial period, the forest communities of the National Forests in Mississippi that we know today began to be shaped by global climate changes, indigenous human cultures, lightning, windstorms, beavers, large ungulates, and native insects and diseases. In the more recent past, European settlement and modern society have disrupted some of these natural processes (fire, beavers, and large ungulates) and introduced new disturbances like non-native invasive species.

This section of the EIS will focus on non-native invasive species, insects and diseases, and old growth. Vegetation management treatments including harvest, fire, manual and chemical treatments to promote forest health, and suppress or eradicate threats will be discussed. There are other forest pests and threats to forest health other than those included in this discussion. However, those discussed are the most serious threats or require the most active prevention, suppression or monitoring efforts. Old growth is included in this discussion because of its contribution to overall forest health including the wellbeing of old-growth dependent flora and fauna.

Non-Native Invasive Species

Invasive species pose a long-term risk to the health of the Nation’s forests and grasslands. In the absence of their natural predators, they can increase across the landscape with little opposition, beyond limited efforts made in control and reclamation measures. These species interfere with natural and managed ecosystems, degrade wildlife habitat, reduce the sustainable production of natural resource-based goods and services, and increase the susceptibility of ecosystems to other disturbances such as fire by increasing fuel loads to hazardous levels. After habitat destruction, invasive species are the second greatest cause of species endangerment and decline worldwide. Current efforts are focused primarily on two species, kudzu and cogongrass, that are the most problematic and seem to have the most potential for rapidly spreading over large areas.

Insect damage and plant disease are natural disturbances that are part of a healthy, functioning ecosystem, along with fire and wind damage. However, both native and non-native insects and diseases have caused above normal mortality rates on forested lands in the United States. There are approximately 58 million acres, or 8 percent of the forested land at risk of experiencing 25 percent or more basal area mortality due to insects and diseases in the next 15 years, without some sort of remediation (Krist et al. 2007). High mortality rates can accelerate the development of high fuel loading in fire-dependent forests, effectively remove important ecosystem elements, and reduce private property values.

Trends

- Encroachment of invasive plant species into Mississippi forests is a continuing concern. They invade under and beside forest canopies and occupy small forest openings, eroding forest productivity, limiting forest use and management activities, and degrading diversity and wildlife habitat. Often called nonnative, exotic, non-indigenous, alien, or noxious weeds, they occur as trees, shrubs, vines, grasses, ferns and forbs. Without their natural predators, they now increase across the landscape with little opposition, beyond control and reclamation measures.
- Noxious weeds are found on every part of the National Forests in Mississippi. Few if any areas would be found to be weed free. Current efforts are focused on two species, Kudzu and cogongrass, that are the most troublesome and seem to have the most potential for destructive spreading over large areas. Currently they cover large areas, and both species have the ability to render acres that they occupy unsuitable for native species.
- Other species such as Japanese honeysuckle, privet, Japanese climbing-fern, and Chinese tallow tree are currently of secondary priority and are treated on a case-by-case situation at the project level.
- High profile exotic insects and diseases include Dutch elm disease, chestnut blight, red-imported fire ant and beech bark disease. High profile exotic animals found on the National Forests in Mississippi include feral hogs and nutria. Feral hogs disrupt plant life, decimate ecosystems, and have been known to decimate hardwood seedling plantings. Nutria are well known for undermining and breaking through water-retaining levees, crop depredation, tree girdling, and decimating seedling bald cypress. Aside from the potential economic loss from timber volume, many wildlife and fish species are dependent on the ecosystems affected by these invasive animals, insects, and diseases.
- In recent years, evolving agency policy aimed at ecosystem management objectives has placed increased scrutiny on undesirable invasive species. Environmental assessments of large landscape areas (in some cases, multiple districts or national forests) and analyzing environmental effects for the control of kudzu, cogongrass, and other invasive species have presented a more complete picture of the impacts of undesirable invasive species.
- Invasive plant species that have been introduced into Mississippi and found their way onto national forests will continue to pose challenges in meeting ecological sustainability objectives.

A multitude of non-native invasive species including non-native plants, insects, pathogens, and mammals threaten the integrity of native ecosystems in the Southeast. The Chief of the U.S. Forest Service has identified non-native invasive species as one of the four critical threats to National Forest System lands ecosystems. Invasive species pose a long-term risk to the health of the nation’s forests and grasslands. These species interfere with natural and managed ecosystems, degrade wildlife habitat, reduce the sustainable production of natural resource-based goods and services, and increase the susceptibility of ecosystems to other disturbances such as fire by increasing fuel loads to hazardous levels. After habitat destruction, invasive species are the second greatest cause of species endangerment and decline worldwide (Wilcove et al. 1998).

Invasions of nonnative plants into Mississippi forests continue unchecked and unmonitored. They invade under and beside forest canopies and occupy small forest openings, eroding forest productivity, limiting forest use and management activities, and degrading diversity and wildlife habitat. Often called nonnative, exotic, non-indigenous, alien, or noxious weeds, they occur as trees, shrubs, vines, grasses, ferns and forbs. Without their natural predators, they now increase across the landscape with little opposition, beyond the control and reclamation measures.

Noxious weeds are found on every part of the National Forests in Mississippi. Few if any compartments would be found to be "weed free". Current efforts are focused on kudzu and cogongrass, two species that are the most troublesome and seem to have the most potential for destructive spreading over large areas. Both species cover large areas both have the ability to render acres that they occupy useless for other native species.

Other species such as Japanese honeysuckle, privet, Japanese climbing-fern, Chinese tallow tree, to name a few, are currently of secondary priority and are treated on a case-by case situation on the project level.

Insect damage and plant disease are natural disturbances that are part of a healthy, functioning ecosystem, along with fire and wind damage. However, both native and non-native insects and diseases have caused above normal mortality rates on forested lands in the United States. Some 58 million acres or 8 percent of forested land are at risk for mortality rates that exceed the norm by 25 percent or more (USDA Forest Service 2001). High mortality rates can accelerate the development of high fuel-loading in fire-dependent forests, effectively remove important ecosystem elements, and reduce private property values. The highest profile exotic insects and diseases include the emerald ash borer, sudden oak death, redbay ambrosia beetle which is associated with laurel wilt disease, Asian longhorned beetle, *sirex noctilio*, and red-imported fire ant.

Table 18. Invasive species

Scientific Name	Common Name	Priority[a]
Triadica sebifera	Chinese tallow	1
Albizia julibrissin	Mimosa	1
Melia azedarach	Chinaberrytree	1
Paulownia tomentosa	Princesstree	1
Ligustrum sinense	Chinese Privet	2/3
Ligustrum vulgare	European Privet	2/3
Ligustrum lucidum	Glossy Privet	2/3
Ligustrum japonicum	Japanese Privet	2/3
Nandina domestica	Sacred bamboo	1
Lonicera japonica	Japanese Honeysuckle	4
Pueraria Montana	Kudzu	1
Wisteria sinensis	Nonnative Wisteria	1
Wisteria floribunda	Nonnative Wisteria	1
Lolium arundinaceum	Tall Fescue	3
Microstegium vimineum	Nepalese Browntop	1
Imperata cylindrica	Cogongrass	1
Miscanthus sinensis	Chinese Silvergrass	1
Rottboellia cochinchinensis	Itchgrass	1
Lespedeza cuneata	Chinese Lespedeza	3
Lygodium japonicum	Japanese Climbing Fern	3
Lespedeza bicolor	Shrubby Lespedeza	2

a - Priority:
1=high, eradicate wherever found
2=medium, control source populations and eradicate outliers
3=low, prevent invasion of last areas not invaded; eradicate high priority areas

The highest profile exotic animal found on the National Forests in Mississippi is feral hogs. Feral hogs disrupt plant life, decimate ecosystems, and have been known to decimate hardwood seedling plantings. Aside from the potential economic loss from timber volume, many wildlife and fish species are dependent on the ecosystems affected by these invasive animals, insects, and diseases.

Non-native Invasive Plants

Many non-native plants are known to occur across the National Forests in Mississippi, often accounting for 25 percent or more of the documented flora. While not all non-native species are known to disrupt native ecosystems, of particular concern are those that are successful at invading and rapidly spreading through natural habitats. As defined in Executive Order 13112 issued February 3, 1999, an invasive species is one that meets the following two criteria: "1) it is non-native to the ecosystem under consideration and, 2) its introduction causes or is likely to cause economic or environmental harm or harm to human health."

A list of 21 species of non-native plants that are the highest priority for management is in Table 18.

Non-native Insects and Disease

Insects and diseases of most concern for the purposes of this analysis include emerald ash borer, sudden oak death, redbay ambrosia beetle which is associated with laurel wilt disease, Asian longhorned beetle, sirex noctilio, and red-imported fire ant.

Emerald Ash Borer

The emerald ash borer (*Agrilus planipennis*) is an insect pest of recent concern for the National Forests in Mississippi. This non-native boring insect was first identified in the United States in 2002. Initial infestations were located in Michigan and Ontario, Canada. The insect has rapidly spread south and east and now occurs in Maryland, West Virginia, and Virginia. Emerald ash borer trapping has occurred in and around the National Forests in Mississippi; however no emerald ash borer have been detected as yet. The emerald ash borer feeds on the cambium of ash trees as larvae. It is the destruction of the cambial layer that disrupts the transport of water and nutrients up the tree and causes mortality. A single generation of larvae occurs in any given season, with the larvae overwintering in the sapwood of the tree. Beetles emerge in May or early June to mate and start a new cycle. At this time, only ash trees are believe to be susceptible to this species of borer. Infested trees decline over a few years and may die after 3 to 4 years of heavy infestation.

Ash is rarely a dominant tree in our forested stand. However, ash species are often found as a minor component throughout the entire National Forests in Mississippi in the more mesic sites. While this insect pest is not likely to cause widespread severe mortality at the stand or landscape level because the host tree is not a dominant species in our Forests, it certainly could lead to severe decline and impact of ash species throughout the Forests.

Sudden Oak Death (SOD)

An occurrence known as sudden oak death (*Phytophthora ramorum)* was first reported in 1995 in central coastal California. Since then, tens of thousands of tanoaks (*Lithocarpus densiflorus*), coast live oaks (*Quercus agrifolia*), and California black oaks (*Quercus kelloggii*) have been killed by a newly identified fungus, *Phytophthora ramorum*. This fungus causes a bleeding canker on the stem. The pathogen could also infect southeastern species including some species from both the red and white oak groups and others such as the southern magnolia (*Magnolia grandiflora*), southern red oak (*Q. falcata*), pin oak (*Q. palustris*), northern red oak (*Q. rubra*), white oak (*Q. alba*), cherrybark oak (*Q. pagoda*), chestnut oak (*Q. prinus*), laurel oak (*Q. laurifolia*), live oak (*Q. virginiana*), water oak (*Q. nigra*), and willow oak (*Q. phellos*)(6).

Widespread susceptibility of many eastern forest and landscape trees and shrubs makes establishment of sudden oak death to Mississippi or other southeastern states a very real possibility. The susceptibility of many popular horticultural plants such as camellias, rhododendrons (including azaleas), and viburnums has already lead to the pathogen being spread to some eastern states, such as Georgia, Florida, the Carolinas, and Mississippi. In these locations, *P. ramorum* was usually detected in potted plants, soil, and water in or adjacent to a nursery that had unknowingly obtained infected stock. So far, the pathogen is not yet established in natural forests in Mississippi or elsewhere in the eastern United States.

Redbay Ambrosia Beetle

Laurel wilt is a deadly disease of redbay (*Persea borbonia*) and other tree species in the laurel family (*Lauraceae*). The disease is caused by a fungus (*Raffaelea lauricola*) that is introduced into host trees by a non-native insect, the redbay ambrosia beetle (*Xyleborus glabratus*). The fungus plugs the water-conducting cells of an affected tree and causes it to wilt. Laurel wilt has caused widespread and severe levels of redbay mortality in the southeastern coastal plain.

In 2002, the USDA Forest Service Forest Health Unit, captured three specimens of the redbay ambrosia beetle, *Xyleborus glabratus Eichhoff*, in detection traps near Port Wentworth, Georgia. This was the first record of this Asian species in North America. In 2009, laurel wilt expanded into south Florida and coastal Mississippi while it continued its spread in Georgia and South Carolina as well. The detection of laurel wilt in Jackson County, Mississippi reflects a very large geographic jump for the beetle and fungus; it is not known how the problem got there, but human-aided movement or a separate introduction in cargo seem to be more likely causes than “natural” spread. Laurel wilt has not been detected on the National Forests in Mississippi, but the likelihood of occurrence is high because it has been found nearby.

The ecological impacts of drastic reductions in redbay populations are not well researched or have not yet been reported in the scientific literature. Potential ecological impacts on host species other than redbay are even less certain at this time.

Asian Longhorned Beetle (ALB)

The Asian longhorned beetle (*Anoplophora glabripennis*) has been discovered attacking trees in the United States. Tunneling by beetle larvae girdles tree stems and branches. Repeated attacks lead to dieback of the tree crown and, eventually, death of the tree. Asian longhorned beetle probably travelled to the United States inside solid wood packing material from China. The beetle has been intercepted at ports and found in warehouses throughout the United States.

This beetle is a serious pest in China. In the United States, the beetle prefers maple species (*Acer* spp.). Other preferred hosts are birches, buckeye, elms, and willows. Occasional to rare hosts include ashes, European mountain ash, London planetree, mimosa, and poplars. A complete list of host trees in the United States has not been determined.

Sirex Woodwasp

Sirex (*Sirex noctilio*) woodwasp has been the most common species of exotic woodwasp detected at United States ports-of-entry associated with solid wood packing materials. Recent detections of sirex woodwasp outside of port areas in the United States have raised concerns because this insect has the potential to cause significant mortality of pines. The sirex woodwasp is considered a secondary pest of trees in its native range of Europe and Asia. However, it is a major pest in exotic pine plantations. Females carry a fungus, *Amylostereum areolatum*, they deposit in trees when laying their eggs. This fungus and the mucus injected by the wasp rapidly weaken and kill host trees, and the developing larvae feed on the fungus. This pest is attracted to stressed trees that are often used to make solid wood packing material. Since the life cycle can take a year or more, the insect is transported easily in pallets or other solid wood packing material and not readily detected at a port.

Red-imported Fire Ant

The red-imported fire ant (*Solenopsis invicta*) has invaded many habitats in the United States primarily due to the absence of predators, effective competitors and disease. *Solenopsis invicta* was introduced into the United States in the early 1930s, and now occupies much of the southeast. Imported fire ants are often characterized as being associated with disturbed habitat, but may be found in most habitats, including woodlands and savannas, with an open canopy.

Red-imported fire ants can reduce species diversity and become the dominant species in a habitat, but they may fail to replace native species' functions. Native arthropods may act as pollinators, seed dispersers or decomposers and rarely does *Solenopsis invicta* replace these functions. In the longleaf pine ecosystem, herbivores and detritovores play an important role in ecosystem function (Epperson and Allen 2010).

Human activities often create and maintain disturbance-dependent ecosystems potentially facilitating colonization by red-imported fire ant. Disturbance promotes red-imported fire ant colonization in two ways: 1) by opening canopy or heavy herbaceous layers allowing light penetration and 2) by removal of competitive ant species. Native ants generally do not colonize as rapidly or exhibit the rapid population growth of the red-imported fire ant.

Management practices commonly prescribed to enhance habitat, such as fire, create and maintain early successional characteristics that may have the unintended consequence of increasing red-imported fire ant abundance or activity (Williamson et al. 2002).

Feral Hogs

Local feral hog populations have proliferated and expanded their range across the National Forests in Mississippi. Feral hogs have the potential to damage ecosystems as they create wallows and root for food, compete with native species, and transmit diseases. Evidence of feral hogs has been found in on or near all ranger districts across the Forests.

Foraging by wild pigs may reduce oak regeneration because the animals have been known to feed on acorn crops. Pigs also damage longleaf pine regeneration when they root up seedlings to feed on their roots. Pigs can also compete with or prey on native wildlife and game species. Habitat damage in sensitive areas may have a negative impact on endangered and sensitive species and their habitat, as well as game species, such as turkeys and deer. Pigs may also destroy the nests, eggs, and offspring of ground-nesting birds and can impact other animals directly or indirectly.

Southern Pine Beetle

Southern pine beetle (*Dendroctonus frontalis*) infestations have occurred cyclically throughout recorded history in the South. This is a native pest. Southern pine beetle outbreaks move from low levels of infestation to high levels over several years. The cycles may be localized or regional and depend upon weather and other stress factors as well as the interrelationship between the populations of southern pine beetle and its predators.

The female southern pine beetle kills pines and occasionally other conifers by boring under the bark and destroying the cambium layer of the tree. They construct winding galleries while feeding and laying eggs. During outbreaks, trees are usually mass-attacked by thousands of beetles. The crowns of trees attacked by southern pine beetle during warm, dry weather may fade in color within weeks. Once a tree is successfully attacked, the tree usually turns light greenish-yellow, then yellow, and finally reddish-brown. This color change pattern can vary depending on the tree and environmental conditions.

Old Growth

Old-growth conditions on the Forests are not prevalent because these lands were acquired as mostly cutover lands beginning in the 1930s. Nearly 80 years of forest restoration and management have provided the opportunity now to identify and manage for old-growth character across the landscape.

An assessment of the status of possible old-growth forest acreage for the National Forests in Mississippi was undertaken in 2005. A preliminary inventory of possible old-growth was developed based on the Southern Region's old-growth guidance.

A number of selection criteria were utilized to identify stands for this preliminary list of possible old-growth. These included lands withdrawn from timber production, red-cockaded woodpecker clusters, late seral designations, stands at or above Southern Region minimum old-growth age, and rare community types. The areas identified were grouped based on their forest type into twelve old-growth community types. The development of this list resulted in the identification of 118,592 acres to manage as possible old growth.

The areas on the preliminary list of possible old-growth range from small to large sized patches. The current percentage of forested acres on each district included in the preliminary list of possible old-growth varies from six to 32 percent. The overall Forest average is ten percent. The current percentage of forested acres on each district included as medium sized or larger possible old-growth ranges from one tenth of one percent to four percent. The overall Forest average of medium sized or larger possible old-growth is one half of one percent.

Old-growth forests are ecosystems characterized by the presence of older trees, minimal signs of human disturbance, mixed-age structure, presence of canopy openings due to tree falls, pit-and-mound topography, and downed woody debris in various stages of decay, standing snags (dead trees), multi-layered canopies, intact soils, and a healthy fungal ecosystem. Because old growth is so rare in the eastern United States and is in such short supply, it essentially represents an endangered habitat. As second- and third-growth forests (last logged at the turn of the last century) approach maturity, the opportunity exists to set aside stands for future old growth preservation. Old-growth forests are not necessarily virgin or primeval communities. They can develop over time following human disturbances, just as they do following natural disturbances. Old growth encompasses both older forests with a significant early seral species component and forests in later successional stages dominated by shade tolerant species.

The preservation of old growth is important for a variety of reasons. First, much of what is known about the structure, function, and natural disturbance regimes of forests have been derived from the study of old-growth forests. These forests provide a valuable benchmark or "experimental control" against which managed lands can be compared. Old-growth forests also serve as reservoirs of biological diversity. They may provide habitat structure that certain animals and plants need and that is not elsewhere in the landscape because old growth is so rare.

Table 19. National Forests in Mississippi preliminary inventory of possible old-growth acreage by district and status/selection criteria

Old-growth Status / Selection Criteria		Bienville	De Soto	Homochitto	Chickasawhay	Delta	Holly Springs	Tombigbee	Totals
Existing old-growth	1	0	0	0	0	0	0	0	0
Future old-growth	2	0	0	0	0	0	0	0	0
Wilderness	3	0	6,466	0	0	0	0	0	6,466
Research Natural Areas	4	189	1,820	230	539	670	186	803	4,437
Other Administratively designated unregulated areas	5	568	5585	84	451	3,122	235	72	10,117
Red-cockaded woodpecker clusters	6	8,505	3,236	4,230	2,007	0	0	0	17,978
Late seral	7	10,770	14,578	7,300	7,239	2,946	5,138	3,004	50,975
R8 old-growth minimum age	8	698	2,031	580	14	13,581	6,393	958	24,255
Rare community types	9	937	1175	807	134		759	552	4,364
Totals		21,667	34,891	13,231	10,384	20,319	12,711	5,389	118,592

Trends

- Old-growth guidance for the Southern Region is contained in a report titled, "Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region" (USDA Forest Service 1997). The National Forests in Mississippi are implementing this regional guidance to establish an appropriate network of old-growth forests distributed across the national forests. This network should represent the ecological integrity needs for all vegetation community types. The first step in this process involved developing a preliminary inventory of possible old growth. The draft forest plan set of documents includes guidance on old-growth for the National Forests in Mississippi.
- The results of the preliminary inventory of possible old-growth acreage by ranger district for the National Forests in Mississippi are presented below in Table 19. The information in the table is summarized by ranger district and old-growth status/selection criteria (July 2007). Table 20 is the same information presented by district and old-growth community type. Project-level evaluations will be needed to assess areas identified in the preliminary inventory and assign them to the existing or future old-growth categories.

Table 20. National Forests in Mississippi preliminary inventory of possible old-growth acreage summarized by district and old-growth community type

Old-growth Community Types	Bienville	De Soto	Homochitto	Chickasawhay	Delta	Holly Springs	Tombigbee	NFs in MS Totals
Coastal Plain upland Mesic Hardwood (6)	436	394	325	66			42	1,263
Hardwood Wetland (10)	28	3,988		642				4,658
River Floodplain Hardwood (13)	2,944	9,210	1,965	3,642	20,189	448	103	38,501
Cypress-Tupelo Swamp (14)		260	399			204		863
Dry-Mesic Oak (21)	5,663	2,355	1,362	481		4,976	4,300	19,137
Dry and Xeric Oak (22)		206				441		647
Xeric Pine and Pine-Oak (24)	823	1,130	1,485	11		5,244	192	8,885
Dry and Dry-Mesic Oak-pine (25)	10,656	7,769	6,996	1,657		1,398	732	29,208
Upland Longleaf (26)	346	5,062	607	1,828				7,843
Seasonally Wet Oak-Hardwood (27)	771	1,311	92	1,601				3,775
Eastern Riverfront (28)					55			55
Southern Wet Pine (29)		3,192		456				3,648
Unclassified		14			75		20	109
Totals	21,667	34,891	13,231	10,384	20,319	12,711	5,389	118,592

3.5.7 Fire Management

Restoring fire to fire-dependent ecosystems through prescribed burning contributes to long-term resiliency, integrity, and sustainability of productive forest ecosystems. Social concerns, such as proximity to structures, smoke management requirements, public health, and safety limit the scale of managed fire short of historic levels. The protection of human life is the overriding priority.

Fire regime condition class (class) is a classification of the amount of departure from the natural fire regime in terms of the following ecological components: vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency; severity, and pattern; and other associated disturbances (e.g. insect and disease mortality and drought). The three condition classes are based on low (class 1), moderate (class 2), and high (class 3) departure from the natural (historical) condition. Class 1 areas are considered within the historic range of variability while condition class 2 and 3 represent a moderate to high departure from the natural regime, respectively. Fire regimes in stands that contain a class 3 have been significantly altered from their historic return interval and species composition.

Due to the history of prescribed fire on the National Forests in Mississippi, especially during the dormant season, significant portions of the national forests are in condition classes 1 and 2. The prescribed fire strategy on the National Forests in Mississippi is to maintain ecosystem specific prescribed burning rotations by season and interval. Following this strategy will allow National Forests in Mississippi to maintain condition class 1 areas, move condition class 2 areas into condition class 1, and move condition class 3 areas into condition class 2.

In spite of a significant reduction of fuel loads through post-storm salvage operations, a large fuel buildup created by Hurricane Katrina still exists. Before Katrina, the fuel loadings on the De Soto National Forest averaged 1-4 tons per acre, and now it is as high as 40 tons per acre. Over the next few years, many residual large materials will degrade naturally, and the prescribed burning program will concentrate on removing the more dangerous fine materials and volatile live fuels. Forestwide, prescribed burning accomplishments are expected to return to pre-Katrina annual acreage provided the weather and funding levels are adequate.

Dormant season burns, which are conducted during the winter and early spring in Mississippi, are used to accomplish reduction of hazardous fuels. Fires during this season may top-kill some vegetation, but the roots will sprout. Growing season burns have more effect on species composition and are used to reduce competition. The goal is to knock back hardwood stems and eliminate a larger portion of vegetation growth. Currently, approximately 70 percent of the prescribed burning program in Mississippi is conducted during the dormant season, with the remaining 30 percent is conducted during the growing season.

Table 21. Total annual prescribed burn acreage by year

Year	Total Prescribed Burn Acreage
1995	134,840
1996	91,165
1997	125,910
1998	132,913
1999	142,978
2000	72,596[a]
2001	189,026
2002	216,050
2003	259,314
2004	257,183
2005	248,156
2006	91,755
2007	222,104
2008	177,714
2009	251,165
2010	169,166

a – Region-wide drought

Fire Management Trends

- The National Forests in Mississippi have an aggressive prescribed fire program. Prescribed burning levels on the National Forests in Mississippi have increased from 135,000-150,000 acres burned annually in past decades to 235,000-250,000 acres today, weather conditions permitting.
- By far, the largest part of this program is the reduction of hazardous fuels (95 percent or more) and maintaining condition class 1 where it exists. Due to an intermingling of public and private lands within the forest, prescribed burning for treatment of hazardous fuels primarily occurs in the wildland urban interface.

- Table 21 lists the total acres prescribed burned across the national forest each year since 1995. The increase in annual burn levels around 2000 was due to the establishment and staffing of the current fire organization. The drop in acres burned in 2006 was the result of the aftermath of Hurricane Katrina.
- Prescribed fires are conducted for ecosystem restoration objectives, wildlife habitat maintenance and improvement, threatened and endangered species habitat maintenance and improvement, control of undesirable species, site preparation, and brown spot needle blight control in longleaf pine. The National Forests in Mississippi is actively moving from an exclusive dormant season program to more growing season prescribed burning.
- Since the introduction of the forest plan in 1985, the use of aerial ignition has made a significant change in the ability of the National Forests in Mississippi to implement large scale prescribed burning projects.
- The vast majority of wildfires in Mississippi are human caused (approximately 98 percent). Wildfires generally have limited impacts in Mississippi. There are few lightning-caused fires since most storm events tend to have associated rainfall. Table 22 shows the average number of wildland fires per year and average acres burned per year since 1980.
- With the increase in large-scale understory prescribed burning, wildfire occurrence and intensity has decreased and resource damage has been reduced.
- Fire management complexity is increasing, particularly in areas of expanding wildland urban interface. Wildland urban interface results in increased risk for structures and natural resources.

Table 22. Wildland fires and average acres burned per year

Time Period	Average Wildland Fires/Year	Average Acres Burned/Year
1980-1984	303	7,689
1985-1989	263	6,799
1990-1994	182	5,331
1995-1999	162	5,563
2000-2003	123	5,596
2004-2006	180	9,639
2007-2010	133	6,198

3.6 Economic and Social Environment

3.6.1 Timber

Ecological sustainability requires a diversity of species composition, age classes, stand structure and densities. These conditions provide for a forest resilient and resistant to insect, disease, and disturbance from natural disasters. Healthy forest conditions also include a mix of younger regenerating vegetation and old-growth stands. Primary vegetation management activities for attaining healthy forests include regeneration and thinning timber harvest, and prescribed burning. While timber harvesting contributes to the local economy and America’s supply of wood products, it is also used to create wildlife habitat conditions, manage fuels, manage vegetation to achieve shifts in species composition and restoration of native ecological communities, and provide alternate bio-energy fuel sources.

Trends

- An average of over 228 million board feet (MMBF) was harvested annually from 1986 through 1995.
- On a decreasing trend, an average of over 137 MMBF was harvested annually from 1996 through 2000. From 2001 through 2003 annual timber harvests were down significantly at approximately 27, 33 and 42 MMBF, respectively, for each year.
- Increases in timber harvest occurred in 2004 and 2005 (approximately 89 and 77 MMBF, respectively) but still down to less than half of the annual average in the first 10 years of the 1985 forest plan implementation.
- Timber harvest in 2006 was up significantly due to hazardous fuel reduction salvage efforts following Hurricane Katrina, at over 308 MMBF for the year.
- Salvage of dead or dying trees has constituted more than 10 percent of harvest volume in 6 of 20 years (through fiscal year 2006) since the 1985 forest plan was adopted. This exceeds expectations and would indicate a need for change in management. Salvage has come primarily from pine beetle and tornado damage and more recently from efforts to reduce hazardous fuels resulting from Hurricane Katrina.
- Hurricane Katrina caused heavy random thinning of forests on the De Soto and Chickasawhay Ranger Districts primarily. While this can have a positive effect in creating more open habitat for some threatened and endangered species, the gain will be lost unless prescribed burning can keep down the heavy re-growth of shrubby vegetation that happens quickly in this part of the country.
- Implementation of the 1985 forest plan has resulted in a large acreage of young age classes needing thinning. On average, some 11,000 acres become operable for first thinnings annually. The current thinning program is accomplishing less than one-third of this and is not keeping up with this forest health need. This represents an unhealthy condition.
- Current age class structure of all forested acres is shown below in Table 23. This structure shows some overall balance. However, harvest of hardwood stands to provide early seral conditions within the hardwood types has been very limited, representing an unhealthy condition.

Table 23. Age class structure of all forested acres

Age Class	Percent of Forested Areas
0-10 years	5%
21-60 years	25%
61-80 years	37%
80+ years	15%

- The percentage in the 0-10 age class has dropped sharply in recent years because of reductions in regeneration. The appropriate level of early seral age classes needs to be determined by vegetation type and attained to assure a vigorous, resilient forest is maintained.
- Restoration of site-appropriate species should be a priority. Vegetation classification inventory data as of October 2006 indicated 265,000 to 345,000 acres of longleaf, 24,000 to 60,000 acres of shortleaf and 94,000 to 308,000 acres of hardwood restoration potential.

Old-growth components are present across the National Forests in Mississippi. Implementation of the 1985 forest plan provided for the designation of “late seral” areas. These areas have some old-growth characteristics. Additional potential old growth has been identified and will be evaluated further at the project level.

3.6.2 Range

Public demand for grazing on the National Forests in Mississippi has been on the decline since 1976. The only active range allotments occur on the De Soto National Forest. The program level has reduced to the point that an active range allotment program is no longer feasible from a resource management perspective. The existing allotments under permit will continue until they expire. No new allotments are expected to be authorized unless a significant increase in demand is realized.

Trends

- Authorized grazing through range allotment permits (grazing permits) on the National Forests in Mississippi has been declining since 1976.
- Since fiscal year 1999, the number of grazing permits has dropped from seven to four permits.
- In 2003, a range monitoring survey of 1,869 acres of the 2,724 total acres with active range allotments was completed. No situations were found that required actions to protect natural resources from damage.

Range allotments and impacts of range use on the National Forests in Mississippi are minor resource considerations. There are no plans or incentives to increase use of range resources through the forest plan revision effort. Range availability exceeds the public demand for the use.

3.6.3 Minerals

The National Forests in Mississippi are located in the Gulf Coast Plain. The De Soto, Homochitto, Delta, and Bienville National Forests lie within the Mississippi Salt Basin. The Tombigbee and part of the Holly Springs National Forests lie within the Black Warrior Basin. A number of minerals occur, but their economic significance varies greatly. Iron ore, bituminous coal, lignite, limestone, aluminum ore, bentonite, sulfur, oil and gas, and common variety minerals are all present in varying quantities. Oil, gas and common variety minerals are the only minerals being produced from the National Forests in Mississippi. Oil and gas are the most valuable mineral resources on the National Forests in Mississippi. Drilling began in 1929 and continues on a large scale today. The forest has approximately 500,000 acres under current oil, gas and mineral leases. It typically administers about 150 oil, gas and mineral leases to standard and processes 8 to 10 new applications annually for permits to drill each year.

Mineral activity and key conditions and trends can be summarized as follows:

Table 24. Summary of mineral activity

Mineral	Past	Present	Future
Oil and Gas	High	High	High
Bentonite	Low	Low	Low to Moderate
Common Variety	Low to Moderate	Low to Moderate	Low to Moderate
Lignite	Low	Low	Low to Moderate

Practically all National Forest System lands in Mississippi are acquired status. Only 1,291 acres are public domain. Between 7 and 8 percent of the mineral rights underlying National Forest System lands in Mississippi are reserved or outstanding in third parties; the rest are owned by the United States of America.

Table 25. Mineral ownership on the National Forests in Mississippi (acres)

Forest	Reserved	Outstanding	Private Surface	USA Surface
Bienville	1,082	5,592	2,037	171,700
Delta	273	2,518	1,891	56,727
De Soto	3,094	33,370	6,402	478,095
Holly Springs-North	3,063	6,652	2,862	116,600
Homochitto	526	25,117	3,234	163,138
Tombigbee	1,296	2,219	2,289	62,681
Holly Springs-Yalobusha Unit	106	80	353	20,236
Totals	9,440	75,548	19,068	1,069,177

Oil and Gas

The National Forests serve a key role in support of the Nation's energy needs. With minor exceptions, nearly the entire forest land base is available for oil and gas leasing, exploration and development. Currently, there are approximately 200 active oil and gas wells, including injection and disposal wells, with associated facilities such as tank batteries and pipelines.

The potential for future oil and gas exploration and development is high. The reasonable foreseeable development scenario (BLM – October, 2005) concludes that exploration and development will continue on the national forest at a higher level for the next 15 years. Considering current and likely future demand for domestic oil and gas, prospecting activity in Mississippi is expected to continue at a moderate to high level.

Existing law, rule, regulation and agency policy direction are to cooperate with the Bureau of Land Management (BLM) to expedite authorization of drilling permits on National Forest System land. The two agencies are guided by an interagency memorandum of understanding regarding oil and gas operations.

The earliest records indicate oil and gas exploration on what became National Forest System lands commenced in the 1920s. Of the approximately 1.1 million acres of National Forest System lands, oil and gas leases are presently issued on approximately 500,000 acres where oil and gas rights are federally owned. There are also approximately 85,000 acres of privately owned mineral rights underlying National Forest System lands.

In the 1990s federal leases have typically generated in the range of $2 to $4 million in receipts annually to the General Treasury. In 2004, federally administered onshore oil and gas leases in Mississippi generated $3.7 million in gross receipts of which $925,408 was disbursed to the State (25 percent fund). In boom years, Federal oil, gas and mineral receipts from the lands administered by the National Forests in Mississippi have run as high as $15 million per annum. Overall, oil, gas and mineral extraction activities involving gas and crude oil on national forest land are estimated to contribute in the range of $3.1 to $6.3 million in associated wages and salaries to the State's economy in a typical year.

Present interest in federal sector oil and gas leasing and wildcat drilling activity is up sharply due in part to high current oil prices, but more due to speculative interest in locating exploitable natural gas reserves. Natural gas demand is projected to rise sharply in the next few years as industry faces increasing pressure to convert to use of this cleaner burning fossil fuel in response to tightening environmental rules and regulations. Seismic exploration projects are detailing much of the National Forest in Mississippi. These projects will likely cause much drilling activity and yield significant finds.

In August 2010, the National Forests in Mississippi renewed its decision for lands available for oil and gas leasing (National Forests in Mississippi - Lands Available for Oil and Gas Leasing Environmental Assessment, August 2010). The 2010, oil and gas leasing decision authorized all lands on the National Forests in Mississippi, except for congressionally designated wilderness areas (Black Creek and Leaf) and the deferred Sandy Creek RARE II Further Study Area, available for Federal oil and gas leasing through the Bureau of Land Management (BLM). These lands, approximately 1.2 million acres, would be administratively available subject to 1) management direction in the National Forests in Mississippi forest plan, 2) oil and gas lease stipulations, 3) the wide range of laws and regulations that require environmental protections for oil and gas exploration and development and 4) site-specific environmental analysis as detailed exploration proposals are made by lease holders. Additionally, all administratively available lands will be available for lease by the BLM, subject to the stipulations identified in the analysis, the standard USDA stipulation, and the environmental requirements of the standard federal lease terms detailed in appendix B of the National Forests in Mississippi Lands Available for Oil and Gas Leasing Environmental Assessment, August 2010.

The deferred decision on oil and gas leasing availability on the Sandy Creek RARE II study area is now being evaluated and addressed in this environmental impact statement. Alternatives A and B would not authorize oil and gas leasing in the Sandy Creek RARE II Study area. Alternatives C, D, and E would permit oil and gas leasing in the Sandy Creek RARE II Study area subject to the 2001 Roadless Area Conservation Rule restrictions. The restrictions include no new road construction permitted in the former RARE II study area; therefore existing system roads would be utilized as access for lease activities.

Common Variety and Other Minerals

The National Forests in Mississippi are located in the Gulf Coast Plain. Iron ore, bituminous coal, lignite, limestone, aluminum ore, bentonite, sulfur, and common variety minerals (sand, clay and gravel) are all present in varying quantities.

Bentonite and coal are commercially mined from private lands adjacent to the Bienville and Tombigbee National Forests, respectively, and it is likely that commercial deposits also exist on these national forests. Lignite is found on the Tombigbee and Holly Springs National Forests. The Tombigbee National Forest in particular is situated over sizeable known coal reserves. Private land adjacent to the forest has been leased for lignite, but no leases for these minerals currently exist on the national forests. Given that Federal law prohibits surface (strip) coal mining on Federal lands situated East of the 100th Meridian, the probability of mining lignite on the National Forests in Mississippi appears low; however, wells may be drilled to produce the coal bed methane gas (leasable) believed to be associated with these low grade coal deposits.

While these deposits contain relatively low grade lignite coal and interest in developing has historically been low (there is only one current large scale coal mining operation now going, that being a sole source supply for a local coal-fired power plant), geologists believe there are considerable quantities of methane gas associated with these coal deposits. Methane can be used in industrial processes in place of natural gas, and can be produced at a relatively attractive cost with little surface disturbance or impact via extraction wells.

The national forest provides a needed source of common variety minerals to support local construction activities; for example, road building. Forest management needs for minerals materials are met as well as the legitimate needs of cooperators, partners and other governmental entities. Common variety minerals are being produced from the Holly Springs, Homochitto and De Soto National Forests.

3.6.4 Infrastructure

Facilities

The National Forests in Mississippi currently have an inventory of 303 owned buildings and 5 leases, including the Supervisor's Office in Jackson. A total of 206 owned buildings are categorized as administrative (e.g., offices, warehouses, sheds, and storage buildings), while the remaining 97 are categorized as recreation (e.g., bath houses, pavilions, and gazebos). Many of the buildings have exceeded their useful life, having an average age of over 40 years. Many are obsolete, undersized, non-ADA (Americans with Disabilities Act) compliant and have very high deferred maintenance needs (failing structural, electrical, and mechanical systems, etc.). A consolidation in the mid-1990s reduced the number of ranger districts across the National Forests in Mississippi from 10 to 7, resulting in some administrative sites and buildings being under-utilized or no longer needed. The National Forests in Mississippi intends to continue to dispose of facilities it no longer needs. Although the Forests' remaining lookout towers are still structurally sound, newer methods of fire detection such as aerial observation have made them obsolete.

Roads

There are approximately 3,000 miles of roads under Forest Service jurisdiction on the National Forests in Mississippi. These roads serve many functions, the main one being to provide administrative and public access to national forest land. Forest Service jurisdiction roads in many cases also serve as through routes across the national forests or as access to private lands inside the national forest boundaries. They often serve as an integral part of the local transportation systems, carrying school buses, emergency vehicles, and local residents in addition to forest visitors and workers. These routes vary from asphalt surfaced or wide gravel roads with occasional private driveways to narrow dirt paths opened only as needed for activities such as timber harvesting, prescribed burning, or fire suppression. As linear openings, they provide varied habitat and act as fire breaks.

Of the Forest Service roads on the National Forests in Mississippi, 32 percent are suitable for passenger car use, 24 percent are for use by high clearance vehicles, and 44 percent are closed for administrative or intermittent use only. The desired road system is essentially in place and project work generally requires only the rehabilitation of existing roads and not the construction of new ones. The exception to this would be on newly acquired lands such as tracts obtained through land exchanges or the recently acquired University of Mississippi lands on the De Soto National Forest. Road maintenance funding has historically been below that necessary to maintain roads to the desired levels. To compensate, many roads are closed to reduce maintenance costs, while many others are maintained at less than ideal levels.

Table 26. Number of Forest Service roads

Number of Roads By Maintenance Level By District						
District	ML1	ML2	ML3	ML4	ML5	Totals
Bienville	202	76	78	7	2	365
Chickasawhay	245	158	35	7	3	448
De Soto	412	248	120	17	2	799
Delta	27	3	11	0	0	41
Holly Springs	233	67	28	5	0	333
Homochitto	619	131	54	6	1	811
Tombigbee	81	31	10	4	0	126
Totals	1819	714	336	46	8	2923

Table 27. Miles of Forest Service roads

Miles of Road By Maintenance Level By District						
District	ML1	ML2	ML3	ML4	ML5	Totals
Bienville	157.92	91.64	141.00	28.33	0.45	419.33
Chickasawhay	160.97	135.03	75.47	84.00	3.00	458.46
De Soto	279.71	234.02	270.77	83.60	0.10	868.20
Delta	41.33	4.41	28.25	0.00	0.00	73.99
Holly Springs	235.00	64.42	62.48	14.50	0.00	376.39
Homochitto	325.69	149.93	103.33	12.81	1.01	592.78
Tombigbee	80.64	37.83	25.53	4.67	0.00	148.66
Totals	1281.26	717.27	706.82	227.90	4.56	2937.81

Table 28. Maintenance level definitions for Forest Service roads

Maintenance Level Definitions	
1	Closed
2	For use by high clearance (4WD) vehicles
3	Suitable for passenger cars (well-maintained gravel road)
4	Moderate degree of user comfort
5	High degree of user comfort (asphalt paved road)

3.6.5 Land Use and Ownership

The National Forests in Mississippi are composed of a mixed and often fragmented land ownership base. Federal, other governmental, corporate and small landowner holdings together make up a patchwork mosaic of interspersed ownership. Small private land holdings, which represent about two-thirds of the State’s total forested area, have frequently been deforested and converted to agricultural uses on a large scale. These small private ownerships (sometimes referred to as non-industrial private forests or NIPF) are often improved with structures and ancillary improvements. Other classes of ownership, such as industrial and government forest land holdings, are typically larger parcels of undeveloped land. National Forest System lands typically represent the predominant ownership class within the congressionally declared forest proclamation boundaries.

Many emerging factors in private forest ownership are affecting National Forest System (NFS) lands in Mississippi. The most important and interacting changes affecting private forest lands in the South are: 1) land development fueled by economic and population growth; 2) new patterns of growth that place higher populations in the vicinity of forests; and 3) restructuring of the forest products industry, which had long held many of the largest tracts of contiguous forestlands in the region. These ownership changes create additional demand on National Forest System land and its management by increasing workloads for administration (special uses) and protection (fire management and law enforcement) on adjacent National Forest System lands.

In recent years, large numbers of people moving into close proximity to National Forest System lands have generated pressure for change in forest management practices along the urban/forest interface. The successful establishment of the gaming industry in coastal Mississippi spurred population growth and associated demand for home sites and the businesses to support them. The De Soto National Forest in particular has been impacted by expanding suburban developments along the southern border of the national forest. The devastation resulting from Hurricanes Katrina and Rita in 2005 spurred considerable relocation inland for coastal residence. To a lesser extent, similar ownership changes are occurring across the state. Appreciable growth is also occurring in the northerly portion of the state affecting the Holly Springs National Forest. Existing forest lands are close enough to Memphis, Tennessee, to attract development interest and activity to satisfy the needs of commuters looking for housing of a rural character.

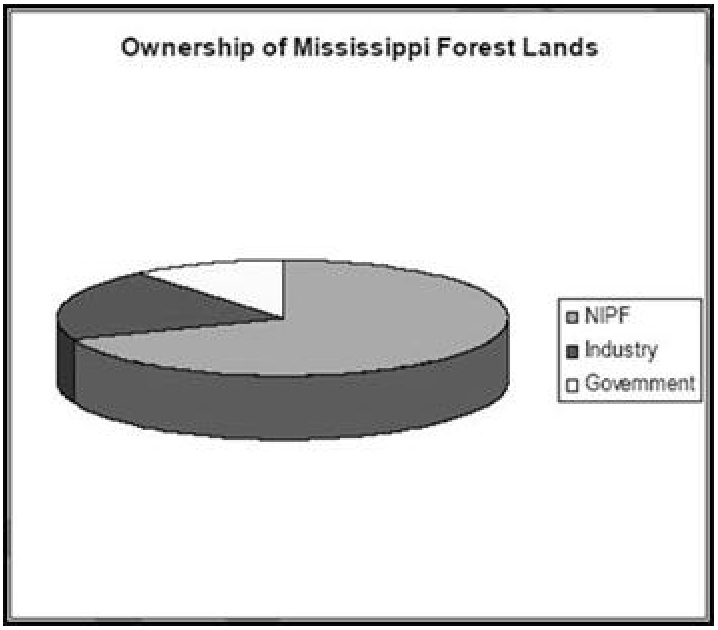

Figure 22. Ownership of Mississippi forest lands

Land ownership adjustments are anticipated to simplify and improve the management of National Forest System lands. Consolidating the national forest land base through ownership adjustments is one way of maximizing efficiency. By disposing of isolated tracts and acquiring inholding properties, the National Forests in Mississippi can reduce landline and corner maintenance, reduce the potential for encroachments, reduce the number of rights-of-way necessary to acquire or grant, and reduce the need for special use permits on National Forest System land to serve the needs of adjacent non-Federal land. Lands needed for special resource objectives are targeted during land ownership adjustment planning and implementation. Resource objectives can include benefits to soil, water, air, vegetation, fish, wildlife, wilderness and natural beauty. Examples include unique recreational lands or tracts of unusual character or attributes, such as stream flows and the species that depend on maintenance of minimum in-stream flows.

Trends

- The National Forests in Mississippi are composed of a mixed and often fragmented land ownership base. Such physical fragmentation of forest lands can severely reduce biological diversity and sustainable production of wildlife by creating forest areas of insufficient size to support diverse ecological communities or resulting in areas that lack one or more essential ecosystem elements.
- Efforts to consolidate ownership of national forest land are ongoing. Land adjustment activities include land purchase and exchange, transfers and donations, land use permits, acquiring and granting rights-of-way, landline location, and resolving title claims and occupancy trespasses.
- Large scale change in ownership patterns and attendant land management practices by adjoining property owners are occurring along many of the forests’ boundaries.

- Development of adjacent private land fueled by population growth is placing increased demands on national forest land for permitted uses such as utilities and access and other uses such as recreation, and some parts of the forest are losing its rural character.
- Population growth historically results in increases in encroachments and unauthorized uses of national forest land. Boundary line management conflicts will likely increase, particularly in urban interface settings.
- Development adjacent to national forest land increases impacts and management complexity on threatened and endangered species and other species of concern, water quality and watershed values, scenic beauty and wildlife habitats.
- As population density adjacent to national forests increases, potential for conflicts between forest users or forest management activities and adjacent residents and occupants increase for a variety of issues including such things as smoke, smoke management, noise, litter, public health concerns and conflicting uses.
- Adjacent development and forest fragmentation contributes to the elimination or degradation of wildlife corridors that connect important forested areas and increase wildlife/human conflicts.
- Landline marking (property boundary paint, corners, signs and monumentation) rapidly deteriorates in Mississippi's warm, moist climate. The National Forests in Mississippi's land lines are also deteriorating due to reduced funding for maintenance.
- At present there are some 400 inventoried, unresolved title claims and encroachments on the National Forests in Mississippi. Annually, only one or two cases have been resolved during the last decade. The backlog is expected to continue to grow over the next decade given projected growth and development on adjacent lands.

3.6.6 Outdoor Recreation

Located throughout the state, the public lands managed by National Forests in Mississippi are truly the backyard for many local residents. In fact about 75 percent of outdoor recreation visits are made by people who live within 25 miles of the national forest. The National Forests in Mississippi offer a diversity of terrain and ecosystems for its visitors to explore. Wildlife is abundant, and there are over 2,700 acres of lakes and ponds and more than 11,000 miles of rivers and streams. The numerous plant and animal communities and a rich cultural history add value to the national forest visitors' experience. Mild winters permit for year-round recreation.

Although the National Forests in Mississippi is one of the largest Forest Service units in the southern states, however the fragmented ownership pattern can make typical Forest Service management practices challenging in some places. While the presence of many neighbors allows them easy access to the forest as well as creates a good environment for community partnerships, the structures and activities of nearby dwellings, roads and other development can disrupt a sense of remoteness and naturalness for the forest visitors.

National Forest Role in Statewide Outdoor Recreation

The National Forests in Mississippi are joined by Mississippi Parks, the Army Corps of Engineers, the National Park Service and US Fish and Wildlife Service as the major providers of public lands and facilities for outdoor recreation in Mississippi (see Figure 23). Using a 75 mile radius from the national forest properties, the National Forests in Mississippi serves two market areas in the state. The Holly Springs and Tombigbee National Forests serve the "Northern Market" of north Mississippi counties reaching into Tennessee. The Bienville, De Soto, Delta and Homochitto NFs serve the "Southern Market" includes south Mississippi and parts of Alabama, Arkansas and Louisiana.

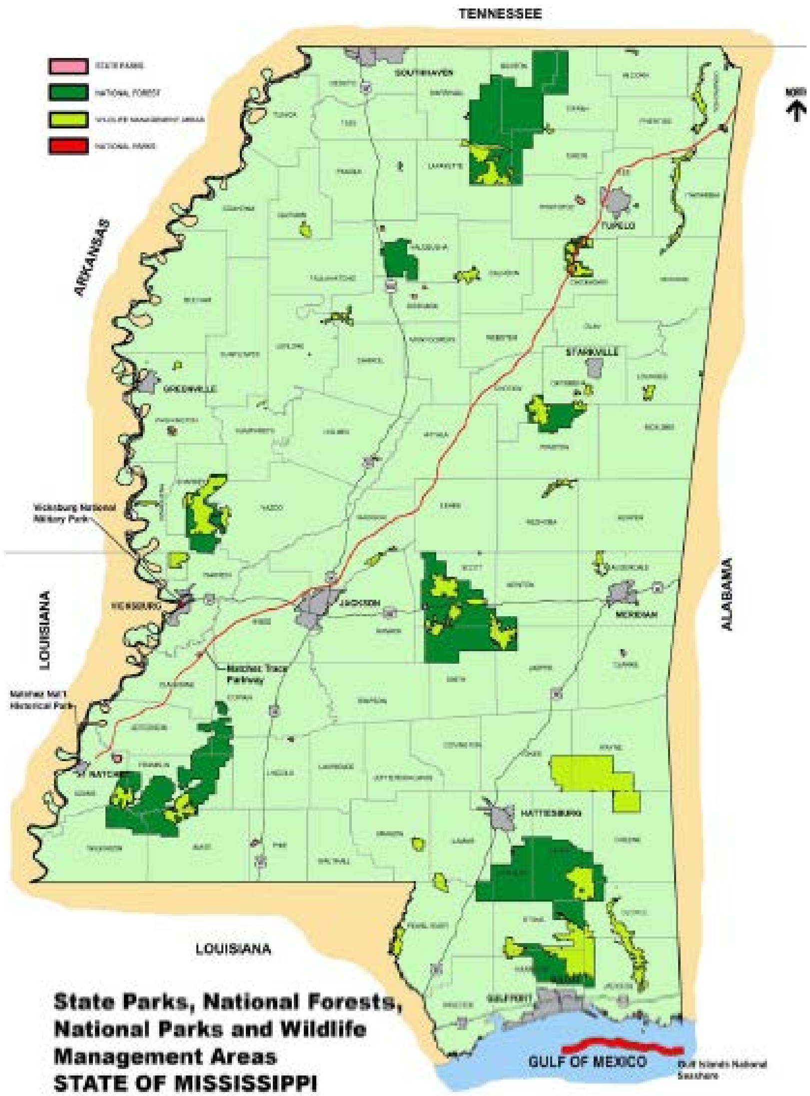

Figure 23. State Parks, National Forests, National Parks and Wildlife Management Areas

In both market areas, National Forests in Mississippi is a leading provider of dispersed recreation opportunities, with hunting, fishing, nature watching and trails being leading activities. The National Forests in Mississippi program of developed recreation areas (both day use and overnight facilities) is not as big statewide as the Army Corps of Engineers or Mississippi State Parks programs. Yet most national forest recreation sites are important to local communities, offering unique outdoor settings. These places often serve as base for, or facilitate, visits focused on dispersed recreation activities. In 2009, an estimated 2.6 million visits were made to the undeveloped woods and water bodies managed by the National Forests in Mississippi. And around 330,000 visits were seen at developed day use and overnight areas. Over 89 percent of visits came from the two markets.

The Mississippi Department of Wildlife, Fisheries and Parks spearhead the hunting and fishing programs (habitat, population, and use management) across the State. This department administers about 50 wildlife management areas totaling more than 668,000; many of which are cooperatively managed with other agencies like the Forest Service, or some are operated under lease from private landowners.

Deer hunting is the first choice of Mississippi hunters (representing over half of the annual hunting demand in the state) there are many other resident and migratory game species available to pursue on wildlife management areas. Wild turkey, squirrel, rabbit, quail, raccoon, opossum, fox, and bobcat are among the resident species traditionally hunted. Ducks, geese, and doves are the most commonly hunted migratory species, but several other migratory game birds may be taken, too. Wild hogs have proliferated and spread throughout the state in recent years. Hunting of this nuisance species, which has detrimental impacts on so many game and nongame species, is also offered.

The National Forests in Mississippi work corporately with the state to manage about 15 large wildlife management areas (approximately 570,000 acres) with extensive habitat improvements that support abundant game and non-game species. In north Mississippi, the Chickasaw, Choctaw, Sunflower, Twin Oaks and Upper Sardis Wildlife Management Areas are on national forest. Totaling over 150,000 national forest acres, these five wildlife management areas represent over half of the wildlife management area lands available for public hunting in the north Mississippi. Additionally, of course, these acres are open for other non-hunting outdoor activities like nature viewing, picnicking, gathering berries, trails and other recreational pastimes.

In the southern part of the state, there are ten Forest Service cooperative wildlife management areas: Bienville, Caney, Caston, Chickasawhay, Leaf River, Little Biloxi, Mason Creek, Red Creek, Sandy Creek, and Tallahalla. These areas comprise almost 427,000 acres (76 percent) of the total 530,551 acres managed by MDWFP for wildlife habitat improvement and public hunting. These wildlife management areas also can provide for a superior opportunity for wildlife and bird watching.

Outdoor Recreation Trends

- The National Forests in Mississippi will continue to be a major provider of outdoor recreation. The demand for dispersed and developed recreation opportunities will continue to increase and some of that new demand can be met accommodated on national forest lands.
- The demand for today’s outdoor activities will not be the same in 10 years or 20 years. Interest in some activities will grow more quickly than the rate of population growth, some will keep pace, and interest in others will decrease. However, the total numbers of people seeking to recreate on National Forest will increase.
- By 2060, private forest lands in the south will decrease by 11 to 23 million acres and a range of 30 to 43 million acres of rural and will become urbanized. The past trend of agricultural land transitioning to forest land will stop. The acreage of state and federal lands and waters managed for outdoor recreation will remain about the same.
- The demand for outdoor recreation – setting activities and facilities - will be influenced by a myriad of factors but population growth and income are most defining. Over the next 60 years in the South, it predicts that the participation in hunting may grow by 8 to 25 percent while that of hiking may grow by 70 to 113 percent. Activities that are land intensive – like hunting and long distance trails will feel pressure from growing number of people wanting to participate in other activities.
- The predicted changes in weather due to climate change – more frequent and intense storms --- will increase challenges in keeping National Forest facilities safe, maintained and open to the public.
- To date, private lands in Mississippi are sometimes leased for hunting and there are private campgrounds. But there is not a trend of public use of private lands for other outdoor recreation activities. More trail systems are being built in suburban regional parks to meet growing demand.
- The National Forest developed recreation areas are small compared with the other outdoor recreation providers in the state. However, there is unused capacity at National Forest developed sites that can

be taken advantage of. Finding a niche among the outdoor recreation providers will be a key to a sustainable future.

- Not only is the state's population growing, but much larger segments of the population will be older. The forest and suburban/urban interface will continue to intensify, especially in the coastal counties of the Desoto National Forest and outside of Memphis near the Holly Springs National Forest.
- The National Forests in Mississippi and its partners are expected to focus on these activities: hunting, fishing, featuring areas of special interest (e.g., wildflowers and wildlife viewing) driving tours and short loop trails for day hiking and exploring the interior of the general forest area. Places highlighting opportunities for families to swim, fish, and picnic will also be important.

Table 29. National Forests in Mississippi inventory of developed recreation areas

Site Type	# of Areas	PAOT[a]	% Estimated Occupancy
Campgrounds	13	4,360	32%
Picnic Areas	4	160	25%
Boating	7	300	23%
Shooting Ranges	2	45	21%
Trailheads	11	435	20%
Horse Camps	6	381	25%
Total PAOT[a]		5,681	

a – PAOT – persons at one time

Table 30. National Forests in Mississippi camping and developed day use areas

	Lake Acres	# ofCamp Sites	# of Picnic Sites	# of Boat Ramps
Northern Market Area				
Choctaw Lake CG Complex	100	25	35	1
Davis Lake CG Complex	200	24		1
Chewalla CG Complex	260	27	40	1
Puskus Campground	96	19	13	1
Total	**637**	**95**	**88**	**4**
Southern Market Area				
Lake Okhissa	1075	-	-	1
Clear Springs CG Complex	12	22	-	-
Turkey Fork CG Complex	240	20	12	1
Marathon Recreation Complex	50	34	14	1
Big Biloxi CG Complex	-	25	-	-
Airey Lake Campground	3	Primitive	-	-
P.O.W Lake Campground	7	Primitive	-	-
Delta NF Hunt Camps	-	Primitive	-	-
Total	**1387**	**101**	**26**	**3**

Developed Recreation

Compared to the dispersed recreation opportunites, the Forests' developed recreation opportunities have a smaller role statewide. Other federal and state agencies host day use and overnight facilities on large lakes and rivers, dominating water based recreation opportunity statewide. The Corps of Engineers large reservoirs alone report nearly 14 million visits per year. See Table 29 and Table 30 for a description of National Forest facilities. Other developed recreation providers in Mississippi combine for nearly 4,400 RV camp sites, about 250 primitive camp sites, nearly 300 cabins, group facilities and several Mississippi parks have hotel facilities.

Trails

National Forest visitors may use trails to travel though the forest while hunting or bird watching. And some visitors come to enjoy the trail activity itself by hiking or riding horses, bikes or all-terrain vehicles. The current state comprehensive outdoor recreation plan acknowledges the importance of the trail systems on public lands and recommends the development of a statewide master plan for land and water trails on large federal lands and all state parks so that opportunities can be better understood and marketed. The biggest challenge to the National Forest trail program has been the numerous, devastating storms and hurricanes which have toppled forests and cover miles and miles of trail over the past six years.

Table 31 summarizes the size and types of trail systems provided by the National Forests in Mississippi in the northern market and southern market of the state. The Holly Springs and Tombigbee National Forests serve the “Northern Market” of north Mississippi counties reaching into Tennessee. The Bienville, De Soto, Delta and Homochitto NFs serve the “Southern Market” includes south Mississippi and parts of Alabama, Arkansas and Louisiana.

Table 31. National Forests in Mississippi trail summary by market

	Northern Market (miles)	Southern Market (miles)	Forest-wide (miles)
Non –Motorized Trails	73.2	191.4	264.6
Motorized Trails	17.4	136.8	154.2
Total	90.6	328.2	418.8

National Forest opportunities include a wide variety of trail types distributed and largely meeting the current needs of nonmotorized trail users.

As is the situation in other southern states, the miles and number of motorized trail systems, offered by public and private providers, are lower than for other trail use types. The National Forests in Mississippi have the largest motorized trail system for all-terrain vehicles and motorcycles in the state; it is located mostly in south Mississippi. The Delta National Forest system is geared for use by hunters during hunting season. Because of the explosive sales of ATVs over the past 2 decades, the need for trails to ride ATVs has not been addressed, so the demand statewide has not been satisfied. In fact, it has been overwhelming for public land managers, as these systems require consistent and thoughtful management to keep trails enjoyable, safe and well maintained. Some of motorized trails are temporarily closed as better management schemes are put in place, following large storm events. Other public land management agencies, such as State Parks, National Park Service and some Corps of Engineers facilities have a designated routes only policy for OHV/ATV and offer very limited motorized riding opportunities. Good for local economies, the high demand has begun to attract local business interests, and in both market areas, private ATV/OHV parks have become available, with some trails and areas for mud bogging, racing and hill climbs.

The National Forests are a major provider of recreational trails in Mississippi. Trails provide access to the forest interior. Approximately 287 miles of non-motorized hiking, biking and horseback riding trails offer challenge and scenic enjoyment. There are 140 miles of designated motorized trails that are located on three ranger districts. Use of these motorized trail systems, primarily by motorcycle and ATV enthusiast, is high. As a result of high use, most of these trails require continual monitoring and maintenance to ensure environmental protection and user safety. These issues make motorized trails the most timely and costly to maintain. Over the last few years, many of these motorized trails have been heavily degraded and temporarily closed for major reconstruction and organizational improvements to the fee structure.

Table 32. Trail opportunities by market

	North		South	
	NFS Miles	Others Miles	NFS Miles	Others Miles
Hike[a]	11	81	73	88
Mountain Bike[a]	29	56	37	67
Equestrian	23	77	82	74
ATV/Motorcycle	17	25 miles 2 areas[b] (public)	137	3 areas[b] (private)
Actual Miles	80	127	319	

a - This mileage is managed specifically for this trail use type, although these uses – hiking and mountain bike is permitted on some other “multiple use” trails. Hiking can occur on any trail. Most mountain bike and equestrian use is on shared trails. All nonmotorized uses are allowed on motorized trails. Motor vehicle are limited to routes designated for that use only.

b - Areas allow recreational ATV and other OHV riding activities in open cross country areas and do not designate trails. Private area may offer specialty activities like hill climbs and racing.

Infrastructure Trends: Facilties and Trails

- Some National Forest System trails are multiple use; while managed primarily for a specific type of use, several use types may be allowed. For example, a trail system may accommodate both equestrian and mountain bike use or accommodate equestrian and motorized use. All trails are open to hiking. Nonmotorized trail opportunities are also available from other State, Federal, community, and private providers across Mississippi.
- National Forest visitors may use motor vehicles on roads and trails specifically designated for motorized use. The designation indicates the type of motor vehicle and season of use. There is also the ability to use all-terrain vehicles during hunting season on designated roads and the ability to retrieve game.
- Technology can quickly change outdoor recreation activities and introduce the new patterns of use that show up on the ground. Certainly the GPS unit and the cell phone have increased people ability to navigate the forest and their sense of security, on or off roads. The advent of the all-terrain vehicle very much influenced trail management across the nation, including this state. The motorized trails in National Forest trails mostly serve smaller off-highway vehicles (OHVs) such as all-terrain vehicles (ATVs); utility vehicles (UTVs); and motorcycles. All-terrain vehicles are popular with hunters who want convenient access and to assist in game retrieval but are also ridden for trail sport.
- Skilled, consistent maintenance on motorized trails is critical to a safe riding experience with minimal environmental impacts. The high maintenance needs of National Forests in Mississippi’s motorized trail systems is an ongoing challenge.
- Recent state comprehensive outdoor recreation plan recommended the establishment of an annual statewide OHV permit, in order to support motorized trails across the state. Similar to the other southern states, motorized trail systems are not widely available on public lands in Mississippi. However, there are private providers that are starting to offer different types of riding opportunities for motorized sport enthusiastic.
- Forest Service campgrounds in both the north and south market areas are much smaller in scale, amenities provided, and receive fewer visitations than many other public providers in Mississippi.

- Forest Service developed recreation areas do however fill a unique niche, providing a more tranquil, slower paced recreation experience than most opportunities found at Corps of Engineers or State Park facilities. FS developed recreation sites may function more like community parks in rural areas than as statewide resources.
- Existing National Forest facilities have capacity that is not being used throughout the season.
- An inventory of recreation facilities in 2001 assessed compliance with accessibility guidelines for persons with disabilities. The findings of this inventory were compiled into an accessibility transition plan for the National Forests in Mississippi. Many of the identified needs were easily implemented, did not require a large capital investment, and subsequently have been accomplished. However, on all ranger districts many accessibility projects remain and are a priority for the National Forests in Mississippi as funding becomes available.
- Improving visitor access to forest facilities and activities for persons with physical limitations or disabilities will continue to be emphasized. These improvements (such as hardened walkways) appeal to a wide segment of the population and will make facilities more convenient for many. Emphasis will be to operate and maintain existing recreation areas where a quality experience is offered and not to duplicate recreational offerings by other providers.
- A significant backlog of maintenance needs at developed recreation areas exists. Based on current and expected budgets, the National Forests in Mississippi does not anticipate significant investment in new or expanded recreation areas or facilities.
- The sustainability of the National Forests in Mississippi's trails program (motorized and nonmotorized) will be considered before additional trails are constructed. Distribution of trail types within market areas, presence of other providers, availability of partnerships, and environmental considerations will all factor into the ability of the National Forests in Mississippi to provide additional trails.

Recreation Demand on National Forest: Recreation Visitation

The demand for recreation is indicated by recreation visits. A 2009 National Forest visitor survey (known as National Visitor Use Monitoring - NVUM) makes available visitor data. Neighbors and local residents living within 25 miles of the forest make up just over 75 percent of the annual recreation visitation to National Forests in Mississippi. (By comparison, the regional average has only 20 percent of visitors to southern national forests living within 25 miles of a national forest.)

As shown in Table 33, the overwhelming attraction for these visitors is the undeveloped woods and waters of the National Forests in Mississippi, otherwise called "the general forest area". A large portion of general forest area visits are due to hunting or fishing, while developed day use sites received about 9 percent of the site visits, and the overnight camping at developed Forest Service campgrounds received only about 2 percent of the annual site visits.

The annual visitation information in the 2009 National Visitor Use Monitoring Survey is a snapshot of visits that year. Visits may vary from year to year based on weather or economic trends for example.

A site visit is the entry of one person onto a national forest site or area to participate in recreation activities for an unspecified period of time.

A national forest visit is defined as the entry of one person upon a national forest to participate in recreation activities for an unspecified period of time. a national forest visit can be composed of multiple site visits.

Table 33. 2009 National Forests in Mississippi recreation visits

Visit Type	Visits (1,000s)	% of total site visits
Total Estimated Site Visits	2,918	100%
Day Use Developed Site Visits	272	9%
Overnight Use Developed Site	60	2%
General Forest Area Visits	2,586	89%
Total Estimated National Forest Visits	2,795	

Table 34 provides ethnic demographics for recreation visitors to the National Forests in Mississippi. According to the 2009 National Visitor Use Monitoring Survey conducted by the Forest Service, most visits (76 percent) are made by men, which is a bit higher than the average of 70 percent for all visits to southern national forests. Looking at other racial and ethnic demographics, the following chart shows that the National Forests in Mississippi have more American Indian and White visits than their population proportion, but less Hispanic and Black/African American than their population percentages.

Table 34. Demographics of recreation visits

Race/ Ethnicity	2010 MS Statewide % of population	2010 National Forests in Mississippi Counties % of Population	2009 National Forests in Mississippi % of visits
Hispanic	2.7%	3.42%	0.1%
American Indian/Alaska Native	0.5%	0.44%	2.8%
Asian	0.9%	0.92%	0%
Black/African American	37%	30%	2.8%
White	59.1%	65.3%	94.2%

Recreation Supply: National Forest Settings

Recreation visitors to the National Forests in Mississippi can quickly immerse themselves in undeveloped, natural appearing forest lands. Most National Forest System acres are reachable by car due to the high number of roads. The setting for outdoor recreation opportunities in natural environments is influenced by the type and density of roads and presence of infrastructure. While the National Forests in Mississippi is interspersed with a mature roads system for accessing public and private landholdings, there are pockets of National Forest System lands that seem remote and far away from civilization, especially in the large sloughs and swamps. Two areas are managed as designated wilderness, and there are historic places and structures on National Forest System lands which add to the character of the forest and are important to people understanding their cultural roots.

A visitor may choose developed recreation sites like campground, swim, and picnic areas designed with hardened sites, beaches, tables, grills, flush toilets, and showers. There are also facilities that provide access to the general land and water areas like trailheads and boat ramps. Or visitors may choose simply to be in the woods – enjoying dispersed recreation activities such as hunting, fishing, and wild life watching, or relaxing. Often the trails are the attraction for exploration, exercise, or sport. Developed and dispersed camping areas provide rustic overnight accommodations that support hunting, water-based recreation and destination camping.

Table 35. 2009 National Forests in Mississippi outdoor recreation activity participation

Activity	Percent Participation[a]	Percent Main Activity[b]	Average Hours Doing Main Activity
Viewing Natural Features	44.6	30.1	6.8
Hunting	36.2	34.3	4.6
Fishing	26.4	14.9	3.3
Viewing Wildlife	23.6	1.6	2.1
Driving for Pleasure	23.3	8.4	1.9
Relaxing	22.5	0.4	1.7
Hiking / Walking	17.9	0.6	1.4
Visiting Historic Sites	7.9	0.0	0.0
Other Nonmotorized	7.6	1.4	2.5
Picnicking	7.1	0.3	5.1
Gathering Forest Products	6.5	1.7	2.0
Some Other Activity	6.4	3.0	1.3
Developed Camping	6.4	1.1	30.0
Nonmotorized Water	5.9	1.4	10.1
Horseback Riding	4.9	2.1	3.9
Primitive Camping	3.7	0.2	12.0
Nature Study	3.6	0.0	0.0
Motorized Trail Activity	3.3	0.0	1.0
Backpacking	2.9	0.3	12.7
Bicycling	2.4	0.0	3.0
OHV Use	0.2	0.0	0.0
Nature Center Activities	0.2	0.0	0.0
Motorized Water Activities	0.2	0.0	4.4
Other Motorized Activity	0.1	0.0	0.0
Resort Use	0.0	0.0	0.0
Snowmobiling	0.0	0.0	0.0
Downhill Skiing	0.0	0.0	0.0
Cross-country Skiing	0.0	0.0	0.0
No Activity Reported	0.0	0.0	

National Forests in Mississippi National Visitor Use Monitoring Survey (FY 2009) Results represent use during that year and not long term average.

a - Survey respondents could select multiple activities so this column may total more than 100 percent.

b - Survey respondents were asked to select just one of their activities as their main reason for the forest visit. Some respondents selected more than one, so this column may total more than 100 percent.

The full listing of visitor activities on the National Forests in Mississippi in 2009 is shown in Table 35. This national visitor use monitoring survey also indicated that most camping occurs in dispersed or designated primitive hunt camps, rather than in developed campgrounds.

Mild winters in Mississippi permit year-round recreation, and hot summers make any place with a cool body of water especially popular. Warm-water fishing and relaxing at the lake are favorite past-times. Water bodies are purposely managed to provide good fishing – from the expert bass tournaments at Lake

Okhissa to more relaxed sport of bank fishing. Picnic sites and pavilions near the water are popular for small and large family and group gatherings. The top three activities identified for National Forests in Mississippi visitors are viewing natural features (44 percent), hunting (36 percent), and fishing (24 percent). Hunting is an important southern tradition and, while not the only activity, is often identified as the leading reason for the visit. Thirty six percent of visitors are hunters, and 34 percent said it was the main reason they were there.

Like the wildlife management areas, other parts of the Forests are managed for a particular recreation opportunity. Black Creek in southern coastal Mississippi is a destination for those seeking more remote recreation experience in a designated wilderness area and wild and scenic river. The Black Creek Wilderness and the nearby Leaf Wilderness were set aside by Congress to be natural of places where recreationists need primitive outdoor skills and can find solitude. However, hurricanes have decimated this wilderness forest and its trail system, and storm damage will likely limit recreational wilderness opportunities for the future.

Other special areas on the National Forests in Mississippi have been designated for outstanding cultural, botanical or scenic characteristics. These can serve as destination, whether a visitor wants simply to enjoy a walk or is eager to learn about the forest environment and history.

The recent findings of the USDA Forest Service Southern Forest Futures Project[3] identified and projected the driving changes for forests in the southern United States over the next 50 years. Mississippi is no longer an isolated agricultural state and shares the trends across the south, where "[r]ecent population and economic growth has outstripped national growth rates, with resulting urbanization steadily consuming forests and other lands." A straightforward finding is given: "Increasing populations would increase the demand for forest recreation while the availability of land to meet these needs is forecasted to decline." Places for nature based recreation managed by federal and state governments will probably remain constant. Non-National Forest System land area is expected to decline with conversions from forests and farmlands to cities and suburbs. And the amount of public land acres will not significantly increase.

"The density of use of general forest area [on National Forest System land] is expected to rise by 22 to 55 percent as participants substitute national forests for private forest and rangelands that have been reduced by urban development."

Important recreational trends in the South over the last 15 years include:

- Most popular activities category (+ 30 million participants annually):
    - Participation in viewing trees and wild flowers and viewing other wildlife (expanding beyond the tradition of bird watching) increased over 32 percent, one of the largest increases.
    - Walking for pleasure is the leading activity. Eightyfour percent of the population participates. Almost 60 percent of southern recreationists participate in viewing and photographing natural scenery.
- Mid level activities (10 – 30 million participants). These changes were observed:
    - The biggest increase in participation over the decade was 42 percent more people participated in OHV driving. About 21.3 percent of the population participates in OHV use.

[3]Greis, John G., Wear, David N., "Southern Forest Futures Project", Summary Report (May 11, 2011). This report includes Mississippi and 12 states in USFS Southern Region - Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Louisiana, Arkansas, Oklahoma, and Texas.

- 27 million people viewed or photographed birds, (which had a 29 percent increase)
- There as a 0.2 percent decrease in developed camping and a 7.3 percent increase in mountain hybrid biking.

However, the Southern Forest Futures Project does predict there will be less per capita use of the National Forest, even though the total number of visitors will be increasing.

Recreation Opportunity Spectrum (ROS)

The recreation opportunity spectrum is a planning tool used to identify and evaluate the supply of recreation settings on national forests. 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. The three components of supply are settings, activities and facilities. The Forest Service manages a supply of settings and facilities that allow activities. Activities and facilities (developed sites and trails) have been discussed earlier.

The National Forests in Mississippi, because of the highly roaded and fragmented ownership pattern, is predominately classified as roaded natural (RN1), with smaller acreages in remote roaded natural (RN2), semi-primitive nonmotorized (SPNM) and rural settings[4]. Desired conditions which included ROS for different places and forest types were also identified.

Table 36. Current distribution of ROS classes

Recreation Opportunity Spectrum (ROS) Class	Acres	Prescription or Designation
Semi Primitive Nonmotorized (SPNM)	6,064	Wilderness, Black Creek Wild and Scenic River in Wilderness
Remote Roaded Natural (RN2)	4,681	Hawk's Nest Area, Tombigbee RD and recent property acquisition bordering Black Creek Wilderness
Roaded Natural (RN1)	1,164,921	Majority of National Forests in Mississippi including Black Creek Wild and Scenic River, scenic areas, research natural areas
Rural (R)	14,342	Developed recreation sites, administrative sites, experimental forests
Total	1,190,008	

Semi-Primitive Nonmotorized (SPNM) opportunities are currently limited to the two areas managed under the Wilderness Act on the Desoto Ranger District – Black Creek Wilderness (5052 acres) and the Leaf Wilderness (994 acres) and the Black Creek Wild and Scenic River within the wilderness. The current stands of old growth are too small for this designation. However, as the time goes by, the old growth will provide a center for more remote recreation opportunities.

Roaded Natural (RN) is the most common opportunity in the National Forests in Mississippi and in other southern national forests. It has been divided into two categories – roaded natural (RN1) and remote roaded natural (RN2) to allow for the management of more remote recreation settings.

RN1 settings are located within a half mile of a road and usually provide higher levels of development such as campgrounds, picnic areas, river access points, and rustic, small-scale resorts. Such evidences of man usually harmonize with the natural environment. Resource modification and utilization practices are

[4] The 1985 ROS inventory has been updated, using more recent national GIS guidelines for classification.

evident, but harmonize with the natural environment. The recreation opportunity experience level is characterized by the probability for equal experiencing of affiliation with individuals and groups and for isolation from sights and sounds of humans. Interaction between users is moderate, but with evidence of other users prevalent. Retaining a natural setting, encounters with other recreationists are expected in RN1. Outdoor skills may or may not be needed; conveniences like restrooms and picnic shelters may be found. Cultural developments are also here. Moderate evidence of human sights and sounds; moderate concentration of users at campsites; little challenge or risk.

The remote roaded natural classification is found only on the Tombigbee National Forest in the proposed backcountry area and some acres bordering the Black Leaf Wilderness on the De Soto National Forest. During the forest plan revision process, the public submitted comments supporting the 4400-acre Hawk's Nest on the Tombigbee National Forest for a wilderness study. However, since it did not meet the stringent criteria for wilderness, it is proposed across three of the alternatives for management as a remote roaded natural, backcountry area.

Remote roaded natural areas typically have fewer roads and nodes of facility development. Management of these areas emphasizes retaining the more undeveloped characteristics. Interaction between users is low, but with evidence of other users prevalent. Therefore, for example, special use events would be focused on individual outdoor challenges and would not attract or involve large crowds in the backcountry area. Camping would be dispersed and more primitive. This subclassification makes more remote opportunities available, expanding the spectrum especially when the large acreages needed for semiprimitive settings are not available.

Rural classifications represent the most developed sites and modified natural settings on the forest such developed recreation areas within the RN1. Rural areas are characterized by a substantially modified natural environment. Resource modification and utilization practices enhance specific recreation activities and maintain vegetative and soil cover 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 is characterized by the probability of affiliation with individuals and groups and the convenience of sites and opportunities. These factors are generally more important than the setting. Opportunities for wild land challenge, risk taking, and testing of outdoor skills are generally unimportant.

3.6.7 National Wild and Scenic Rivers

A comprehensive evaluation of potential rivers in the National Forests in Mississippi for inclusion in the national wild and scenic rivers system was conducted during the mid-1980s. As a result of that systematic inventory, 21 miles of the 80-mile Black Creek, running from Fairley Bridge landing upstream to the Moody's Landing, was congressionally designated, with the classification of "scenic," as a part of the national Wild and Scenic River system, Black Creek Scenic River, (Public Law No. 99-590, Oct.30, 1986).

Black Creek Scenic River serves as a primary portal to the Black Creek Wilderness and the remote recreation opportunity. The legislation designating the wilderness allowed small 5 horsepower trolling motors on boats, so the wilderness does have an exception for these small boat motors. The water quality standard designated by the State for the beneficial use of Black Creek is recreational waters. Also, a large part of the Black Creek Watershed is falls within the 117,000 acres permitted to National Guard's Camp Shelby for training exercises.

In April 1994, the forest plan was amended to adopt direction that upstream and downstream segments of the original study area would be managed like the wild and scenic river segment. This management direction is carried through into the revised forest plan. This amendment incorporated the results of the limits of acceptable change (LAC Alternative 6a) desired conditions, standards and guidelines, management practices, goals and objectives, and monitoring requirements by opportunity class for the Black Creek and Leaf Wilderness Areas and the Black Creek Scenic Corridor (both designated and undesignated segments). It also tiered to the river management plan entitled Management Supplement for Black Creek Corridor, March 1990.

As part of the forest plan revision process, rivers and streams in Mississippi on the national rivers inventory and those eligible or designated in the Mississippi – Scenic Streams Stewardship Program were reviewed (DEIS – appendix D). The review did not identify any new rivers or river segments as eligible for recommendation as an addition to the national wild and scenic rivers system or inventory.

3.6.8 Wilderness

When the National Forests in Mississippi were established in the 1930s, the lands that became part of the National Forest System were previously under private ownership and, in many cases, had been heavily farmed and logged. The patchwork of private and public lands that still characterize the National Forests in Mississippi means that few areas are undisturbed or unaffected by nearby human habitation. With almost 3,000 miles of forest system roads and use of many of the system roads as through routes to private lands, potential roadless areas are limited in size and extent on the National Forests in Mississippi. However, the Forests do contain two Congressionally-designated wilderness areas located on the De Soto Ranger District of the De Soto National Forest:

- Black Creek Wilderness Area (5,052 acres)
- Leaf Wilderness Area (994 acres)

These two wildernesses, the Black Creek Wild and Scenic River, and the Black Creek corridor outside these federally designated areas are all managed with the same goals and standards due to a 1994 forest plan amendment adopting limits of acceptable change process recommendations. This united management scheme expands the primitive setting to over the 12,000 acres. In addition to primitive recreation, designated wilderness also provides opportunities to study ecosystems that are relatively undisturbed by humans. They can provide reference conditions for vegetation, watersheds, and wildlife. They can serve as high-quality habitat for a variety of plant and animal species.

The Black Creek Wilderness is located in the gulf coastal plains of southern Mississippi. Most of this wilderness, the State's largest, lies in the broad valley of Black Creek, stained a deep caramel color by the tannic acid of decaying vegetation. The wild and scenic river bisects the wilderness, creating a hardwood floodplain of oxbow lakes and thick stands of sweet gum, sweet bay, red maple, oak, pine, and bald cypress. The 5- to 20-foot banks offer plenty of white sandbars suitable for camping or a picnic. The Black Creek National Recreation Trail (open only to foot traffic) runs about 41 miles along the drainage of Black Creek, with about 10 miles within the Wilderness. This area is part of the Lower Coastal Plain, with piney woods growing over low rolling hills and a few moderate ridges. The relatively flat terrain rises from 100 feet on Black Creek itself to only 270 feet on nearby uplands. Bass and pan fish attract anglers, and hunters come in season, mostly for deer. On many days, visitors will see no evidence that a human has ever stepped foot in the wilderness or dipped a canoe paddle into Black Creek.

South Mississippi's tiny Leaf Wilderness (964 acres) lies almost entirely on the floodplain of the east-flowing Leaf River, just north of Black Creek Wilderness. Except for a little western upland, the entire wilderness consists of meandering sloughs, oxbow lakes, and level terrain of spruce-pine forest or oak-gum-cypress river bottom. Loblolly and shortleaf pines shade the upland, with a dense understory of dogwood, redbud, persimmon, blueberries, and honeysuckle. The 1.5-mile Leaf Trail, one of two main attractions in the area, crosses the wilderness, three bridges, and a boardwalk to access this piece of Mississippi, where camping is unrestricted. The other attraction is wildlife, including white-tailed deer and wild turkeys, which bring in hunters during the fall months.

Recent hurricanes have created a lot of disturbance in the wilderness forest and ecosystems. It will be a true study of natural processes as both wildernesses recover from the widespread damages of Hurricane Katrina in 2005. The hurricane left tremendous blow-down of hardwood and pine trees across the Leaf and Black Creek Wilderness. Hiking trails critical for providing access to the wilderness interior have almost been obliterated. Heavy fuel loading contributes to the increased risk of wildfire, another natural process that will likely play into the long-term recovery of the two wilderness areas. The Black Creek Wild and Scenic River is open and offers access to solitude in the heart of this wilderness, with trips led by local outfitters. However, in 2010, the national recreation trail was still blocked by fallen trees.

Potential Wilderness Evaluation

As part of the forest plan revision process, the National Forests in Mississippi conducted a forestwide inventory of potential wilderness areas that may be suitable for recommendation for congressional designation as wilderness study areas (DEIS – appendix C). Areas qualify for placement on the potential wilderness inventory if they meet the statutory definition of wilderness. Forest Service Handbook (FSH) 1909.12 Chapter 71 prescribes inventory criteria used to determine if an area meets the statutory definition of wilderness.

The inventory of all National Forest System lands for potential wilderness study area recommendations included:

- Consideration of possible additions to existing wilderness areas,
- Re-evaluation of study areas identified in the Roadless Area Review and Evaluation (RARE II) of 1979,
- Analysis of areas proposed by individuals and groups during the forest plan revision process, and
- A GIS-based forestwide analysis of National Forest System administered lands to identify potential wilderness areas based upon FSH 1909.12 Chapter 71 inventory criteria.

Changes in land ownership around both wilderness areas were reviewed to see if there were any appropriate areas for potential expansion. Although there were no opportunities for expansion of the Leaf Wilderness, tracts surrounding the Black Creek Wilderness have been acquired by the Forest Service in recent years. There are approximately 250 acres of possible additions to the Black Creek Wilderness from land acquisitions along the perimeter of the proclaimed wilderness. However, the acquired parcels have 100 percent of their areas encumbered by 3rd party mineral rights. While these acres do not meet criteria for inclusion in the inventory of potential wilderness, they could become a part of the inventory pending a change in the status of the mineral rights for these acres.

In the RARE II evaluation for Mississippi in 1979, Sandy Creek was identified for further planning. In 2008, as part of the forest plan revision process, Sandy Creek was again re-evaluated and the area did not meet the statutory definition of wilderness based upon FSH 1909.12 Chapter 70, section 71 inventory criteria. However, approximately 300 acres of the Sandy Creek area is being proposed for designation as a special botanical area.

During the forest plan revision process, members of the public proposed three potential wilderness areas. Two areas were located on the Delta National Forest (Ten-Mile Bayou and Six-Mile Bayou), and one area was proposed on the Tombigbee National Forest (Hawk's Nest). Each area was individually considered using guidance in FSH 1909.12, Chapter 70. None of the three areas qualified for placement on the potential wilderness inventory. The areas did not meet the criteria prescribed in FSH 1909.12 (part 71.12) to qualify as lands that have potential for wilderness recommendation.

In addition to the above reviews, the National Forests in Mississippi utilized resource data from the 2008 GIS database as a tool to conduct a district-by-district analysis of any large blocks of land that would warrant further consideration as potential wilderness areas. The screening followed FSH 1909.12, Chapter 70 criteria and was focused on large blocks of contiguous lands (1,000 acres or larger) that had little evidence of human activity and would provide a sense of remoteness and solitude. No areas greater than 5,000 acres were identified in the screening process. Collectively across the Forests, 16 areas were identified as being over 1,000 acres in size with a road density of less than one-half mile per 1,000 acres. However, none of these areas were found to qualify for the inventory of potential wilderness areas based upon FSH 1909.12, Chapter 70, sections 71.1, 71.11 and 71.12 criteria.

Based on findings in the above described analysis there were no areas found on the Forests that qualified for placement on the potential wilderness inventory.

Recreational Fisheries Management

Presidential Executive Order 12962 provides the primary direction for managing the Forests recreational fishing resources. In compliance with the above mandate, forest management activities are implemented in a manner to provide quality recreational fishing opportunities to the public.

The National Forests in Mississippi contains over 50 man-made lakes and ponds totaling more than 3,100 acres of water. These impoundments range in size from 1 to 1075 acres. The original purpose for the construction of many of these impoundments was for flood prevention and erosion control. Others were constructed primarily for recreational purposes. These impoundments were stocked with largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), and redear sunfish (*Lepomis microlophus*) and now provide recreational fishing benefit. Most of the lakes and ponds on the forest over one acre are managed for sustainable recreational fishing.

Recreational fishing is one of the most popular outdoor activities in the state. The Mississippi Department of Wildlife, Fisheries and Parks is responsible for managing and improving the states fisheries resources. The Forest Service cooperates with that agency's efforts in improving the fisheries resources on national forest lands. National Forest lakes and ponds are managed to support balanced, productive self-sustaining recreational fisheries that is capable of meeting current and projected demands. Demand species associated with fishing include: largemouth bass (management indicator species), bluegill, redear sunfish, channel catfish (*Ictalurus punctatus*), black crappie (*Pomoxis nigromaculatus*), and white crappie (*Pomoxis annularis*). Maintenance and restoration efforts cooperate with all program areas to achieve the desired conditions.

The National Forests in Mississippi strategy for restoring, maintaining, and enhancing lakes and permanent ponds emphasizes maintaining water quality and lake and permanent pond enhancement. Fisheries management is practiced on the National Forests in Mississippi to provide fishing opportunities to the public. Management practices include liming and fertilization, fish habitat improvement, aquatic weed control, angler access improvement, fish population management, and nuisance animal control.

Largemouth bass is the principal predator in most Forest lakes. As the principal predator, largemouth bass presence/absence strongly influences the population structure of other fish species in a lake. For this reason, largemouth bass was selected as the management indicator species to represent the effectiveness of Forest Service recreational fisheries management activities. The effects of recreational fisheries management (directly related to this species) is discussed below.

Liming

Many Forest lakes are slightly acidic with poor buffering capacity. Tannic acid from leaves and pine needles from the surrounding forested watershed is washed into the lakes. This results in limited productivity and fish growth. Poor water chemistry is the second leading cause of fish death in Mississippi lakes and ponds (Managing Mississippi Ponds and Small Lakes 2011). Fish in acidic water with low alkalinity are more likely to get sick, especially during times of stress, such as spawning season or periods of rapid temperature change. Rapid fluctuations in pH can cause stress in fish making them more vulnerable to disease and hindering growth. Lime would enhance the water quality and productivity of these lakes.

Fertilization

Lake fertilization is a standard practice by many fish and wildlife agencies in southern states. The addition of some nutrients to lakes can yield positive results as long as the added nutrients are in the appropriate balance and amount. Fertilization enhances the productivity of the fish population and improves the quality of the fishing experience.

Lakes and ponds that receive heavy fishing pressure may be at risk of overharvest or poor fishing. Fertilization can increase the abundance of fish to compensate for heavy fishing (Managing Mississippi Ponds and Small Lakes 2011).

Spawning Habitat Improvement

Good spawning sites are limited in many Forest lakes because natural spawning areas have become covered with silt and muck over the years. Placement of spawning beds enhances the productivity of the fish population and improves the quality of the fishing experience. Where possible, structures would be added to increase spawning success and concentrate sport fish for angling.

The availability of suitable nesting substrate has been recognized as a major factor affecting reproductive success of bass, bluegill, and redear. Although they will use the best habitat available, these fish prefer gravel substrate for spawning material. Willis (2005) examined 75 random locations in a 330-acre lake in South Dakota where 15 bluegill spawning sites were identified. All the locations contained 4 types of substrates (muck, sand, gravel, rock). However, all 15 bluegill colony spawning sites were built on gravel substrate.

Larry Clay (retired Forest Service fisheries biologist) examined numerous natural and man-made spawning sites in several Forest lakes after they had been drained for renovation. He observed that all natural spawning sites were located on flat or level ground. He also found that man-made gravel spawning beds located on sloped banks received limited use that occurred in narrow bands. This suggests that while the fish preferred gravel to spawn on, they only utilized a portion of the spawning bed because of differences in water temperature as the depth of the spawning bed changed. This information indicates that spawning beds should be placed on level ground.

Fish Attractors

Natural fish cover is absent or inadequate in many Forest lakes because during their construction, the basins were cleared of trees and brush. Even where standing trees were left, they have decomposed over the years and become ineffective as cover for fish. In addition, creek channels coursing through the lake bottoms have silted in over time providing little or no irregular bottom features that attract fish.

The purpose of fish attractors is to provide a type of structure that otherwise does not or will not exist in sufficient quantity within the lakebed.

Shoreline Deepening

Many of the Forests' lakes contain areas of excessively shallow water (less than 3 feet deep). This is the outcome of years of natural silt deposition along the shoreline and upper ends of the lakes. Thus resulting in limited access for both bank and boat anglers. It has also promoted excessive aquatic weed growth reducing the predator/prey interaction needed to maintain fish population balance.

Aquatic Weed Control

Many of the Forests' lakes contain areas of excessive aquatic weed growth reducing the predator/prey interaction needed to maintain fish population balance. This excessive aquatic weed growth is the result of vast areas of shallow water (less than 3 feet deep).

Aquatic plants when of the right species, the right quantities, and at the right location are very beneficial to a lake environment. However, if they are the wrong species, or too abundant, or in the wrong location, they become noxious weeds and can be detrimental to the fisheries and recreational use of the lake.

Aquatic weeds present a constant challenge to managing a lake. These plants can greatly reduce the carrying capacity of a lake by using the nutrients normally available to phytoplankton. They can restrict water flow, and often interfere with fishing and recreational boating. Aquatic weeds can contribute to the stunting of game fish through reduced predator/prey interaction; they can also destroy fish habitats. When aquatic weeds die, silting can be accelerated, while oxygen levels become reduced.

Angler Access Improvement

Fishing piers and boat ramps may be provided. These structures enable the lake sport fish population to be managed for optimal recreational benefits. Access to angling opportunities should increase with the installation of these structures.

Fish Population Management

Fish populations in lakes are managed to produce enhanced recreational fishing opportunities. Fish populations when of the proper species mix, the correct ratios, and at the right sizes can provide a quality fishing experience. However, when of the wrong species, too abundant, too few, or the wrong size, can provide a poor fishing experience.

A healthy lake has a balance between predator and prey populations. In lakes of at least one acre, largemouth bass and bluegill provide this balance better than any other species. Other species such as redear sunfish and channel catfish can add variety to the fishing opportunities. Crappie can also add variety to the fishing opportunities. However, because they tend to overpopulate in smaller lakes, these fish are normally only stocked in lakes over 50 acres where sufficient forage is present. It is recognized that crappie may become established in lakes under 50 acres, in which management practices will be determined on a case by case basis. In specific situations, forage species such as threadfin shad (*Dorosoma petenense*), gizzard shad, and fathead minnows (*Pimephales promelas*) are sometimes used to enhance largemouth bass and crappie quality.

Nuisance Animal Control

Beavers, muskrats, nutria, otters, and alligators can be a nuisance or even cause damage. Burrowing and damming activities can cause dam failure or flood adjacent landowners. Angler access and fish habitat improvements can also be flooded. A family of otters can virtually eliminate catchable-size fish in a small lake. Alligators can present a safety concern in lakes with swimming. Trapping and removal will be practiced to maintain nuisance animal populations at acceptable levels.

3.6.9 Cultural Resources

Cultural Resources are archaeological and historic sites located by conducting field surveys and archival research. As of June 2006, the National Forests in Mississippi have recorded over 8,000 such sites, with the majority being of prehistoric Native American origin. The Forests also consult with Native American groups on the management of Federal lands, as required by the numerous Federal laws and Executive Orders directing the management of cultural resources on Federal lands.

Trends

- Inventory of national forests land by professional archaeologists is ongoing. Initial survey methods have included shovel testing, field inspection, and in some cases, occurrence prediction modeling.
- Inventory and evaluation of cultural resources are actively pursued on each of the National Forests in Mississippi. These inventories (normally and historically) have occurred prior to the initiation of ground-disturbing activities. The State historic preservation office (SHPO) granted a waiver of the requirement to survey prior to ground-disturbing activity after Hurricane Katrina, provided that follow-up surveys would be completed after the emergency removal of hazardous fuels. Currently, more than 350,000 acres of the total 1.2 million acres of national forest land have had some level of cultural resource survey performed.
- Sites listed in the National Register of Historic Places or considered eligible for listing in the National Register are protected and monitored when project activities near the sites are implemented.
- Priorities for nominating sites to the National Register of Historic Places have been established. In order by priority, they are (1) sites representing multiple themes; (2) sites representing themes that are not currently on the National Register with the State; and (3) sites representing themes that are currently represented by single sites.

3.6.10 Scenery

The previous inventory for the 1985 Land and Resource Management Plan for the National Forests in Mississippi was conducted in the 1970s. Since that time much has changed in terms of goals for vegetation management, land use, neighboring populations, visitation patterns, and public perceptions regarding scenery. In 1995, the Forest Service updated its management framework for scenery, replacing the visual management system with the scenery management system as defined in Landscape Aesthetics, USDA Handbook Number 701. The new scenery management system methodology allows for better monitoring and protection of visual quality in conjunction with other resources.

The scenery management system inventory is an evaluation of the past and present ecological, cultural, and social land use patterns for the national forests that may impact scenic attributes valued by the public. The ecological descriptions of the forest are the starting point for this scenic inventory and are the foundation of the landscape character descriptions.

This forest plan revision adopts the new scenery management system framework, with a base inventory established in the National Forests in Mississippi “2005 Scenery Management System Inventory and Analysis”. That document defines the landscape character themes on the forest, provided excellent existing landscape character descriptions for each National Forest, synthesized extensive input residents and forest recreationists’ appreciation of forest scenery, and developed the base scenery management system inventory.

Based on this information, desired scenic integrity objectives are established, for specific areas and restoration goals. And mitigation and guidance was developed to assist in obtaining the possible actions proposed.

Landscape Character Themes

Including the ecological and cultural features as well as the positive and negative elements of the scenery, the existing landscape character for each district is described as a part of the scenery management system inventory. The scenery management system is an evaluation of the past and present ecological, cultural, and social land use patterns for the national forests that may impact scenic attributes valued by the public. The ecological descriptions of the forest are the starting point for this scenic inventory and are the foundation of the landscape character descriptions.

Natural appearing landscape character expresses predominantly natural qualities but includes minor human interaction along with cultural features and processes that are relatively unobtrusive.

Existing Visual Quality

The existing scenic inventory under the visual management system was updated under the new scenery management system framework. The crosswalk between visual quality objectives (visual management system) and scenic integrity objectives (the updated scenery management system) is as follows:

Table 37. Crosswalk between visual quality objectives and scenic integrity objectives

Visual Quality Objective (VQO)		Scenic Integrity Objective (SIO)
Preservation (P)	unaltered	Very High (VH)
Retention (R)	Appears unaltered	High (H)
Partial Retention (PR)	Slightly altered	Moderate (M)
Modification (M)	Moderately altered	Low (L)
Maximum Modification MM)	Heavily altered	Very Low (VL)
	Extremely altered	Unacceptably Low

Scenic Integrity

Scenic integrity is a measure of the degree to which a landscape character is visually perceived to be complete. Scenic integrity measures those lands most representative of the area’s landscape character type at the present time. It is not a measure of pristine condition.

Deviations from the appealing aesthetic landscape character as valued by constituents can diminish an area’s scenic integrity. Man-made and natural disturbances disrupt the valued landscape character.

The Scenery Integrity Objective (SIO) refers to the degree of acceptable alterations to the valued attributes for the characteristic landscape and is part of the desired future condition of land management prescriptions.

Table 38. Scenic class inventory

Scenic Class	Approximate Acres	Percent	Public Value
1	272,949	23%	High
2	469,188	39%	High
3	405,508	34%	Medium[a]
4	14,714	1%	Medium
5	24,293	2%	Low
6	664	0%	Low
7	133	0%	Low
Total	1,187,449	100%	

a - In development of the scenery management system inventory from the visual quality objectives, the “seldom seem” acres were not assigned a scenic class. For forest plan revision, this large acreage was, following the recommendation of the scenery management system guide, transferred to scenic class 3 (as a typical “B” landscape).

Scenery Trends

- Scenery plays a major role in any visit to the National Forests in Mississippi. About 1/3 of visitors indicate that the primary reason for visiting is viewing nature and wildlife.
- Many recreation activities are dependent on the forest setting like hunting, fishing, or camping. While others are made special by the natural forest setting and the cultural interest areas throughout the forest.
- The potential for future oil and gas exploration and development is high on 3 National Forest units; scenery will be a consideration in mitigation for these wells. However, this forest plan does not make decisions related to oil and gas development.
- Development on neighboring lands generally negatively impacts the National Forest scenic resource by diminishing the natural scene. This impact will expand as surround communities grow. Understanding the value of National Forest scenery to the local community is important. It affects real estate values and quality of life.

3.6.11 Social Demographics

The National Forests in Mississippi (Forests) consist of 1.2 million acres of public lands located in six forests across the state. The Bienville, Delta, De Soto, Holly Springs, Homochitto, and Tombigbee National Forests are headquartered in Jackson, Mississippi. The following socioeconomic overview of the National Forests in Mississippi will discuss the socioeconomic trends and changes in the thirty-five Mississippi counties containing National Forest System lands. The analysis area counties and composition are presented in Table 39.

Land Base Overview

This overview provides information on the physical and organizational characteristics of the National Forests in Mississippian identifies key forest resources and uses. In order to place the Forests in context, brief discussions are provided of the contrasts and comparisons to state characteristics.

Characteristics of an area, such as the growth of population and its various racial and ethnic components, can be used to determine how dynamic and subject to change an area may be.

Table 39. National Forests in Mississippi land base by forest and county

Forest	County	Sq. Miles	Total Acres	NFS Acres	Percent of County
Bienville NF					
	Jasper	677.3	433,472	17,226	4.0
	Newton	579.4	370,816	3,341	0.9
	Scott	610.2	390,528	85,299	21.8
	Smith	637.1	407,744	72,676	17.8
	TOTAL	**2504.0**	**1,602,560**	**178,542**	**11.1**
De Soto NF					
	Forrest	470.0	300,800	50,643	16.8
	George	483.6	309,504	16,080	5.2
	Greene	718.7	459,968	6,111	1.3
	Harrison	975.9	624,576	62,602	10.0
	Jackson	1043.3	667,712	22,974	3.4
	Pearl River	818.7	523,968	4,052	0.8
	Perry	650.1	416,064	162,821	39.1
	Stone	448.0	286,720	54,919	19.2
	Jones	699.6	447,744	32,952	7.4
	Wayne	813/4	520,576	90,146	17.3
	TOTAL	**5608.3**	**3,589,312**	**380,202**	**10.6**
Delta NF					
	Issaquena[a]				
	Sharkey	434.8	278,272	60,215	21.6
Holly Springs NF					
	Benton	408.5	261,440	55,544	21.2
	Lafayette	679.1	434,624	40,014	9.2
	Marshall	709.6	454,144	21,713	4.8
	Tippah	459.9	294,336	9,534	3.2
	Union	416.8	266,752	8,045	3.0
	Yalobusha	494.8	316,672	20,776	6.6
	TOTAL	**3168.7**	**2,027,968**	**155,653**	**7.7**
Homochitto NF					
	Adams	486.4	311,296	14,310	4.6
	Amite	731.6	468,224	35,644	7.6
	Copiah	779.2	498,688	7,305	1.5
	Franklin	566.7	362,688	95,596	26.4
	Jefferson	527.2	337,408	8,003	2.4
	Lincoln	588.0	376,320	7,936	2.1
	Wilkinson	687.8	440,192	22,803	5.2
	TOTAL	**4366.9**	**2,794,816**	**191,597**	**6.9**
Tombigbee NF					
	Chickasaw	504.2	322,688	26,091	8.1
	Choctaw	419.7	268,608	11,550	4.3
	Oktibbeha	461.8	295,552	117	-
	Pontotoc	500.9	320,576	530	0.2
	Winston	610.0	390,400	28,586	7.3
	TOTAL	**2496.6**	**1,597,284**	**66,874**	**4.2**
NF Counties		**20811.0**	**13,319,040**	**1,183,436**	**8.9**
State of					**Percent of State**
Mississippi		**48434.0**	**30997760**	**1183436**	**3.8**

Source: USDA Forest Service

a - The Delta National Forest proclamation boundary extends into Issaquena County. However, national forest lands occur only in Sharkey County.

A static area will imply few possible factors affecting change, but a dynamic growing population may produce conflicting concerns for land managers to consider. Certain areas of the national forests and surrounding lands, which are seen to be attractive to urban dwellers for recreation and second or retirement home residence, may cause conflict with traditional residents of the area. In the following subheading we will discuss demographic characteristics that may assist land managers in identifying issues for current and future projects.

Demography

Information about population characteristics helps describe the general nature of a community or area. An analysis of population trends can help determine if changes are occurring for specific groups defined by age, gender, education level, or ethnicity, thereby influencing the nature of social and economic relationships in the community.

Table 40. Population change for Mississippi 1980-2000

Year	Total Population	Population Change	Percent Change
1980	2,520,638	-	-
1990	2,573,216	52,578	2.1%
2000	2,844,658	271,442	10.5%
2009	2,951,996	107,338	3.77%

Source: U.S. Census Bureau from USDA NRIS HD Model

Mississippi's population, presented in Table 40, increased from 2,520,638 in the 1980 census to 2,844,658 in the 2000 census. This translates into a 2.1 percent increase in population between 1980 and 1990. However, between 1990 and 2000, the population increased by 10.5 percent, much of this growth in the extreme north and southeast areas of Mississippi.

Table 41. Population change for National Forests in Mississippi

National Forest	1980	1990	2000	2009	Percent Change 1980-1990	Percent Change 1990-2000	Percent Change 2000-2009
Bienville	76,842	76,340	84,592	85,675	-0.7%	10.8%	1.28%
Delta	62,104	56,855	58,498		-8.5%	2.9%	
De Soto	501,244	517,692	586,623	607,798	3.3%	13.3%	3.61%
Holly Springs	143,016	146,111	167,728	151,553	2.2%	14.8%	-9.6%
Homochitto	135,491	133,262	138,362	135079	-1.6%	3.8%	-2.4%
Tombigbee	103,259	107,201	118,986	120801	3.8%	11.0%	1.5%
Total NF in Mississippi	1,021,956	1,037,461	1,154,789		2.1%	10.5%	10.5%

Source: U.S. Census Bureau from USDA NRIS HD Model

Population trends for National Forests in Mississippi counties are similar for the entire state. Table 41 presents population changes for the counties in the analysis area. The populations of the Bienville, Delta, and Homochitto National Forests declined from 1980 to 1990. The Holly Springs National Forest population experienced the most growth during that period due to the area becoming a popular family residential and retirement destination. The populations of all forests showed growth during the 1990-2000 decade. The growth or decline of a population has a greater relative impact in smaller, rural areas. The smaller and less dense population base found in rural areas makes delivery of basic services more difficult. In urban areas, the logistics and mechanisms for providing public services produce economies of scale impossible for rural areas to duplicate.

In the future, the population of the United States is expected to age. The median age in the United States has risen steadily since the 1800s in part due to increases in medical technology, hygiene, and rising real income. In 1990 the median age was 32.8 years; by 2020 it is expected to increase to 38 years of age. As the population ages, their recreation preferences will change. The charts below show percent increases and projections in each of the age strata for the thirty year period between 1990 and 2020. Forty five - fifty four is the high growth strata for the 1990s. Sixty five and older, 55-64, and 25-34 are the projected highest growth strata in the Forests analysis area for the next 20 years. Given the ageing of the market area, it is likely that activities that older people like to do will increase in demand.

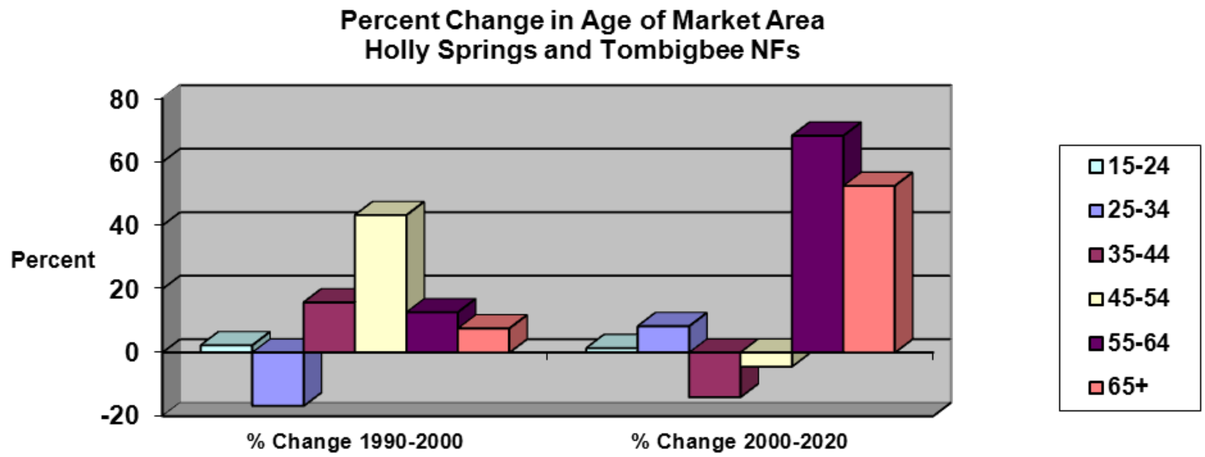

Figure 24. Age of market area for Holly Springs and Tombigbee National Forests (Source: US Census)

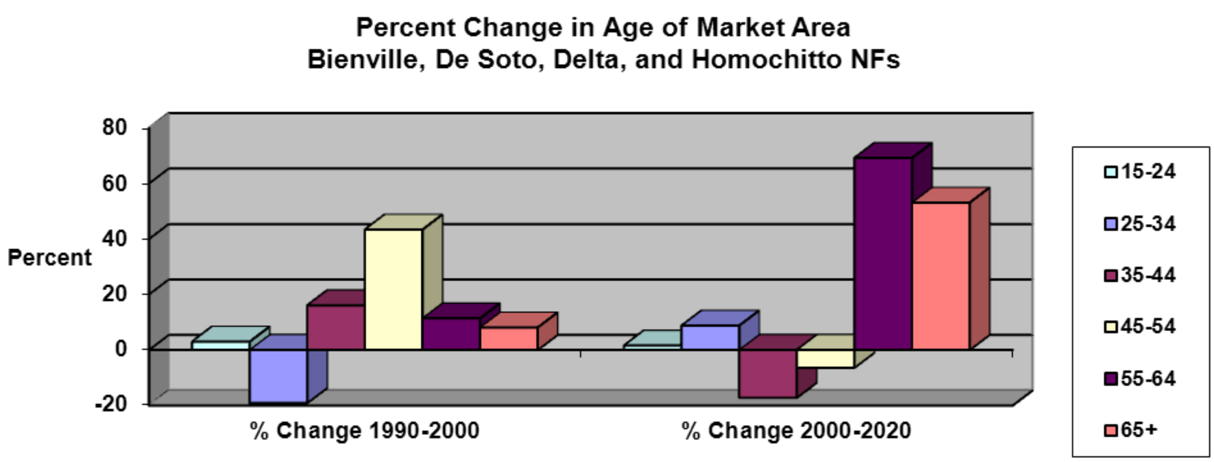

Figure 25. Age of market area for Bienville, De Soto, Delta and Homochitto National Forests (Source: US Census)

Populations increase or decrease in response to three variables that can change over time: fertility, mortality, and migration. Migration is the most unstable of the variables that affect population growth. While the population in Mississippi is estimated to have grown 10.5 percent from 1990 to 2000, according to the Census Bureau, the state experienced a net out-migration of 11,013 from 1995-2000 (Table 42). Growth in the state population appears to be the result of a natural increase in the population during this period, which offset the population out-migration. The South as a whole is experiencing positive migration from other states, but Mississippi is losing more residents than it is gaining. Important factors that influence in- and out-migration include educational and employment opportunities, the physical environment, and perception of regional, state, and local government taxing policies, labor markets, cost of living, population composition, and local and state social legislation.

Table 42. Migration in southern region, Mississippi, and selected cities 1995-2000

Geographic Area	In-migrants	Out-migrants	Domestic 5 year net migration
Mississippi	6,041	11,013	-4,972
Hattiesburg, MS	845	1,969	-1,124
Jackson, MS	3,057	3,321	-264
Southern US	251,658	221,754	29,437

Source: U.S. Census Bureau from USDA NRIS HD Model

In comparison to other areas of the United States, Mississippi as a whole and the analysis area counties show a heterogonous racial composition of whites and blacks, with a recent increase in Hispanic residents. Table 43 shows the population of Mississippi by race in 1980, 1990, and 2000. Over half of the population in the counties that contain national forest lands is white, as compared to the State as a whole which is 61 percent white. Holly Springs and De Soto National Forests have the highest composition of white residents, both over 70 percent.

National visitor use monitoring data reports that 99.4 percent of the visitors to the National Forests in Mississippi are white. A recent values, attitudes, and beliefs survey of the Forests area residents drew responses from white, black, and Hispanic residents.

The minority population increased from 29.4 percent to 32.6 percent between 1990 and 2000 within the forest boundaries and from 35.9 to 38.6 percent in Mississippi. The National Forests in Mississippi percentages of Native Americans, Asian and Pacific Islanders, and Hispanics range from under one-half percent to two percent. The Bienville National Forest has the highest percentage of Hispanics with an increase to 2.4 percent from 0.29 percent in 1990. The Bienville National Forest also has the highest percentage of Native Americans, who make up 1.09 percent of the population.

US aggregated population density is about 80 persons per square mile (2000) in contrast to Mississippi which despite recent growth has a population density of 60 persons per square mile. Population density is dependent in part on the amount of land available for settlement and on transportations systems. The population density (Table 44) of the counties in Mississippi that contain National Forest System land is 119 persons per square mile. This is caused in large part by the high population density of Harrison (284.6), Jackson (158.6), and Forrest (146.4) counties on the De Soto National Forest. Overall, the De Soto National Forest had 184.3 persons per square mile in 2000. Bienville National Forest had the lowest population density of any forest with 36.1 persons per square mile in 2000.

Table 43. Racial composition of National Forests in Mississippi counties

Area	Race	1980	1990	2000	2010
Bienville NF	Hispanic	0.92%	0.29%	2.4%	4.4%
	Native American	0.74%	1.02%	1.09%	1.45%
	Asian	0.06%	0.02%	0.16%	0.16%
	Black	33.4%	35.3%	36.6%	35.75%
	White	65.6%	63.4%	60.5%	59%
Delta NF	Hispanic	1.17%	0.48%	1.04%	0.8%
	Native American	0.09%	0.15%	0.22%	0.1%
	Asian	0.55%	0.53%	0.57%	0.2%
	Black	41.7%	42.8%	46.8%	71%
	White	57.4%	56.3%	51.3%	27.9%
De Soto NF	Hispanic	1.3%	1.04%	1.95%	4.25%
	Native American	0.20%	0.30%	0.36%	0.42%
	Asian	0.57%	1.14%	1.4%	1.53%
	Black	20.7%	21.9%	22.7%	25%
	White	78.1%	76.4%	73.6%	69.45%
Holly Springs NF	Hispanic	0.75%	0.49%	1.4%	3.07%
	Native American	0.04%	0.11%	0.20%	0.24%
	Asian	0.18%	0.51%	0.50%	0.77%
	Black	28.7%	27.9%	27.5%	28.45%
	White	70.9%	71.3%	70.5%	67.81%
Homochitto NF	Hispanic	0.83%	0.24%	0.80%	2.56%
	Native American	0.03%	0.08%	0.13%	0.21%
	Asian	0.08%	0.15%	0.18%	0.25%
	Black	47.2%	47.5%	48%	47.62%
	White	52.6%	52.2%	50.6%	50.2%
Tombigbee NF	Hispanic	0.87%	0.53%	1.44%	2.33%
	Native American	0.19%	0.25%	0.29%	0.32%
	Asian	0.33%	0.96%	1.01%	0.29%
	Black	68%	66.7%	64.3%	32.76%
	White	31.9%	33%	35.6%	63.03%
TOTAL National Forests in Mississippi	Hispanic	1.08%	0.72%	1.6%	3.42%
	Native American	0.19%	0.29%	0.35%	0.44%
	Asian	0.39%	0.79%	0.95%	0.92%
	Black	28%	29%	29.8%	30%
	White	70.5%	69.5%	67%	65.3%
Mississippi	Hispanic	0.98%	0.57%	1.3%	2.7%
	Native American	0.24%	0.34%	0.41%	0.5%
	Asian	0.30%	0.49%	0.68%	0.9%
	Black	35%	35%	36%	37.0%
	White	64%	63%	61%	59.1%

Source: U.S. Census Bureau from USDA NRIS HD Model

Most of the larger population centers in the analysis area are located along major interstate highway routes. Three interstate highways are in the analysis area. Interstate 55 (I-55) connects the major cities of northern and southern Mississippi, passing through Grenada, Jackson, Brookhaven, and McComb. Interstate 20 (I-20) connects the eastern and western parts of Mississippi, passing through Vicksburg, Jackson, and Meridian. Interstate 59 (I-59) connects the southeastern cities of Meridian, Hattiesburg, and Picayune.

In terms of regional neighbors to the National Forests in Mississippi, there are several major population concentrations within an hour drive of the Forests including Tupelo, Jackson, Meridian, Hattiesburg, Gulfport, Biloxi, Pascagoula, and to the north, Memphis, Tennessee. The growing density in Memphis to the north of the analysis area, in Mobile, Alabama, to the east, and the coastal areas around Biloxi suggest that population density may increase if the trend in nearby regions continues to extend into the analysis area counties. This will have implications for land use and regulations.

Table 44. Population projections - percent increase from 2000

	2000 to 2005	2005 to 2010	2010 to 2015	2000 to 2015
Bienville NF	3.68%	3.28%	2.94%	10.2%
Delta NF	2.01%	2.18%	2.31%	6.6%
De Soto NF	6.56%	5.24%	4.23%	16.9%
Holly Springs NF	5.53%	3.99%	3.13%	13.2%
Homochitto NF	1.69%	1.72%	1.76%	5.3%
Tombigbee NF	3.67%	2.47%	1.48%	7.8%
National Forests in Mississippi Counties	5.09%	4.08%	3.33%	13.0%
Mississippi	5.16%	4.23%	3.50%	13.5%

Source: Environmental Protection Agency

Population projection is often times a hard task to accomplish with accuracy. The Environmental Protection Agency has made straight line interpolation projections to 2015 for every county in the United States. Table 44 shows the population and percentage change for the National Forests in Mississippi counties. All of the Forests will gain population in the 15 year timeframe. However, only Delta and Homochitto National Forest will experience an increase in the percentage of growth during each 5 year increment. The rest of the Forests are expected to experience growth similar to the state as a whole. According to the EPA population projections, the National Forests in Mississippi area continues to be seen as a desirable place for people to live. Table 44 gives an estimate of changes between 2000 and 2015 for the Forests and the State.

Per Capita Income

The contemporary community contrast of Mississippi is structured by demography and economy. When giving an overview of the economic characteristics of an area, indicators such as per capita income (Table 45), unemployment rates, poverty rates, transfer payments, and household composition are used to measure economic progress/viability.

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 National Forests in Mississippi analysis area, the per capita income average was $9,375 and $14,550 in 1990 and 2000, respectively.

The real average change in forest area income between 1990 and 2000 was 4.5 percent. This contrasts with that of the State's 5.1 percent per year average annual change between 1990 and 2000. Holly Springs National Forest was the fastest growing forest for per capita income at a 5.7 percent rate per year on a real basis over the 1990 decade. All of the forests are progressing at rate comparable to the state average except the De Soto National Forest, which is rising at a slower rate.

Table 45. Per capita income

Forest	2000 Per Capita Income	2000 Per Capita Income in 2010 $$	2010 Per Capita Income	Real Avg. Annual Change 2000-2010
Bienville NF	$13,912	17616.7656	$26, 385	5%
Delta NF	$16,567	20978.7921	$24,422	1.64%
De Soto NF	$14,265	18063.7695	$32,182	7.82%
Holly Springs NF	$15,077	19092.0051	$27,517	4.41%
Homochitto NF	$13,548	17155.8324	$26,755	5.6%
Tombigbee NF	$14,664	18569.0232	$26,663	4.36%
National Forests in Mississippi Counties	$14,550	18424.665	$29,843	6.2%
Mississippi	$15,853	20074.6539	$30,900	5.39%

Source: U.S. Census Bureau from USDA NRIS HD Model

Real rates of increase were determined by inflating 2000 per capita income to 2010 with the Consumer Price Index Deflator.

Income for the National Forests in Mississippi area grew at a similar pace to Mississippi's income on a real basis (inflation adjusted) during the 1990s. Basic financial well-being increased an equal rate in the National Forests in Mississippi analysis area and in Mississippi for the 1990s decade, with the exception of the De Soto National Forest counties, which increased, but on a lower scale.

Another indicator of relative economic prosperity is the percent of the workforce out of work. 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.

Table 46. Percent unemployment rate - weighted averages 1995-2010

Forest	1995	2001	2010
Bienville NF	6.1	5.0	9.6
Delta NF	9.5	7.0	12.9
De Soto NF	6.1	4.8	9.4
Holly Springs NF	9.1	5.8	11.4
Homochitto NF	7.9	7.6	11.5
Tombigbee NF	7.2	10.2	12.3
National Forests in Mississippi Counties	6.8	6.3	10.3
Mississippi	6.1	5.5	10.4

Source: U.S. Bureau of Labor Statistics from USDA NRIS HD Model

In 2001 the National Forests in Mississippi had slightly more unemployment, 6.4, than that of the State. The Forests' unemployment rate was calculated as a weighted average (unemployment rate and number of unemployed) of all counties in the area (Table 46).

During the period of 1995 to 2001 the unemployment rate for the National Forests in Mississippi analysis area was higher than the rate of Mississippi. Tombigbee, Homochitto, and Delta National Forest had unemployment rates that were higher than the forest average for 2001and 2010. Unemployment for the National Forests in Mississippi analysis area increased between 2001 and 2010, however the average for all Forest Counties and the Mississippi statewide average unemployment rate only differ by one-tenth of a percent.

Table 47. Percentage of individuals in poverty

Forest	1980[a]	1990	2000
Bienville NF	15.5	25.8	20.2
Delta NF	19.7	26.4	21.5
De Soto NF	14.5	21.2	16.8
Holly Springs NF	22.6	23.6	18.5
Homochitto NF	26.2	31.4	25.3
Tombigbee NF	6.2	24.9	22.6
National Forests in Mississippi Counties	16.7	23.9	19.2
Mississippi	23.9	25.2	19.9

Source: U.S. Census Bureau from USDA NRIS HD Model
a - Data for some counties not available for this year

Four forests in the National Forests in Mississippi analysis area had poverty rates in 2000 greater than the weighted average for the State. Bienville, Delta, Tombigbee, and Homochitto National Forest had the highest poverty rates of all forests in the analysis area. De Soto National Forest had the lowest rate in 2000 of 16.8 percent. All but one of the forests experienced declining poverty rates from 1990 to 2000. The average for the Forests in 2000 was comparable to the state average of 19.9 percent. Since 1980 the poverty rate has risen, and then declined for both the National Forests in Mississippi and the state of Mississippi.

Table 48. Federal transfer payments to individuals

Forest	1970	1980	1990	2000	2002	2010
Bienville NF	97,963	187,718	242,549	384,069	445,947	1,446,406
Delta NF	67,631	133,724	166,519	247,620	283,202	204,109
De Soto NF	438,811	1,020,230	1,523,063	2,456,267	2,885,227	3,010,883
Holly Springs NF	141,719	313,460	417,660	671,645	787,626	1,078,476
Homochitto NF	164,832	338,148	442,055	644,025	749,711	2,178,914
Tombigbee NF	79,524	161,973	201,794	314,987	367,467	406,172
National Forests in Mississippi Counties	969,020	2,108,571	2,936,121	4,623,941	5,407,444	8,005,896
Mississippi	5,357,515	11,340,625	15,344,316	23,864,304	27,925,492	10,129,451

Source: U.S. Bureau of Economic Analysis
Note: Pontotoc County is in both Tombigbee and Holly Springs NF. National Forests in Mississippi has Pontotoc in Tombigbee subtracted from total.
Real rates of increase were determined by inflating 1970 dollars to 2000 with the Consumer Price Index Deflator.

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 no current services are performed. 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. There is often an inverse relationship between earnings and transfer payments. A high dependency in an economy on transfer payments can reflect few employment opportunities or a popular retirement area.

Table 48 displays the analysis area average and the state receipts of transfer payments from the Federal Government. The growth rate in Federal transfer payments for the National Forests in Mississippi analysis area was similar to than that of the state from 1970 to 2000. De Soto National Forest had a 6.1 percent growth rate of payments over this period, the highest of all the forests and higher than the state average. Delta National Forest had the least growth of payments at 4.6 percent.

Economy's Diversity

Analyzing the major sectors of an economy allows insight into how diverse and what industries may be driving its growth. Table 49, below, shows the manufacturing sector (which includes lumber), the sub-sectors for wood based industries, and an estimate of the wild land 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 49 displays the fact that the National Forests in Mississippi area economy is becoming more diverse because it is decreasing its reliance on the manufacturing sector. Its importance declined by almost six percent of the share of employment and by more than seven percent of the share of labor income from 1990 to 2000. Still, manufacturing is a sizable proportion of the local economy's labor income, representing almost sixteen percent of the economy in 2000.

Table 49. Economic diversity

	1990 Employment	2000 Employment	% Average Annual Change	1990 Labor Income	2000 Labor Income	% Real Average Annual Change
	% of Total Economy		1990-2000	% of Total Economy		1990-2000
Total Manufacturing	18.5	13.4	0.5	23.1	16.6	0.5
Total Wood Products	2.4	1.6	-1.5	2.6	1.8	0.1
Wood Furn. and Fixtures	2.3	1.8	0.5	2.4	1.9	1.3
Paper and Pulp Products	0.5	0.3	1.7	1.3	0.7	-2.4
Wild land Rec.	NA	NA	NA	NA	2.2	NA
Total Economy[a]	$643,785[b]	$846,169[b]	2.8	$16,594[b]	$24,227[b]	3.9

Source: IMPLAN 1990 and 2000 Data

a - Real rates of change were determined by inflating 1990 to 2000 with the Gross National Product Price Index Deflator

b - Represents dollar totals for category

NA = Not Available

Of the wood-manufacturing sector, total wood products maintained only a 1.6 percent share of the local economy's labor income in 2000. This is a decrease in percent share that it had in 1990 (2.4 percent).

Employment's share diminished from a 2.6 percent share in 1990 to 1.8 percent share in 2000. Wood products comprise a very small share of this economy.

Wildland recreation, which includes federal and state recreation areas, had an estimated 2.2 percent share of the total labor income of the Forests' area economy in 2000. There are no estimates of employment for recreation.

Background data shows employment, labor income, and industrial output, for the all nine sectors of the economy broken out by major standard industrial code and by important industry sub-sectors for wood products. The overall composition of the analysis area economy has not changed greatly from 1990. Services increased from 18.4 to 23.9 percent in 2000 as measured by employment change, or a 5.5 percent annual increase. Other large sector share changes include wholesale and retail sales' employment change of 2.4 percent per year, and government whose share increased slightly from 20.3 percent to 20.8 percent over the decade. The entire economy's labor income grew at an average annual rate of 3.9 percent over the 1990 decade (based in constant 2000 dollars). Thus, the local economy has changed little in the last 10 years. The economy's main drivers are services and government.

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 number the larger the index.

Table 50 contrasts the change in diversity from 1990 to 2000 at the four-digit standard industrial code, or at the individual industry level. For a point of reference Mississippi serves as comparison guide.

Table 50. Shannon-Weaver entropy indices

	1990 Index	2000 Index	Percent Change
Bienville NF[a]	0.55054	0.55312	0.47%
De Soto NF[a]	0.60296	0.59816	-0.80
Delta NF[a]	0.61395	0.62294	1.46%
Holly Springs NF[a]	0.57419	0.57905	0.85%
Homochitto NF[a]	0.60285	0.61712	2.37%
Tombigbee NF[a]	0.54842	0.55942	2.01%
National Forests in Mississippi Counties[a]	0.59017	0.59218	0.34%
Mississippi[a]	0.72414	0.71913	-0.69

Source: USDA Forest Service, Information Monitoring Institute

a - Weighted Average Estimate of Aggregated Counties. Weighted by full-time and part-time employment in their respective years.

The indices measuring diversity indicate slightly more diversity in the state than in the analysis area during the 1990-decade. The Forests' area became 0.34 percent more diverse while Mississippi became 0.69 percent less diverse. Stone County on the De Soto National Forest had the greatest increase in diversity during the 1990 decade, about 9 percent change. Meanwhile, Benton County on the Holly Springs National Forest had the greatest decrease in diversity, 6.3 percent, during the decade.

As indicated by the analysis above of the National Forests in Mississippi cumulative economy, the overall change during the 1990-decade was marginal. This is substantiated by these diversity indices 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 that it exports.

Table 51 below compares the exporting characteristics of the National Forests in Mississippi analysis area for 1990 and 2000.

Table 51. Exporting of selected industries (in millions of 2000 dollars)

	1990 Net Exports[a]	2000 Net Exports
Wood Furniture and Fixtures	$782.2	$464.7
Paper and Pulp Products	$524.7	$301.2
Wood Products	$944.4	$1,021.4
Total Manufacturing	$1,509.0	$343.0
Total of All Sectors	-$2,033.1	-$11,085.9

Source: IMPLAN 1990 and 2000 Data

a - 1990 Dollars Converted to 2000 Dollars via GDP Price Deflator; in millions of dollars

The background data shows that the National Forests in Mississippi local economy continued to be a net importing economy in 2000. The 1990 decade 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, showed net exporting decreases in the wood furniture and fixtures industry as well as the paper and pulp products industry. Total lumber and wood products net exports increased slightly between 1990 and 2000. Total manufacturing lost a significant share in net exporting by about $1,166 million in the 1990 decade. Minerals; finance, insurance, and real estate; wholesale and retail trade; and services were sectors that showed the greatest change in net exports over the 1990 decade.

In summary, the Forests' 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.

Table 52. Revenue for the National Forests in Mississippi for fiscal years 205 through 2011

	2005	2006	2007	2008	2009	2010	2011
Class 1 - Timber	$3,101,710.41	$6,596,328.53	$1,719,560.84	$2,161,107.52	$967,023.39	$839,078.28	$1,957,900.95
Class 2 - Grazing East	$200.84	$190.80	$78.12	$88.83	$108.15	$0.00	$108.15
Class 3 - Land Use	$88,575.82	$101,807.32	$67,203.41	$88,103.57	$105,390.30	$125,983.78	$147,216.28
Class 4 - Recreation Spec. Uses	$1,482.70	$0.00	$425.00	$891.95	$58.00	$59.00	$0.00
Class 5 - Power	$14,196.86	$30,153.45	$26,429.19	$31,533.42	$53,914.97	$74,393.33	$65,766.16
Class 6 - Minerals	$0.00	$375.00	$780.45	$5,580.33	$0.00	$0.00	$0.00
Class 7 - Recreation User Fees	$60.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total NFF Receipts	$3,206,226.62	$6,728,855.10	$1,814,477.01	$2,287,305.62	$1,126,494.81	$1,039,514.39	$2,170,991.54
KV	$3,943,621.05	$3,611,934.95	$3,372,316.44	$1,961,083.72	$1,882,963.69	$1,954,381.86	$4,332,906.91
Timber Purchaser Road Credits	$7,136.88	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Specified Road Credits	$2,269,836.02	$1,243,384.36	$612,143.72	$1,293,325.26	$570,671.17	$789,680.75	$1,440,425.97
Salvage Sales	$63,999.76	$11,085,999.84	$139,780.59	$109,450.03	($7,375.45)	$20,797.85	$2,144.43
TPTP Revenue					$422,674.40	$24,131.67	$25,821.22
Grand Total	$9,490,820.34	$22,670,174.25	$5,938,717.76	$5,651,164.63	$3,995,428.62	$3,828,506.52	$7,972,290.07

Table 53. Payments from all sources made to the State of Mississippi in lieu of taxes for fiscal years 2004 through 2011

	2004	2005	2006	2007	2008	2009	2010	2011
Bienville PNF	$1,604,208	$1,641,104	$1,657,515	$1,654,113	$1,439,323	$1,413,105	$1,287,888	$1,080,767
De Soto PNF	$3,057,466	$3,127,789	$3,153,308	$3,152,583	$3,100,158	$2,748,063	$2,551,554	$2,261,190
Holly Springs PNF	$603,267	$617,141	$623,312	$622,033	$753,438	$737,649	$682,599	$601,468
Homochitto PNF	$2,248,378	$2,300,091	$2,323,091	$2,318,324	$2,364,010	$2,201,958	$1,902,280	$1,693,894
Delta PNF	$103,318	$105,695	$106,752	$106,532	$230,296	$173,851	$149,912	$150,991
Tombigbee PNF	$404,061	$413,355	$417,488	$416,631	$469,104	$431,112	$383,137	$359,198
NFsMS Total	$8,020,698	$8,205,173	$8,281,466	$8,270,217	$8,356,329	$7,705,738	$6,957,371	$6,147,508

National Forests in Mississippi Receipts

The resource management programs of the National Forests in Mississippi generate revenue from timber sales, grazing permits, land use permits, recreation special uses and user fees, power rights of way, and minerals extraction. These revenues are used as authorized by the Forest Service for National Forest management, submitted to the United States Treasury, or paid to the State of Mississippi in lieu of taxes not paid to the local counties. These receipts made a large increase in fiscal year 2006 due to the salvage of large quantities of timber damaged by Hurricane Katrina. The following years from 2007 till 2010 the revenue trends were declining. This was mostly due to declining timber sale receipts. This trend was reversed in 2011 with a doubling of revenue compared to 2010. This was again mostly due to increased timber revenue. Table 52 displays these revenues for fiscal years 2005 through 2011 for each revenue source. Additional details by Forest can be found in the National Forests in Mississippi social and economic overview in the plan set of documents.

Federal Payments

The payments in lieu of taxes (PILT) program is administered by the Bureau of Land Management. Payments in lieu of taxes are made to local governments that have federal lands within their borders to compensate for loss of property tax revenues. Twenty five percent of National Forest revenues are paid to the State. When these receipts do not meet the required level of payment, the 25 percent funding is supplemented. Table 53 includes data on payments from all sources made to the State of Mississippi in lieu of taxes for Fiscal years 2004 through 2011. Trends in the 25 Percent Funds and payments in lieu of taxes are important to show a possible erosion of an area’s tax base. Additional details by county can be found in the National Forests in Mississippi social and economic overview in the plan set of documents.

Trends in 25 percent funds and PILT are important to show a possible erosion of an area’s tax base. Background data tables break out revenues for each of the National Forests in Mississippi counties. Table 54 below, 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 54. Twenty-five percent funds

	1985[a] (2000 $s)	1998 (2000 $s)	Real Avg. Annual Change
National Forests in Mississippi Counties	$8,032,900	$8,068,800	0.03%
Mississippi	$8,109,600	$8,191,800	0.1%

Source: USDA Forest Service

a - Data adjusted to 2003 Dollars via Gross Domestic Price Deflator

County revenues from the Forest Service have been variable since 1985, the first year of available data for 25 percent funds. Even with the year-to-year variability, the Forests’ payments to counties, adjusted to 2000 dollars, have only grown by an average 0.03 percent real rate per year since 1985. Inflation over the 1985-1998 period averaged -2.7 percent per year as measured by the gross domestic price deflator.

Issaquena County is within the proclamation boundary of the National Forests in Mississippi, but does not contain National Forest System land; hence there are no payments to states for these counties.

National Forests in Mississippi counties have experienced changes in funds that vary greatly from the Forests’ average. For instance, Bienville and Holly Springs National Forests’ counties payment to states have decreased by 8 percent and 3 percent each, respectively. The Delta National Forest has made the greatest increase in payments to state, 16 percent more than in 1985. The De Soto National Forest averages are only slightly higher than the Forests as a whole. The Homochitto and the Tombigbee National Forest counties have experienced a 3 percent increase in payment to states since 1985.

At the same time, PILT funds (Table 55) have increased to help offset the large acreage Federal ownership of these counties' lands. While the magnitude of PILT payments is much smaller than 25 percent funds, PILT payments have tended to increase over time as timber harvests have decreased on the National Forests in Mississippi. Inflation adjusted payments in the Forests' analysis area have grown from $210,257 in 1991 to $602,777 in 2001, an 11.1 percent average annual increase. This rate of increase is higher than the rate of increase for all counties in Mississippi over this same period.

Table 55. Payment in lieu of taxes (PILT)

	1991 -(2000 $s)[a]	2001 (2000 $s)[a]	Real Avg. Annual Change
National Forests in Mississippi Counties	$210,257	$602,777	11.1%
Mississippi	$435,523	$909,188	7.6%

Source: U.S. Dept. of Interior

a - Data adjusted to 2000 Dollars via Gross Domestic Price Deflator

Summary of Social and Economic Trends

National and local socioeconomic trends influence the ability of communities to adapt to changing circumstances. Trends identified in secondary and primary data analysis for the National Forests in Mississippi include demography, economy, community attitudes, and implications.

Population growth in the 1990s occurred at a relatively rapid, yet uneven, rate. Thirty-five counties across Mississippi account for an average growth rate of 10 percent. Population growth appears to be a result of a natural increase in the population which offset the out-migration for the state. The population is expected to grow by another 13 percent by 2015.

The analysis area's rural characteristic increased by about two percentage points to 55.8 percent for the National Forests in Mississippi from 1990 to 2000. Despite the fact that the forest areas have maintained or increased their rural characteristics, urban areas influence the Forests. Nearby urban growth (e.g. Jackson, Memphis, and the Gulf Coast) means that demands on recreation resources as well as for land development will increase.

Mississippi as a whole has maintained a heterogeneous population of whites and blacks for the past 20 years. A recent increase in Hispanic residents and a subsequent projection for the Hispanic population to rise significantly in the next ten years translates into changes in community attitudes, values, and beliefs concerning forest management and recreation preferences. The increase on the Forests in conjunction with population decreases may be from non-minorities moving out of the area.

Community culture, lifestyles, local economies, and social structures are changing at different rates. One result is the changes can cause social disruptions or tensions about new residents, new economic activities, or changes in forest management policies. This social disruption can amplify disagreements within communities or groups or it can migrate to conflicts about forest management issues.

Current attitudes, beliefs, and values concerning Forest management were gathered during a telephone survey conducted by the USDA Forest Service Southern Research Station. Nearly 600 phone calls were made to over 139 counties within a 75 mile radius of each of the six National Forests in Mississippi forest boundaries. A general summary of the findings gives insight to attitudes toward national forest management. Residents of Mississippi and the surrounding areas participate in outdoor activities, the majority prefers viewing nature via walking or driving, fishing, hiking, gathering non-timber products, off-road vehicle driving, and developed camping.

The forest management activities that are most important to the respondents included maintaining stream quality, providing habitat for fish and wildlife, and protecting endangered plants. The public was also asked questions about their perceptions of the most important management activities on public lands. The largest share of the public's responses gave preference to forest management objectives that provide water sources, protect habitats, maintain the forests conditions, protect older forests, increase law enforcement, and prevent wildfires. The survey indicated that the local public has a fairly strong environmental conservation leaning. While extraction of natural resources is not completely discounted by the public, preservation and provision of wildlife and recreation services are highly desired.

The Forests' economic health as measured by per capita income grew at a modest rate during the 1990s, a 4.5 percent average annual rate over the ten-year period, slightly less than that of Mississippi's rate. Still, per capita income in 2000 was only about $1,200 less than that of the State.

The National Forests in Mississippi analysis area unemployment rate decreased from 6.8 percent to 6.3 percent from 1995 to 2001. The rate in 2001 was more than the rate of Mississippi, 5.5 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.

Poverty rates in the National Forests in Mississippi analysis area declined nearly 5 percentage points over the period from 1990 to 2000. Similarly, Mississippi's rate has decreased by about 5 percent over the same time period. The De Soto and Holly Springs National Forests area low poverty rates in 2000 played a part in the favorable National Forests in Mississippi area poverty rate versus that of the state.

Transfer payments in the National Forests in Mississippi analysis area showed a 5.5 percent increase in average annual real rate of growth from 1970 to 2000, similar to that of the state, which showed a 5.3 percent increase. Still, the rate of government assistance for the analysis area is slightly greater than that of the state. The Forests' transfer payment growth gives the local economies added economic support.

Percentage of female head of households was lower than the state percentage in the analysis area. The National Forests in Mississippi was 1 percent below the state's 10 percent of all households, indicating a lesser degree of hardship.

The services sector is a significant source of employment in the analysis area accounting for 23.9 percent of the employment. The economy's main drivers, in the labor income area, are services and government. Employment in the manufacturing sector, which includes lumber and wood products, is declining in the state of Mississippi. The area as a whole has become less reliant on the manufacturing sector. The Shannon-Weaver Entropy indexes indicate that overall, local and state economies are relatively diverse making the area less prone to economic recessions.

Thus, the economy and demography of this area appears to be healthy. Population has grown steadily in the 1990s; poverty has decreased. Housing construction is 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. The analysis area has a fairly diverse economy with resilient characteristics that may allow it to weather downturns in the economy. For the National Forests in Mississippi analysis area most of the economic and demographic variables looked at in this overview were comparable with those of Mississippi. Most social and economic characteristics looked at in this overview seem to be on par with that of the state.

3.6.12 Values, Attitudes, and Beliefs Survey

As a part of 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 to what recreation activities they actually undertake. In the summer of 2004 the National Forests in Mississippi commissioned the USDA Forest Service Southern Research station to conduct a values, attitudes, and beliefs random telephone survey of populations within 75 miles of each of the six National Forests in Mississippi forest boundaries 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.

Below is a general synopsis of the findings of the nearly 600 telephone calls made over 139 counties in the sample database. Summary results are described in the following tabulation. About 41 percent of the respondents were residents of Mississippi; approximately 18 percent of the respondents were from Louisiana, 18 percent from Tennessee; and 16 percent from Alabama. The survey had 56 percent female respondents; 65 percent white and 34 percent black; 73 percent high school education or higher, 28 percent with only a high school education, and 17 percent college educated; 54 percent employed; 45 percent retired; 30 percent with incomes in the $25,000-74,999 range; and 34 percent ages 16-34, and 36 percent ages 35-54.

Table 56 presents a "yes" response as to whether the surveyed person participates in given recreation activities:

Table 56. Respondent recreation activities

Forest Activities	% of Participants Responding "Yes"
Mountain Biking	17%
Horseback Riding on Trails	14%
Day Hiking	19%
Backpacking	2%
Developed Camping	20%
Walking for Pleasure	81%
Gather Mushrooms, berries	23%
Nature Viewing/Photography	51%
Big Game Hunting	15%
Small Game or Waterfowl Hunting	18%
Driving for Pleasure	69%
Off-Road Vehicle Driving	25%
Freshwater Fishing	44%
Canoeing or Kayaking	11%
Rafting	15%
Horseback Riding on Trails	8%

Quite clearly, most people participate in the outdoors by walking for pleasure (81 percent) and in their car through driving- for-pleasure (69 percent); nature viewing was third most predominant (51 percent), while fishing was fourth (44 percent).

Table 57 indicates extremely important and important beliefs of respondents for given forest management objectives of the Forest Service:

Table 57. Respondents beliefs

Forest Management Activity	% Extremely Important	% Important
Maintaining Stream Quality	90%	6%
Providing Outdoor Recreation	59%	19%
Providing Habitat for fish and WL	71%	17%
Providing Quiet Places for Renewal	56%	17%
Leave Forest in Natural Appearance	66%	17%
Emphasizing Planting Trees for Timber	68%	16%
Provide Access to Raw Materials	33%	24%
Protect Endangered Plants and Animals	71%	12%
Emphasize Managing Vegetation	65%	19%

Maintaining stream quality (90 percent), providing habitat for fish and wildlife (71 percent), and protecting endangered plants (71 percent) appear to be the most important management objectives of the overall public.

Table 58. Respondents perception of forest management issues

Management Activity	Very Important	Important
Restrict Access for Motorized OHV	35%	29%
Develop and Maintain Trail System	44%	21%
Provide Challenging Trails	30%	14%
Develop New Paved Roads	36%	16%
Develop Primitive-Only Backcountry Areas	45%	22%
Protect Areas that are Sources of Water	78%	10%
Manage Forests for Historical Ecosystems	56%	18%
Manage Forests to Maintain Today’s Conditions	70%	19%
Protect Important Wildlife Habitats	72%	17%
Expand Commercial Recreation Services	27%	21%
Introduce Recreation Fees	42%	24%
Introduce a Rec. Fee for ORV to Maintain Trails	30%	18%
Increase Law Enforcement and Patrolling	65%	17%
Create Open Areas to Mange for Wildlife	38%	21%
Protect Older or Continuous Forest Areas	66%	16%
Use Controlled Fires to Reduce Threat of Wildfires	64%	18%
Control the Spread of Invasive Species	42%	22%
Encourage Timber Harvesting	43%	16%

Next, the public were asked questions about their perceived choices for forest management on public lands. Results indicating very important or important are listed in Table 58.

The largest share of the public's wishes dealt with forest management objectives that provide sources of water (78 percent), protect habitats (72 percent), manage forests to maintain today's conditions (70 percent), protect older continuous forests (66 percent), increase law enforcement (65 percent), and prevent wildfires (64 percent).

This survey of local publics indicates that people have a fairly strong environmental conservation leaning. 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.

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Chapter 4. Environmental Consequences

4.1 Soils

4.1.1 Soil Direct and Indirect Effects

The National Forest Management Act (NFMA) requires that management activities not significantly impair site productivity. Management activities can reduce soil productivity by compaction, loss of nutrients by removal of vegetation or loss of organic matter, soil erosion, loss of soil biota, and decreased water infiltration. Vegetative management (including timber removal and cultural treatments), developed recreation and other intensive land use (i.e. administrative sites), road and trail construction or reconstruction, and oil and gas development are the land management activities most likely to cause soil compaction, soil erosion, loss of nutrients, and loss of soil biota. Mechanically pushed and plowed fire breaks associated with prescribed burn management activities are likely to result in displaced soil surface and accelerated soil erosion. Road and trail construction or reconstruction, oil and gas development, developed recreation and other intensive land use, associated temporary roads and skid trails used for vegetative management, and artificially constructed fire breaks are the activities most likely to reduce long term soil productivity.

Quantifying potential changes in soil compaction, nutrient loss, soil erosion, soil biota loss, and reduced water infiltration is, dependent on site-specific data and project-specific variables. The scale of this forest plan makes it infeasible to quantify the impacts. However, impacts can be qualitatively described to indicate relative potential impacts on the soil resource. The acres of annual timber harvest by alternative are shown in Figure 26. Comparing the frequency and intensity of proposed management activities best illustrates likely effects to long term soil productivity. The frequency of harvest entries by alternative are seen in Figure 32. All alternatives are considered as having extended periods between harvest entries, thus allowing adequate site recovery between harvest events. Generally, long rotations, with less frequent harvest entries, and combinations of low impact activities are more favorable in terms of maintaining long-term soil productivity. All alternatives are considered as having long silvicultural rotations. The exception would be the restoration of desired species conversions and salvage events resulting from storm damage and bug infestations. The relative effects of vegetation management activities on soil resources are, from least to most, herbicides, fire, and mechanical. Lower risk mechanical techniques typically include mowing, mulching, stem only harvest, drum chop site preparation, and shear only site preparation. Moderate risk mechanical techniques may include, shear and pile site preparation, whole tree harvest, and biomass harvest. High risk mechanical techniques may include root raking, heavy disking, and soil bedding.

Direct effects are the alteration of physical, chemical, and biological properties of the soil from changes in soil organic matter content, erosion of the soil, soil compaction, and nutrient leaching or displacement. Managing top soil (organic matter plus soil surface) is a key component of maintaining long-term site productivity. The primary factors used to evaluate long-term site productivity impacts are accelerated erosion, compaction, fertility, and extent of displacement of soil surface. Soil movement and soil compaction are primary soil productivity concerns associated with conventional timber harvest. Also, soil movement and compaction are closely related to water quality in terms of increased runoff and increased sedimentation. Mitigation measures, in the form of forest standards and guidelines, are used to minimize above impairment thus ensuring long-term site productivity.

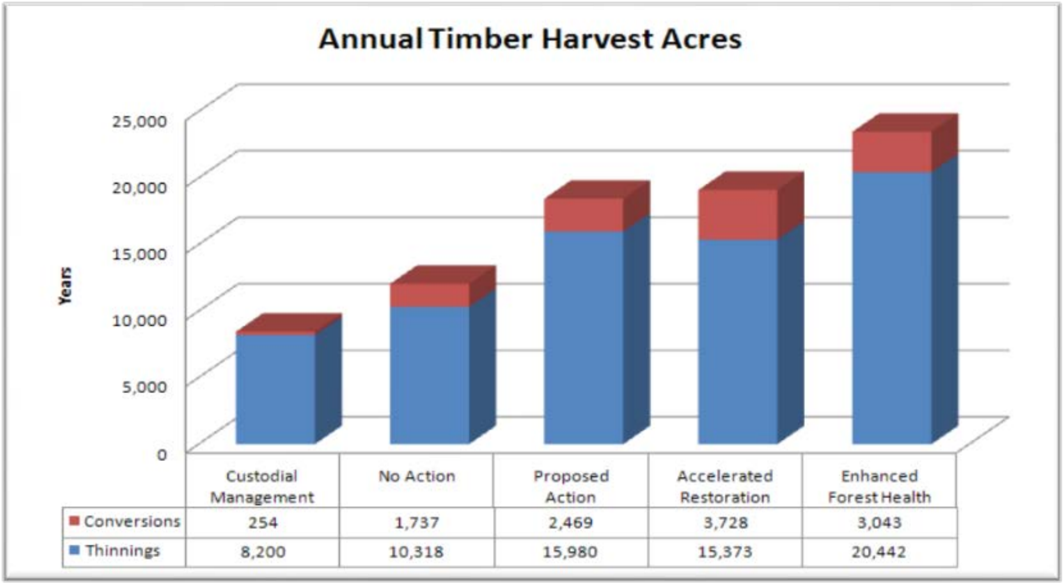


Figure 26. Annual timber harvest acres by alternative

Soil Compaction

The weight of heavy machinery used for harvesting, site preparation, temporary road construction, and road reconstruction can compact soils, decreasing soil productivity. Soil compaction affects soil productivity by increasing bulk density and decreasing soil porosity. Compaction can detrimentally impact both soil productivity and watershed conditions by causing increased overland flow during storm events; and reduced plant growth due to reduced amounts of water entering the soil and thus reduced availability for plant growth, a restricted root zone, and reduced soil aeration. Other forms of compaction, such as rutting and churning, disturb soil structure as well soil porosity and may have greater impact soil productivity (Tiarks 1990).

Compaction is most severe in top 3 inches of soil. The ease and degree of soil compaction and rutting is a function of soil moisture, soil type, pounds per square inch (PSI) equipment displacement, ground cover, and the number of machine passes. Slash, litter and duff buffer the soil against vehicle pressures. Compaction increases with number of machine passes, although most is cause by the first three passes and little occurs after 10 passes (Burger et al. 1985). Soils are typically wetter for prolonged durations in the winter and early spring. Soils with high rutting susceptibility have water tables near surface or flooding that induce long periods of saturated conditions. Soil compaction susceptibility ratings are determined by the particle size fractionation of the surface horizon.

Soil resource inventories are used during project planning to identify soil suitability and management limitations in the project areas that could affect long-term productivity. The suitability and management limitations ratings do not indicate the ability to implement project activities; rather, they indicate the relative amount of mitigation needed to protect the soil resource and to successfully implement a chosen activity. These soil ratings are taken into account in the planning phase, or in the required mitigation measures. An example of this would be soils with a high rutting susceptibility. Soils with high rutting susceptibility are typically too wet for mechanized harvest equipment more than half of year and require sale administer to halt activities during these times. Usually, these soils are dry enough for harvest activities more than 3 months of year; however, a small percentage of these soils (i.e. organic soils and ponded units) are not compatible using conventional harvesting techniques. Figure 27 illustrates the proportional extent of soil rutting susceptibility throughout the Forest. Soils with moderate rutting susceptibility are generally wet 3-6 months of year. Soils with low rutting susceptibility are generally wet less than 3 months of year. Figure 28 illustrates the proportional extent of soil compaction susceptibility throughout the Forest.

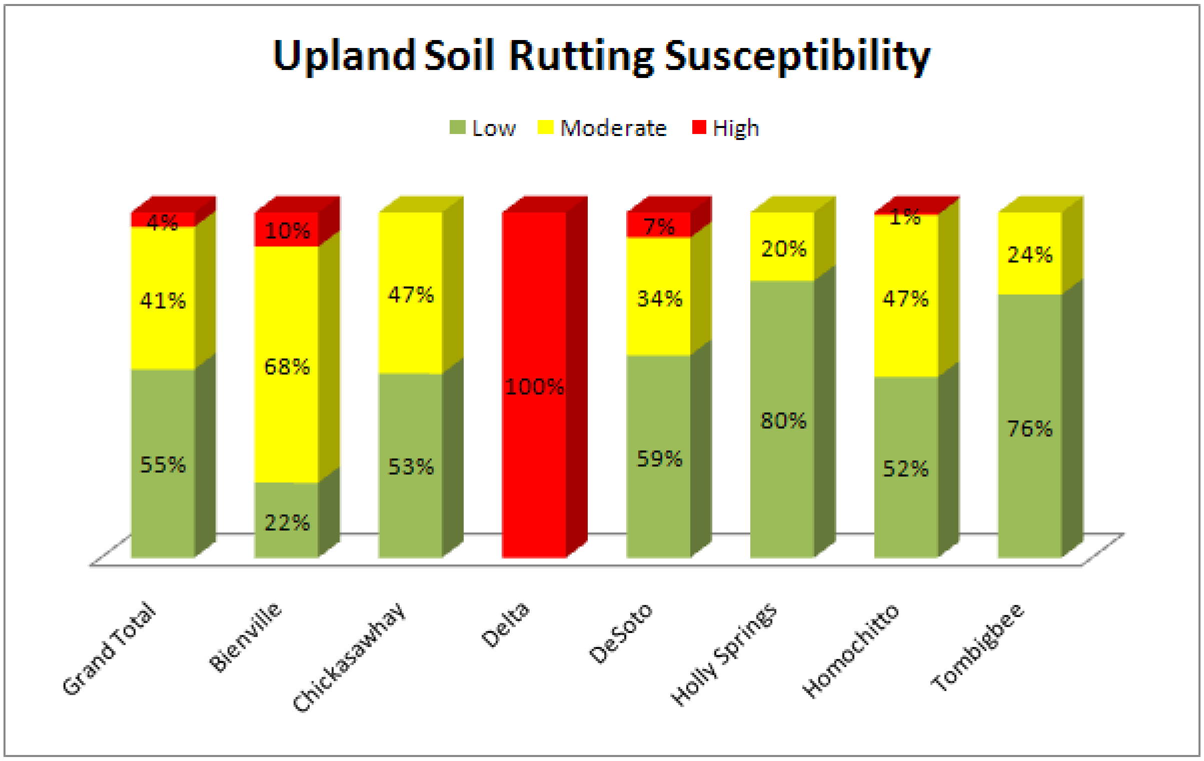


Figure 27. Proportional extent of soil rutting susceptibility

Excessive compaction generally occurs on heavy traffic areas such as landings, primary skid trails, and temporary roads, particularly when the soils are wet. The smaller the percent area used for concentrated use of equipment the less impacts (compaction and erosion) there will be to the site. Forest monitored timber harvested areas to determine the percent area in skid roads, haul roads, log landings, and skid trails within conventional harvest (rubber tired skidder) sites on the National Forests in Mississippi. The monitoring was designed to estimate disturbance in associated timber harvesting and its relationship to potential erosion and soil compaction. The information obtained from the monitoring could then be compared to the threshold values identified in the soil quality standards. Disturbed areas (skid trails, roads, and landings) averaged less than 10 percent of the sale unit area. About 2 to 6 percent of sale areas were significantly disturbed, which is well within the soil quality standard threshold value of 15 percent significantly disturbed. Historically, these areas have had various types of harvest activities such as clearcuts and thinnings. Harvested areas are not typically re-entered with harvest equipment for 20-30 years outside of insect outbreak or other salvage events, thus providing time for the soil to recover. More often than not, historical skid roads, haul roads, and log landings are reused during most harvest activities.

Natural soil compaction recovery is accomplished chiefly through three mechanisms (Miwa et al. 2004). Generally, the most important process is process of wetting and drying (shrinking and swelling associated with 2:1 expanding clays). The second process is through biological disturbance via root penetration and biopedoturbation (or mixing of soil materials by insects, worms, and other ground-dwelling organisms). The third, much less common in Mississippi, is freezing and thawing.

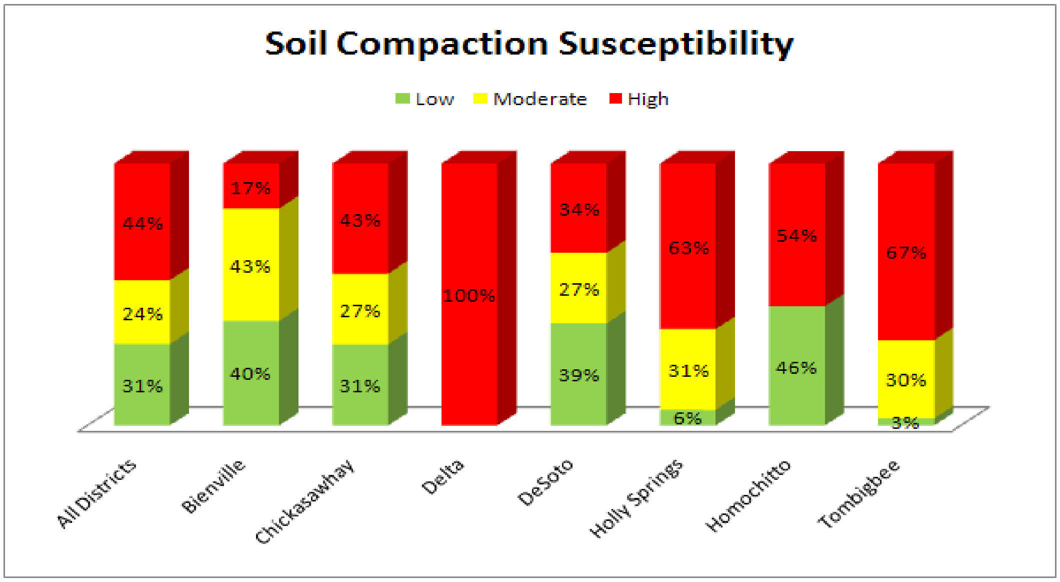


Figure 28. Proportional extent of soil compaction susceptibility

Under all alternatives, measures to minimize compaction and displacement include operating heavy equipment when soils are dry to reduce slippage; operating over intact forest floor and downed woody debris; constructing as few firelines, roads, skid trails, and logging decks as possible; and redistributing topsoil back over areas where it has been removed. In addition, heavy equipment operation will be suspended, when conditions are conducive to excessive rutting. Given mitigation, soil compaction/rutting would be limited and is not expected to exceed soil productivity thresholds for any alternatives. Also, areas of heavy use, such as skid trails, would be re-vegetated to ameliorate compaction.

Soil Erosion

Ground-disturbing activities increase erosion primarily by removing ground cover or concentrating overland water flow. Soil erosion is the detachment and transport of individual soil particles by wind, water, or gravity. A key component of maintaining soil productivity is preserving top soil, including soil organic matter layer and the surface soil layer. A soil's susceptibility to erosion varies by soil type and is affected by rainfall intensity, soil erodibility, soil cover conditions, and steepness and length of slope. The different erosion characteristics of the soils are to a large extent responsible for the variations in the topography of soil map units illustrated in Figure 29.

Soil resource inventories are used during project planning to identify soil suitability and management limitations in the project areas that could affect long-term productivity. The suitability and management limitations ratings do not indicate the ability to implement project activities; rather, they indicate the relative amount of mitigation needed to protect the soil resource and to successfully implement a chosen activity. These soil ratings are taken into account in the planning phase, or in the required mitigation measures. An example of this would be a poor rating for access roads due to slope. One solution for this would be to locate the road on the ridgetop or along the contour of the slope, instead of locating the road straight up and down the slope. Another example is in the specifications for waterbar construction. Closer spacing is required for waterbars on moderately and highly erosive soils than is required for waterbars on slightly erosive soils.

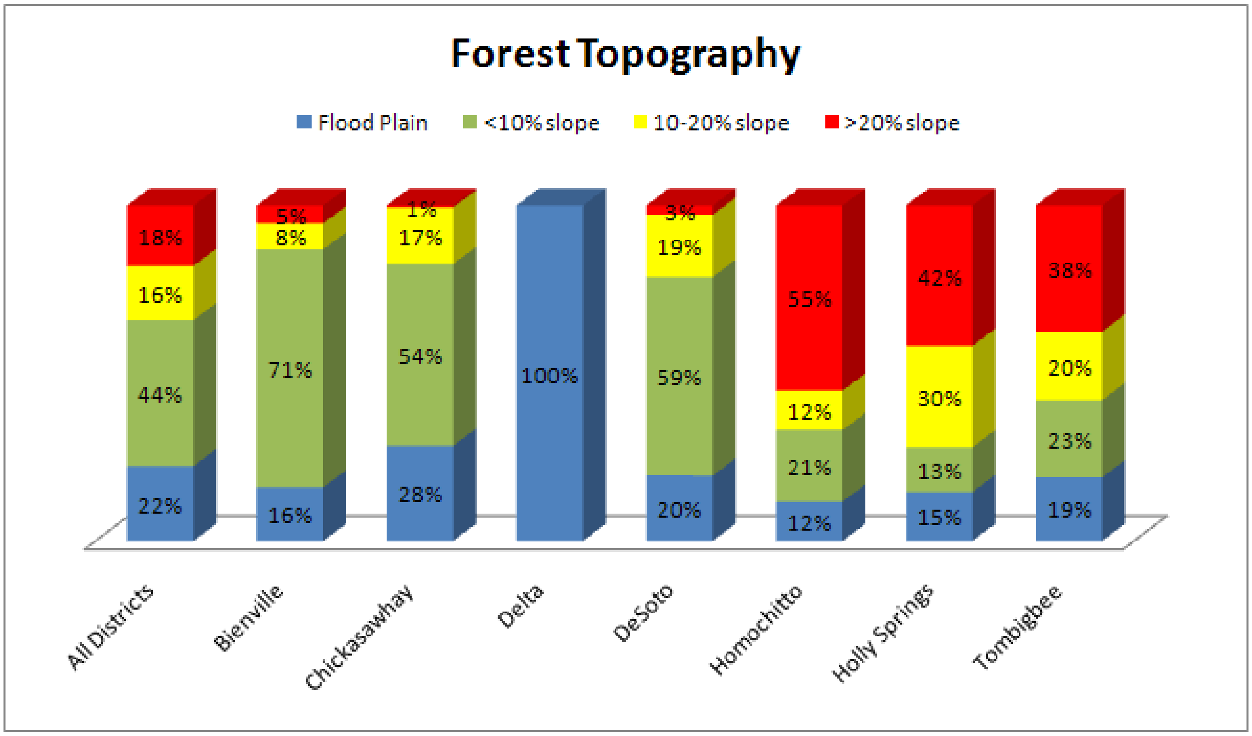


Figure 29. Proportional extent of district flood plains and slope phases

Figure 30 illustrates the proportional extent of soil erosion susceptibility throughout the Forest. Moderate or low erosion hazard indicates that standard erosion control measures, such as installing water bars, plus seeding and fertilizing are sufficient to prevent excessive erosion. Soils with severe erosion hazard ratings require more intensive efforts to reduce the potential for accelerated erosion both during and after the soil disturbing activity and in some cases eliminating higher risk activities such as mechanical site preparation on slopes greater than 20 percent.

Natural erosion rates from undisturbed forest soils are very low and only increase minimally during most harvest events. Soil movement is not due to the removal of the tree canopy but from harvest operations that expose excessive amounts of bare soil or concentrate surface waters. The use of machinery during timber harvest, road construction, road reconstruction, and site preparation, has a potential to increase erosion by exposing bare soil. In forested watersheds, the most common cause of accelerated erosion is creation and use of forest roads, although timber harvest, site preparation, mineral activities, grazing, trail construction and use, and some recreation uses, such as OHV trails, also have the potential to remove or disturb the surface or cover of soils. Erosion rates tend to remain greater on these areas for many years following their use due to altered soil structure and loss of infiltration. Erosion is most effectively managed by leaving sufficient amounts of the forest floor (slash, and other onsite woody debris material) intact, not overly compacting soils (which would reduce water infiltration rates and result in increased overland flow), and not allowing water to concentrate and channel on roads or trails.

Mitigation measures included under all alternatives are designed to keep erosion at acceptable levels under normal circumstances. These measures include: limiting activities when soils are wet, carefully locating and limiting roads and skid trails, seeding skid trails and landings after use, and limiting disturbance to the litter layer during site preparation activities. Use of erosion control measures is specified in forest plan standards and required for all projects. Experience has shown that these measures, when properly implemented, are effective at minimizing erosion.

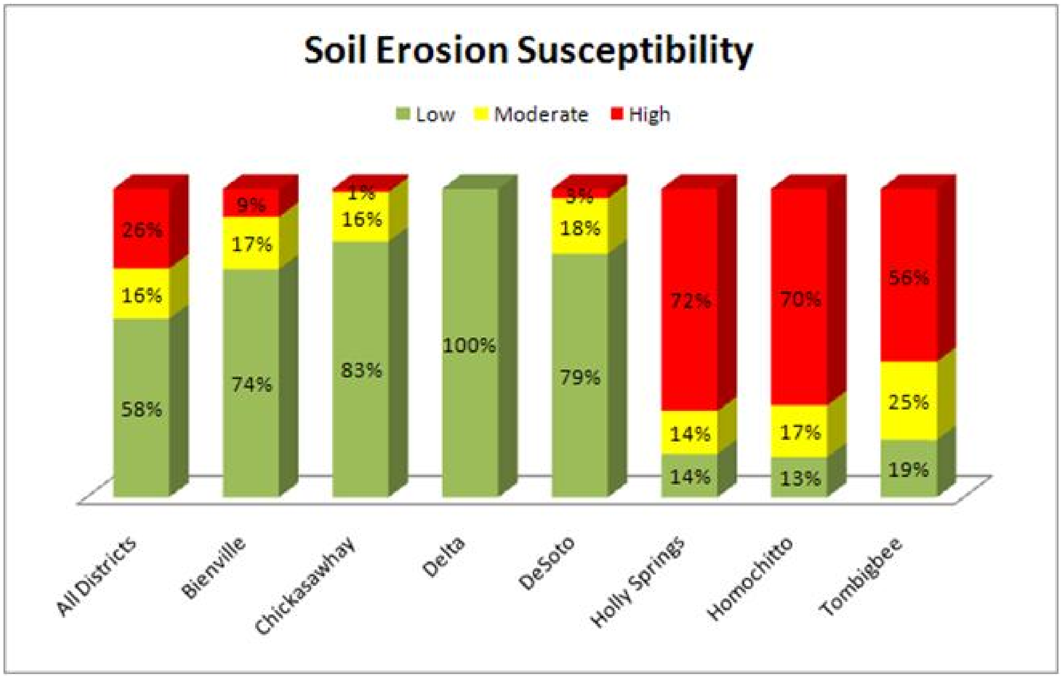


Figure 30. Proportional extent of soil erosion susceptibility

Soil Fertility

Loss of nutrients occurs through loss of organic matter, soil erosion, removal of vegetation, and severe burns. The removal of forest products would result in some loss of nutrients. Soil nutrient losses would be negligible in terms of long-term site productivity. This loss would be minimal since the tops of the trees and their branches, which provide the majority of the available nutrients in a tree, would be left on site to provide some short-term nutrient recycling. Biomass removal in the form of timber harvest can result in nutrient deficits (mainly phosphorus). Nutrient depletion; however, is generally only a concern where soils are initially nutrient-poor, where whole-tree harvest (total biomass removal) is used, or where stand rotations are short, i.e., on the order of 20-35 years (Jorgenson and Wells 1986).

Prescribed burning could increase potential of nutrient loss. Adverse effects from a single light to moderate burn are minimal. Frequent burning (less than 3 year return interval) can reduce soil organic matter which subsequently reduces nitrogen mineralization and plant uptake. Return intervals greater than 3 years causes very little change soil organic matter, temporarily enhance plant nutrient availability, and reduce soil acidity. Three year prescribed burn intervals allows the litter-duff biota to recover between burns and result in minimal nutrient loss because nutrients are quickly immobilized through plant uptake and sorption to soil particle. Light and moderate burns do not heat soil enough to significantly affect soil biota. Litter biota would be reduced but should quickly recover. The risk of affecting the soil productivity is minimal unless sites are burned more often than every 3 years or during high burning intensities.

Prescribed Fire

Prescribed fire has both positive and negative effects on soils. 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, thus limiting adverse impacts. Frequency, duration, fire severity, and season, as well as moisture content of the duff layer are some of the more critical factors affecting long-term soil productivity. The majority of burning occurs during the cooler winter or early spring months when moisture levels are high and under parameters that facilitate low and moderate fire intensities. Only the upper forest floor litter layer consisting of non-decomposed or semi-decomposed pine needles, leaves, and small twigs should be consumed. This will leave the underlying layer, which consists of more decomposed needles, leaves, and twigs, to protect the mineral soil. Maintaining this organic layer minimize soil movement and maintains soil productivity. These fires are often designed to reduce fuel loadings that diminish the likelihood of detrimental impacts from subsequent wildfires. Negative effects are principally associated with mechanically pushed/plowed control lines and severe burns, which may kill soil biota, alter soil structure, consume organic matter, and remove nutrients and lead to soil erosion and additional nutrient loss during later rainfall events.

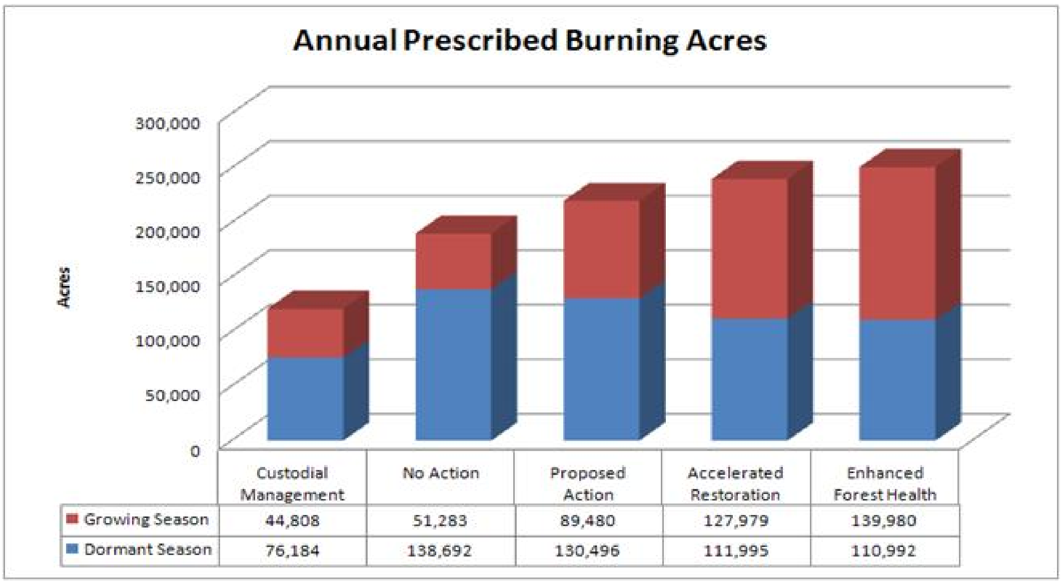


Figure 31. Annual prescribed burning acres by alternative

High intensity burns, usually wildfires, can adversely affect long-term soil productivity. Generally, high-severity prescribed burns occur when slash is not evenly distributed (i.e. burning piled or windrowed debris) or when fuel or soil moisture conditions are extremely low. Excessive nutrient loss from severely burned areas may occur through atmospheric volatilization, deep leaching, and loss of soil organic matter. Even soil structure and infiltration rates can be seriously compromised, leading to accelerated erosion rates.

In contrast to high-severity burns, properly managed light and moderate-severity burns generate acceptable or beneficial effects on soil. Light to moderate-severity burns will result in little to no detectable change in the amount of organic matter in surface soils. These burns will not change the structure of mineral soils because the elevated temperatures are of brief duration. Light to moderate severity burns generally do not expose large areas of bare soil; therefore little chance of excessive erosion. Soil biota is reduced but recovers quickly. In addition, light to moderate severity fires accelerate the recycling process by releasing nutrients in the soil, thereby stimulating nutrient uptake by vegetation. Even though prescribed fires release some nitrogen gases, mainly from forest floor material, overall nitrogen budgets are not significantly affected. Post-burn, nitrogen is restored by atmospheric input from lightning, rain, and dust and through increased levels of nitrogen fixation by wild legumes and soil bacteria. Prescribed fires may also help in reducing rates of soil acidification. Because prescribed fire is planned, there are usually fewer firelines on steep slopes, which have a higher potential to erode. In some cases, especially along forest service boundary lines, it is necessary to push fire lines on steep slopes.

Firelines are stabilized with water bars and in some cases require re-vegetating after the burn to prevent erosion.

Herbicide

The use of herbicides for controlling vegetation competition and stand development can be beneficial to forest ecosystems, sustainability, and water quality by minimizing off-site soil loss, reducing on-site soil and organic matter displacement, and preventing deterioration of soil physical properties (Neary and Michael 1996). Herbicide applications to control competing vegetation do not disturb the nutrient rich topsoil layer, create additional bare soil, or adversely affect watershed condition when used responsibly (Neary and Michael 1996). Soils on recently harvested sites treated with herbicides have higher moisture contents due to the reduction of surface runoff and transpiration as compared to other mechanical site preparation methods. The soils are also better able to supply the nutrients needs for early growth of forest crops (Carter et al. 1984, Neary et al. 1990, Smethurst et al. 1993). Maxwell and Neary (1991) concluded in a review that the impact of vegetation management techniques on erosion and sedimentation of water resources occurs in this order, herbicides<fire<mechanical. They also concluded that sediment losses during inter-rotation vegetation management could be sharply reduced by using herbicides and moderate burning instead of mechanical methods and heavy burning.

Herbicides could affect soil productivity through biotic impacts, soil erosion, and nutrient leaching. Depending on the application rate and soil environment, herbicides can stimulate or inhibit soil organisms. Adverse effects can occur when herbicides are applied at higher rates than the label rate. Use of herbicides at the lowest effective rate required by mitigation measures does not reduce activity of soil biota (Fletcher and Friedman 1986). Forest standards have been developed to ensure that herbicides are applied correctly and pose no greater than minimal risk to soils and soils biota and do not accidentally contaminate surface waters. No herbicide will be mixed or used within 100 feet of perennial streams, lakes, or ponds, or within 30 feet of other streams with defined channels. Herbicides, carefully directed and foliar sprayed during late spring to summer at the minimum recommended application rate, should result in no detrimental effects to long-term soil productivity or impact water quality. With forest plan standards in effect, all alternatives show acceptably low risk with respect to potential herbicide use.

4.1.2 Soil Cumulative Effects

The Forest Service recognizes vegetation management benefits a variety of forest resources and investments by protecting and improving forest health, forest growth, and wildlife habitat, plus maintenance of roads, trails, and utility lines. All alternatives provide a balance of resource management which favors prescribed fire and selective methods of herbicide, plus mechanical methods that cause low to moderate soil disturbances.

Most of soil productivity losses are generally associated with areas with greater soil disturbance such as firelines, trails, roads, landings, primary skid trails, and temporary roads. The smaller the percent area highly disturbed activities, the less impacts (compaction and erosion) there will be to the site. Highly disturbed areas typically averaged less than 10 percent of the forest. About 2 to 6 percent may be considered significantly disturbed, which is well within the soil quality standard threshold value of 15 percent significantly disturbed. These areas are typically dedicated to forestry management activities in that they are typically re-used every 20-30 years. Trails, roads, and firelines are re-used more frequently.

All alternatives are considered as having extended periods between harvest entries, thus allowing site to adequately recover between harvest events. The frequency of harvest entries are seen in Figure 32. However, Figure 32 may not accurately address first thinning units which typically occur around 20-30 years of age. When rotations are short than 20-35 years, cumulative depletion of nutrients can be a concern (Jorgenson and Wells 1986). Generally, long rotations, with less frequent harvest entries, are more favorable in terms of maintaining long-term soil productivity. All alternatives are considered as having long silvicultural rotations. The exception would be the restoration of desired species “conversions” and salvage events resulting from storm damage and bug infestations.

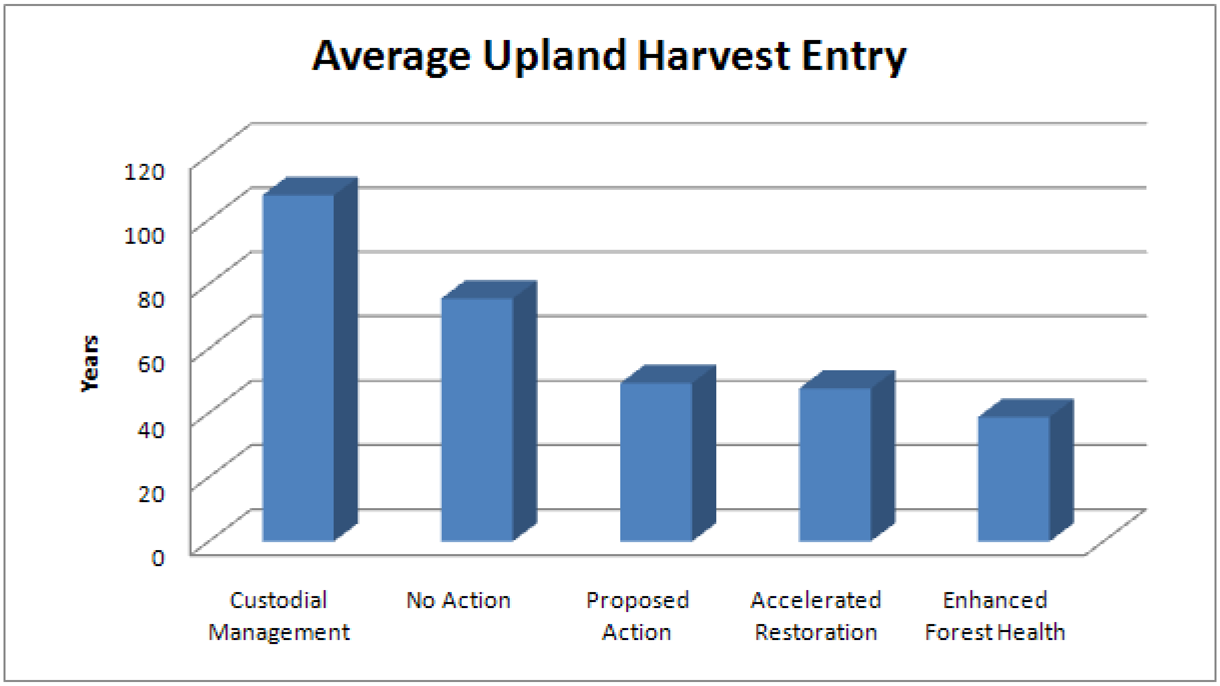


Figure 32. Average years between harvest entries by alternative

Adverse effects from a single light to moderate burn are minimal. Frequent burning (less than 3 year return interval) can reduce soil organic matter which subsequently reduces nitrogen mineralization and plant uptake. Average burn return interval by alternative is illustrated in Figure 33. All alternative showed average burn intervals are greater than 3 years. Some of the ecosystems guidelines in forest plan promote burn intervals ranging from 1-3 years. Burn intervals may be less than three years during restorations period; however, long-term maintenance on these site will most likely occur at three year intervals. Return intervals greater than 3 years causes very little change soil organic matter, temporarily enhance plant nutrient availability, and reduce soil acidity. Three to five year prescribed burn intervals allows the litter-duff biota to recover between burns and result in minimal nutrient. Burn intervals greater than 5 often result in increase soil organic matter. The risk of affecting the soil productivity is minimal unless sites are burned more often than every 3 years or during high burning intensities. Growing season burns result in 2.5-4.5 times more nitrogen loss than dormant season burns. For this reason, it is advised not to have more than two growing season underburns in succession without an intervening dormant season burn. Nitrogen budgets have shown that timber harvest followed by light slash burns produces positive nitrogen budgets and allows for long-term nitrogen buildup. The same scenario with a moderate burn produced neutral nitrogen budgets. Severe burns produced negative nitrogen budgets.

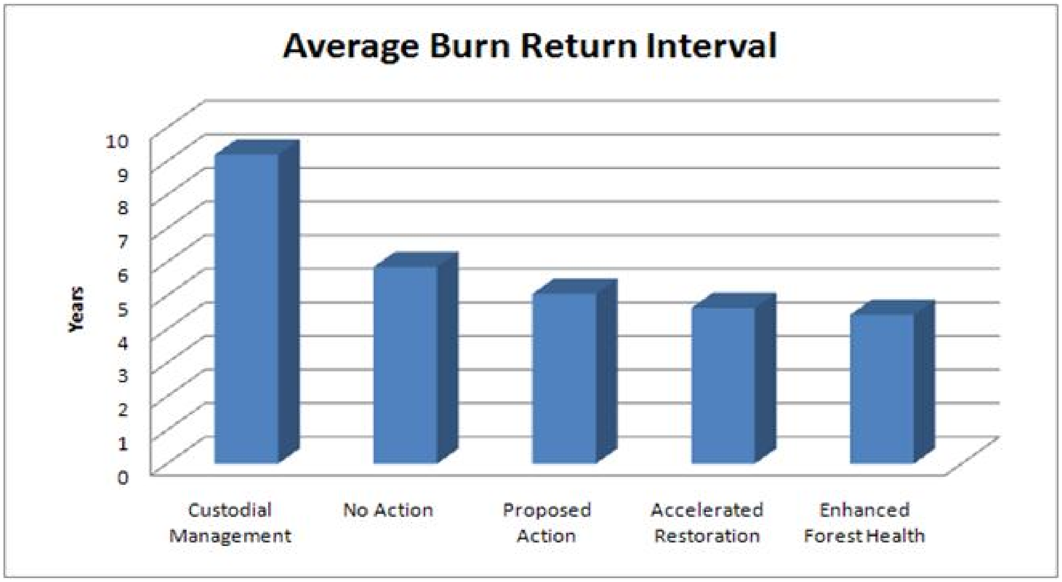


Figure 33. Average burn return interval by alternative

Implementation of the best management practices, proper mitigation measures, and monitoring by the Sale Administrator would result in minimal soil effects for all the action alternatives. The cumulative effects of all management actions over time are not expected to reduce soil productivity. Mitigation measures for past, present and reasonably foreseeable management activities (timber harvesting, site preparation and prescribed burning) are designed to keep the litter layer in place, or to replace the litter layer on exposed soils by seeding and fertilization; therefore, impacts associated with any one treatment would be completely recovered within three years. Upon completion of these treatments, timber harvesting activities would not occur in this analysis area for about 20-30 years, thus providing more than adequate time for the soil to recover. An exception to this could be an insect outbreak or other salvage events.

4.2 Air

The air quality program for the National Forests in Mississippi provides guidance for conducting forest management activities in a manner that complies with State and Federal standards, protects human health, promotes safety, and does not degrade air quality. Prescribed burning is the activity most likely to contribute air emissions, and the most frequent locations for prescribed burns are the national forests in the southern portion of the state. Use of prescribed burning moves the National Forests in Mississippi toward the desired conditions of restoring and maintaining fire-dependent ecosystems and reducing fuel loading to lessen the chances of catastrophic wildfires. Smoke emissions from prescribed fires are managed through best available smoke management practices. These practices are conducted in accordance with the Clean Air Act, the State Implementation Plan, and the Southern Smoke Management Guidebook. Since air issues are often regional in nature, the Forest Service also works cooperatively with State and Federal air management agencies and regional haze reduction organizations to improve air quality for the region.

In order to minimize the negative effects of smoke and associated pollutants on human health and visibility, smoke management plans are a required part of every prescribed fire burn plan. The negative effects of smoke can be reduced by planning and executing prescribed fires on days that maximize smoke dispersion and avoid smoke-sensitive areas. For each prescribed burn conducted, the Forest Service determines smoke dispersion characteristics that must be met in the weather forecast for the day of the burn. These characteristics include the depth of the atmosphere available for smoke mixing (dispersion), transport wind speed and direction, and the probability of air mass stagnation during the day. Forest Service smoke management guidelines include:

- Predicting smoke behavior for the weather conditions anticipated during the burn.
- Determining if there are smoke-sensitive targets (public or private ownership) within the probable smoke impact area and coordinating with them to avoid or mitigate problems.
- Monitoring the actual weather conditions and smoke behavior to make sure burn continues to be within the prescription.
- Being prepared to cease ignition or initiate suppression if the weather changes from the forecast and causes smoke behavior problems that cannot be mitigated.
- Application of the precautionary and mitigation measures described above will limit the risk and severity of any problems that might occur from prescribed fire smoke.

Alternatives A through E have progressively larger prescribed burning programs with alternative A having the smallest program and alternative E having the largest. The range is 121,000 to 251,000 acres. The greater the alternative's program acres, the larger the likely air quality impacts. However, the program controls mentioned above should keep the impacts within acceptable standards for all alternatives.

4.3 Water

4.3.1 Water Direct and Indirect Effects

The Clean Water Act provides the primary regulatory framework for managing the National Forests in Mississippi water resources. In compliance with the above mandate, forest management activities are implemented in a manner that does not substantially or permanently impair water quality. Mitigation measures, in the form of State best management practices and forest standards and guidelines, are used to meet this requirement.

Vegetation management practices are known to potentially affect water quality, water quantity, channel morphology, and downstream beneficial uses. Cutting and thinning have the potential to cause the following direct effects: erosion, changes in ground cover condition, and changes in stand composition of streamside forest communities. Indirect effects could include sedimentation, changes in stream nutrient levels (particularly nitrates), increases in water yield, and changes in stream flow behavior (Brown and Binkley 1994).

Floodplains and Wetlands

Approximately 22 percent of the forest is located in the floodplain. Generally, the larger and wider floodplains occur on larger drainage systems. All floodplains would be protected from harvesting and site preparation activities by restrictions on operating during wet periods. Since floodplains and wetlands are generally on predominately hardwood sites, the majority of ground disturbing activities will occur on upland pine sites (over 95 percent). The exception to this would be the use of floodplains and wetlands as natural fire breaks during prescribed burns. No effects on floodplain or wetland function are expected due to the minimal nature of these actions.

In large watersheds, peak flows from large storm events are natural, rather than a result of vegetation management practices due to scale of Forest Service vegetation operations. However, smaller watersheds have shown increased stormflow volumes and peak flows as well as increased summer base flows for one to three years after harvest. Increases in water yield are generally proportional to decreases in vegetative cover. Because vegetative cover would only slightly decrease under all alternatives, water yield increases are expected to be small. Forest streams are capable of withstanding small increases in flow. No discernible effects are expected under any alternative.

Water Quality

Herbicides

Herbicides can work to protect water quality and maintain site productivity by not disturbing the forest floor, resulting in retention of nutrient-rich top soil and subsequently not contributing to additional stream sediment loadings (Neary and Michael 1996). In contrast, continued non-selective herbicide use can result in increased sedimentation by exposing bare soil. Selective herbicide treatments usually have lower potential effect to water quality than broadcast treatments. Aerial applications generally pose the greatest risk. Water pollution by an herbicide can occur during storage, transport, application, clean up or container disposal. The direct effect of herbicide application is potential contamination of surface and ground water (Michael and Neary 1993). The indirect effects are potential increases in sediment and water yield. Slight increases in stream nutrients, particularly nitrates, may also occur as an indirect effect.

Herbicides have been found in surface water and ground water. However, concentrations are usually far below levels harmful to human health and the occurrence is infrequent (Larson et al. 1997). Concentrations of herbicide in runoff water are generally of short duration with the peak concentrations occurring after the first runoff event. The highest concentration of herbicides in water bodies generally occurs when buffer strips are not used or as result of accidental spills. When buffer strips are used along with other mitigation techniques, herbicides generally do not pose a threat to water quality. Peak concentrations are usually low and do not persist for long periods of time (less than 6 months) (Neary and Michael 1996). Generally speaking, buffer strips of 15 meters (45 feet) or more are effective in minimizing pesticide residue contamination of stream flow (Neary et al. 1993). Using buffer strips can keep herbicide residue concentrations within water quality standards. They are not absolute; a buffer as large as 140 meters did not keep residues out of perennial streams in North Carolina. However, the peak concentration was 50 times lower than the water quality standard. Short-term, low-level stream contamination has been found in ephemeral to first order streams draining studied sites; the levels of herbicides in these streams has been neither of sufficient concentration nor of sufficient residence time to cause observable impacts on aquatic ecosystems (Michael et al. 2000). These studies have, with a few exceptions, confirmed the absence of significant contamination of surface water. Thus, herbicides, when used properly, can help protect water quality by reducing sediment in streams while accomplishing forest management goals.

Herbicides generally pose a low pollution risk to groundwater because of their use pattern. Applications of herbicide are used only a couple times in a stand’s rotation; once desired conditions are attained, then prescribe fire would typically be used to maintain desired site conditions. However, herbicides may be used more frequently for improving endangered species habitat. The greatest potential hazard to groundwater comes from stored concentrates, not operational application of diluted mixtures (Neary and Michael 1996). Additionally, regional, confined, groundwater aquifers are not likely to be affected by silviculture herbicides (Neary 1985). Unconfined surface aquifers in the immediate vicinity of herbicide application zones have the most potential for contamination. It is these aquifers which are directly exposed to leaching of residues from the root zone. The only known groundwater contamination incidents of an importance (contamination of bedrock aquifers, persisting more than 6 months, concentrations in excess of the water quality standard, etc.) in the southeastern United States, was where significant amounts of forestry herbicides were used, involving extremely high rates of application, or accidental spills of concentrates. In these situations, herbicide residue was detected in ground water 4 to 5 years after the contamination. These situations are no longer typical of current operational use of herbicides, established standards and guidelines minimize this contamination risk.. Proper handling precautions during herbicide transport, storage, mixing-loading, and clean-up are extremely important for preventing groundwater contamination (Neary and Michael 1996).

Herbicides applied on the forest require comprehensive risk assessments that analyze human, wildlife and environmental risk. The Forest Service generally applies only low risk herbicides chosen to minimize risk to human and wildlife health, and often uses selective treatments over broadcast treatments, and technology that minimizes spray drift. Risk assessments estimate potential off-site movement by spray drift, percolating ground water, and surface water runoff, which must be minimal to un-measurable for approved pesticides and rates of active ingredient per acre. Approved herbicides have low toxicities and short persistence, and low risk of exposure. No significant offsite exposures for humans or wildlife were predicted for approved pesticides applied at approved rates and with required mitigations. Mitigation measures include applying herbicides according to labeling information, using formulations registered by EPA and approved by the Forest Service. Based on minimal offsite movement, short half-life, lack of bioaccumulation and infrequent applications there is no unreasonable potential for direct, indirect, and cumulative impacts.

Sedimentation

Sediment is often the most appropriate measure to determine the effects of management activities on water quality (Coats and Miller 1981). Other contaminants, such as stream nutrients as result of management activities are considered minor (Beasley, Miller, and Lawson 1987).

Erosion, when delivered to streams, becomes sediment that clouds water and changes substrate characteristics. Sediment is one source of impact to water quality, specifically the amount of sediment delivered and stored within the stream channels. Sediment impacts are dependent on the amount of erosion produced by land disturbing activities, intensity and duration of storm events occurring during the activities, proximity of the activities to a stream course, and the amount of sediment actually moving into the stream channels and remaining stored. Sedimentation can adversely affect fish productivity and diversity (Alexander and Hansen 1986), degrade drinking water, and affect recreational values. Large sediment loads may block sunlight, impair photosynthesis by algae and aquatic plants, and erode gill filaments of fish and aquatic invertebrates. Once deposited, the sediment can bury aquatic plants and insects, smother eggs and prevent fry emergence in spawning gravels, and fill in deep pools that are vital for fish cover.

Habitat quality within a freshwater ecosystem is determined by activities within the watershed (Abell et al. 2000; Scott and Helfman 2001). Therefore, the influence of these activities upon habitats, or waterbodies, can be described to determine the condition of the habitat. Using the no-action alternative (or current management) as a baseline to compare other alternatives, custodial management has the lowest potential for effects, 30 percent less potential for harvest effects compared to current management levels. Enhanced Forest Health has the highest potential for effects, which is nearly double the current management harvest level. Potential effects for all alternatives as compared to current management are seen in Figure 34.

Under all alternatives, erosion control measures will be implemented to reduce the potential effects of proposed project work. To reduce soil loss from roads and improve water quality, erosion control measures may include re-shaping the road prism (where needed), scarifying roads to be closed to provide an effective seedbed, water barring, seeding and fertilizing, and gating roads to be closed. Erosion control measures will include proper timing of activities to avoid heavy equipment operation during wet weather, limit drainage crossings, and only allow necessary pre-selected drainage crossings that occur at right angles to the stream. Use of erosion control measures is specified in forest plan standards and required for all projects.

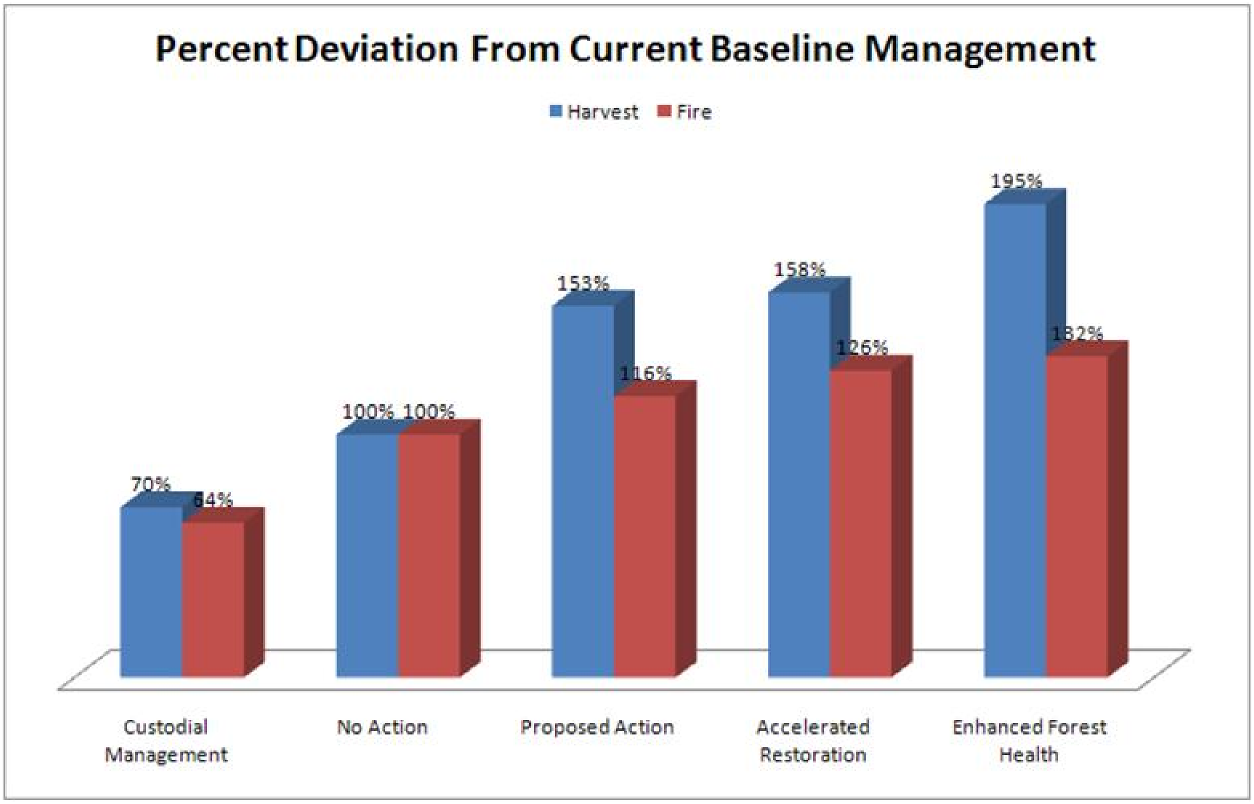


Figure 34. Percent change from current baseline management by alternative

4.3.2 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).

Sediment is an appropriate measure to determine the effects of management activities on water quality and its associated beneficial uses on National Forest System lands (Coats and Miller 1981). Sedimentation can adversely affect fish productivity and diversity (Alexander and Hansen 1986), degrade drinking water and affect recreational values. There may be other cumulative impacts such as increased water yield as a result of harvesting methods. However, water yield models do not characterize the impacts of all management activities such as road construction and the increase in water yield is generally less than the natural variability. Changes in water nutrients or nutrient fluxes within streams as a result of management activities are minor and not an appropriate indicator of cumulative effects at the forest plan level.

The Mississippi cumulative effects model uses predicted sediment yields as the surrogate for determining cumulative impacts for water quality. A valid cumulative effects analysis must be bounded in space and time. For the purposes of forest planning, 5th level watersheds (10 digit hydrologic units) are the appropriate spatial bounds for cumulative effects. The implementation period for a forest plan is 5 to 15 years, however the appropriate time period captured for the sediment model is for 5 decades (50 years).

Changes in land use and disturbances were modeled to estimated increases in sediment and predicted cumulative impacts. The significance of predicted impacts are related to criteria designed to determine levels of watershed health or watershed condition rank as described in a following section.

Watershed condition rank is a measure that characterizes the condition of 5th level watersheds with respect to current and future sediment load increases. In order to establish watershed condition rank, the current sediment average annual yield is determined and expressed as a percent above the baseline conditions. This provides a relative measure to determine changes within watersheds. The next step in this process is determined by using fish community structure with respect to predicted sediment increases to create a fish assemblage – sediment profile. A more detailed discussion of this process is found in the supporting forest plan documentation, Determining Watershed Condition for Aquatic Sustainability and Cumulative Effects at the Planning Level for National Forests of Mississippi. This score is modified by a weighted average where the watershed occurs in more than one physiographic zone.

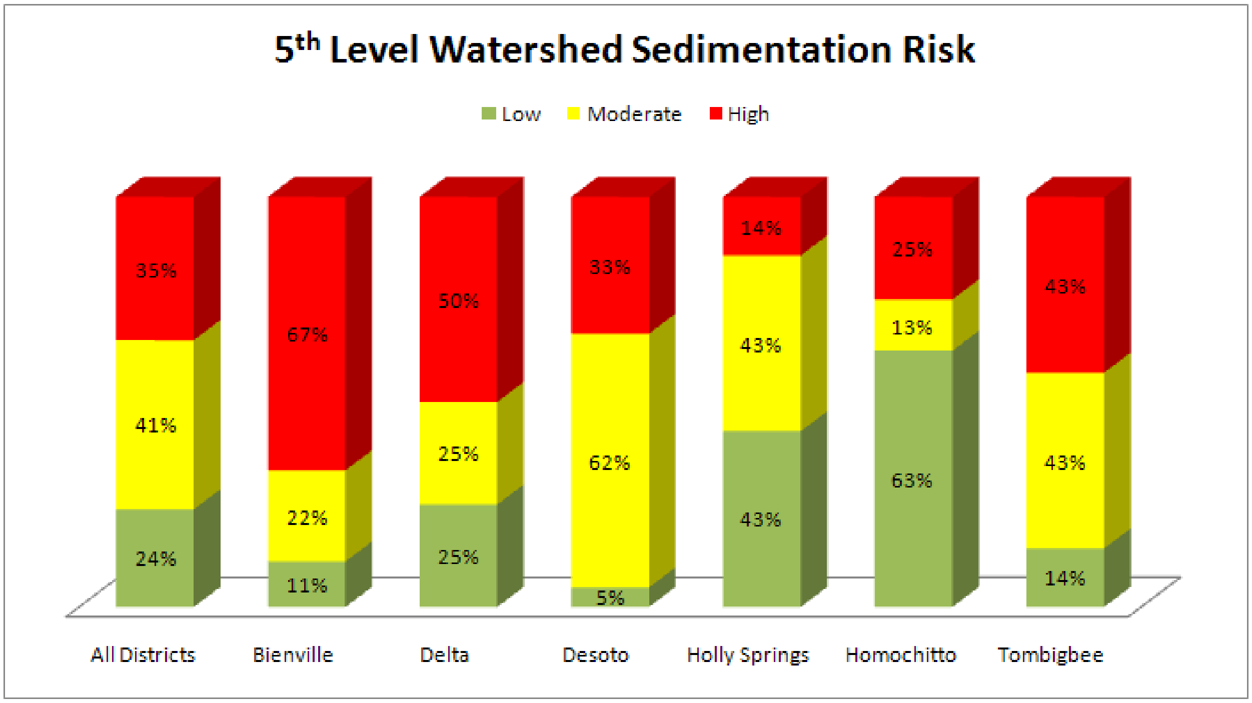


Figure 35. Proportional extent of 5th level watershed sedimentation risk by forest

Watershed condition is expressed in three categories of risk: high, medium and low. This does not necessarily translate into an excellent or poor watershed but categorizes the watersheds based on the sediment prediction/aquatic sustainability relationship. Where a watershed risk level is low, the probability (or potential) is low for adverse effects to aquatic species. If the results of planned forest actions remain within this range there should be no adverse effect on water quality with respect to beneficial uses (fish communities). Forest Service project planning objectives would be to maintain or improve aquatic health through the implementation of best management practices. Where a watershed risk level is moderate, the potential to adversely affect beneficial uses is moderate. Where a watershed risk level is high, the potential to adversely affect beneficial uses is high. In addition to ensuring that best management practices are implemented, the elements within the watershed that are contributing to the moderate or high ranking should be identified and evaluated during project planning. Priority should be placed on incorporating additional forest plan components during project planning that would seek to maintain or restore watershed health and aquatic systems. Emphasis should be placed on addressing the watershed stressors (for which the agency has control or jurisdiction) that promote healthy watershed conditions.

An evaluation based upon existing watershed conditions was evaluated then compared to a watershed evaluation which incorporated proposed and probable management activities (vegetation management, prescribe fire, road, trail and fireline construction) to achieve forest plan objectives. A comparison of all alternatives indicated that none of the fifth-level watershed condition ranks changed as result of implementing the any of alternatives. Table 59 and Figure 35 shows watershed risk level. This indicates that, at the forest level, the expected intensity of management activities planned will not result in measurable changes either beneficial or detrimental to overall watershed condition ranking.

Table 59. Predicted risk levels for all alternatives in first decade

District	HUC 10	5th Level Watershed Name	Risk Levels for Sediment (Same Risk for all Alternative)
Bienville	0317000401	Tallabogue Creek-Leaf River	Low
Bienville	0317000402	Quarterlian Creek-West Tallahala Creek	Moderate
Bienville	0317000403	Hatchapaloo Creek-Oakohay Creek	Moderate
Bienville	0317000501	Horse Creek-Tallahoma Creek	High
Bienville	0318000108	Conehatta Creek-Tuscolameta Creek	High
Bienville	0318000110	Shockaloo Creek-Tuscolameta Creek	High
Bienville	0318000201	Coffee Bogue	High
Bienville	0318000203	Pelahatchie Creek	High
Bienville	0318000207	Raspberry Creek-Strong River	High
Delta	0803020717	Silver Creek-Big Sunflower River	High
Delta	0803020719	Big Sunflower River-Little Sunflower River	High
Delta	0803020801	Collins Creek-Yazoo River	Low
Delta	0806020302	Foster Creek-Bayou Pierre	Moderate
Desoto	0317000301	Maynor Creek-Big Creek	Moderate
Desoto	0317000302	Byrd Creek-Chickasawhay River	Moderate
Desoto	0317000303	Mason Creek-Big Creek	Moderate
Desoto	0317000304	Merrill-Chickasawhay River	Moderate
Desoto	0317000504	Little Boque Homo-Boque Homo	High
Desoto	0317000505	Buck Creek-Boque Homo	Moderate
Desoto	0317000506	Beaumont-Leaf River	High
Desoto	0317000507	Little Thompson Creek-Thompson Creek	High
Desoto	0317000508	Piney Woods Creek-Gaines Creek	Moderate
Desoto	0317000509	Atkinson Creek-Leaf River	Moderate
Desoto	0317000601	Big Cedary Creek-Pascagoula River	Moderate
Desoto	0317000602	Moungers Creek-Bluff Creek	High
Desoto	0317000701	Little Black Creek-Black Creek	High
Desoto	0317000702	Beaverdam Creek-Black Creek	High
Desoto	0317000703	Flint Creek-Red Creek	High
Desoto	0317000704	Bluff Creek-Red Creek	Moderate
Desoto	0317000705	Hickory Creek-Big Black Creek	Low
Desoto	0317000804	Rocky Creek-Escatawpa River	Moderate

District	HUC 10	5th Level Watershed Name	Risk Levels for Sediment (Same Risk for all Alternative)
Desoto	0317000905	Little Biloxi-Biloxi River	Moderate
Desoto	0317000906	Tusachanie Creek-Tchoutacabouffa River	Moderate
Desoto	0317000913	Crane Creek-Wolf River	Moderate
Holly Springs	0801020706	Hurricane Creek-Muddy Creek	Moderate
Holly Springs	0801020802	Piney Creek-Hatchie River	Low
Holly Springs	0801021002	Indian Creek-Wolf River	Moderate
Holly Springs	0803020103	Cane Creek-Mud Creek	High
Holly Springs	0803020104	Hell Creek-Little Tallahatchie River	Moderate
Holly Springs	0803020106	Snow Creek-Tippah River	Low
Holly Springs	0803020107	Cypress Creek-Little Tallahatchie River	Low
Holly Springs	0803020108	Big Spring Creek-Little Tallahatchie River	Moderate
Holly Springs	0803020203	Tillatoba Creek-Panola Quitman Floodway	Moderate
Holly Springs	0803020301	Yellow Leaf Creek-Yocona River	Low
Holly Springs	0803020303	Bynum Creek-Yocona River	Low
Holly Springs	0803020401	Upper Coldwater River	High
Holly Springs	0803020503	Turkey Creek-Skuna River	Low
Holly Springs	0803020506	Cane Creek-Yalobusha River	Moderate
Homochitto	0806020306	Clarks Creek	Moderate
Homochitto	0806020501	Hurricane Creek-McCall Creek	Low
Homochitto	0806020504	Middle Fork Homochitto River	Low
Homochitto	0806020506	Wells Creek-Homochitto River	Low
Homochitto	0806020601	Little Buffalo River-Buffalo River	Low
Homochitto	0806020602	Beaver Creek-Buffalo River	Low
Homochitto	0807020202	West Fork Amite River	High
Homochitto	0807020203	Woodland Creek-Beaver Creek	High
Tombigbee	0316010202	Tallabinnela Creek	High
Tombigbee	0316010401	Upper Chuguatonchee Creek	High
Tombigbee	0316010402	Cane Creek-Houlka Creek	Moderate
Tombigbee	0316010801	Little Noxubee River-Noxubee River	Low
Tombigbee	0316010803	Yellow Creek-Noxubee River	Moderate
Tombigbee	0318000101	Tallahaga Creek	High
Tombigbee	0318000111	Tibby Creek-Yockanookay River	Moderate

The National Forests in Mississippi are comprised of six national forests administered by seven ranger districts, these National Forest System lands are interspersed with private lands and other state and federal lands. Watershed conditions were evaluated across the entire watershed delineated by fifth-level hydrologic units. In Mississippi, a total of 63 fifth-level watersheds contain some portion of National Forest System lands. The fifth-level watershed hydrologic units containing National Forest System lands ranged in size from 39,000 to 291,000 acres. The total area of fifth-order watersheds evaluated was approximately 9,280,000 acres. Of this total watershed area evaluated approximately 1,200,000 acres are National Forest System lands or approximately 13% of the area evaluated. On an individual watershed basis, the National Forest System land percentage ranged from a low of less than 0.001 percent up to a high of approximately 54 percent.

The low percentage of National Forest System land within the watersheds and anticipated level of planned activities are two primary reasons watershed condition ranks did not change. Another important reason for there being little impact (or sensitivity) to change in watershed condition rankings is that, land use classifications (percent forested, percent agriculture/urban, percent riparian area that is forested) are major determinates in the watershed condition ranking. Forest Service management activities have very little, if any, influence on affecting a change in the land use classifications occurring within the watersheds evaluated. The land use classification for National Forest System lands are not expected to change and the Forest Service does not have jurisdiction or authority to directly affect land use changes on non-National Forest System lands.

The only land use classification changes that planned Forest Service activities may influence would be the percent of forested riparian areas occurring on National Forest System lands. Attainment of forest plan desired conditions for ecological systems associated with riparian areas such as: floodplain forests, lower Mississippi River bottomland and floodplain forest, river and streams, lakes and permanent ponds, ephemeral ponds and emergent wetlands, cypress dominated wetlands, seeps, springs, and seepage swamps, and rare wetland systems, would contribute to sustaining and improving the conditions of forested riparian areas on National Forest System lands. While this may not change the overall watershed condition rank it would contribute to sustaining and improving watershed areas within national forest control.

Other important determinates (or metrics) in the watershed condition ranking include: sediment yields, point source pollutants (density of point sources), riparian habitat (road density in riparian areas, and percent forested in riparian area), altered stream flow (density of dams, road density in riparian, and density of road crossings). Forest plan components (desired conditions, objectives, and guidelines) are better suited for affecting measurable changes to these watershed condition rank determinants than to the broader land use classification determinants within any given watershed. Limited ownership and the actual location of National Forest System lands within a given watershed inhibit our ability to make measurable positive changes to the overall watershed condition ranking. However, interpretation of the watershed condition ranking analysis provides important information that aids in identifying and establishing priorities for implementation of key forest plan components that promote healthy watershed conditions.

During project design place priority on achieving watershed desired conditions to improve hydrologic conditions and provide refuge for associated species to the extent practicable given limited ownership within the watershed. All management activities should incorporate best management practices to minimize short-term impacts and expedite recovery of watershed conditions to promote water quality and enhance aquatic species viability.

The results of the watershed condition rank and other information can also be used to develop partnerships with other landholders or managers to improve overall watershed condition and improve aquatic health. This is one advantage of analyzing entire watersheds. Not only can Forest Service activities and contributing effects be isolated but other watershed effects can be identified as well.

4.4 Ecological Systems

Performance measures were identified for both terrestrial and aquatic systems, criteria were set for rating each performance measure as poor, fair, good, and very good relative to ecological sustainability. In general, poor and fair ratings indicated areas of concern for ecological system sustainability (Table 60). Rationale and sources used in making choices were recorded in the ecological sustainability evaluation tool. See Appendix G – Ecosystems and Species Diversity Report for additional information.

The primary key attributes and corresponding actions to assure the ecological sustainability of ecosystems are as follows:

- Percent acres in appropriate system type (including acres restored from previously converted system types).
- Percent of occurrences in mature open canopy conditions.
- Percent acres burned at the desired interval and seasonality/intensity.

Sustainability of some systems is driven by only some of these or other attributes. Where this is the case, the key attributes are stated in the discussion below by system.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this ecosystem to derive composite current scores and estimated scores by alternative for 1st and 5th decade intervals. These composite scores were calculated at both the unit level (appendix H) and aggregately across the Forest. Forestwide summaries of these scores for each ecosystem are presented by alternative below.

Table 60. Element condition scores

Range of Condition Score	Condition	Definition of Ecological Sustainability Evaluation Score Applied To Planning Elements
3.51 - 4.0	Very Good	Element conditions are optimal; associated species' populations should remain robust and potentially even expand.
2.51 - 3.50	Good	Element conditions are acceptable; associated species' populations should remain stable.
1.51 - 2.50	Fair	Element conditions are slightly inadequate; although associated species' populations may persist for some time, they may be subject to gradual decline.
1.00 - 1.50	Poor	Element conditions are severely inadequate. Associated species' populations are expected to severely decline; localized extirpations are occurring or are imminent.

Road and trail density is an important aspect of these data that is unlikely to change or improve over time. Many roads that cross National Forest System lands are administered under the jurisdiction of local, State, and other Federal entities and are therefore, outside of the control of the National Forests in Mississippi (Forests). Roads and trails administered by the Forests are in most cases considered essential to public access. While some roads and trails may be gated and rehabilitated if considered unessential to the public good, the overall road and trail density scores among all alternatives will change little due to the statistical weight of roads outside National Forest System jurisdiction. While road densities are a concern in some instances, in many cases road and trail scores are already in the good or very good range which is expected to continue to contribute to ecological sustainability on National Forest System lands.

4.4.1 Upland Longleaf Pine Forest and Woodland

Upland Longleaf Pine Forest and Woodland Alternatives and Effects

Upland longleaf pine forest and woodland is native to the following units:

- Bienville
- Chickasawhay
- De Soto
- Homochitto

A forestwide summary of ecological sustainability evaluation scores for upland longleaf by alternative is presented in Figure 36.

It is important to note that these scores, particularly as they relate to ecological system abundance, are measured exclusively to address fully restored upland longleaf and do not take into account the high function slash and loblolly phases of restoration. As a result, scores may appear somewhat lower than the actual condition and functionality of the systems on the ground.

As shown in Figure 36, alternatives A and B contribute little to the restoration and maintenance of upland longleaf. Alternatives C, D, and E are more successful, but will still require decades to achieve all restoration goals. Alternatives C, D, and E indicate acceptable rates of ecological sustainability by the fifth decade. Although alternatives C, D, and E are more successful, they will require decades to achieve all restoration goals.

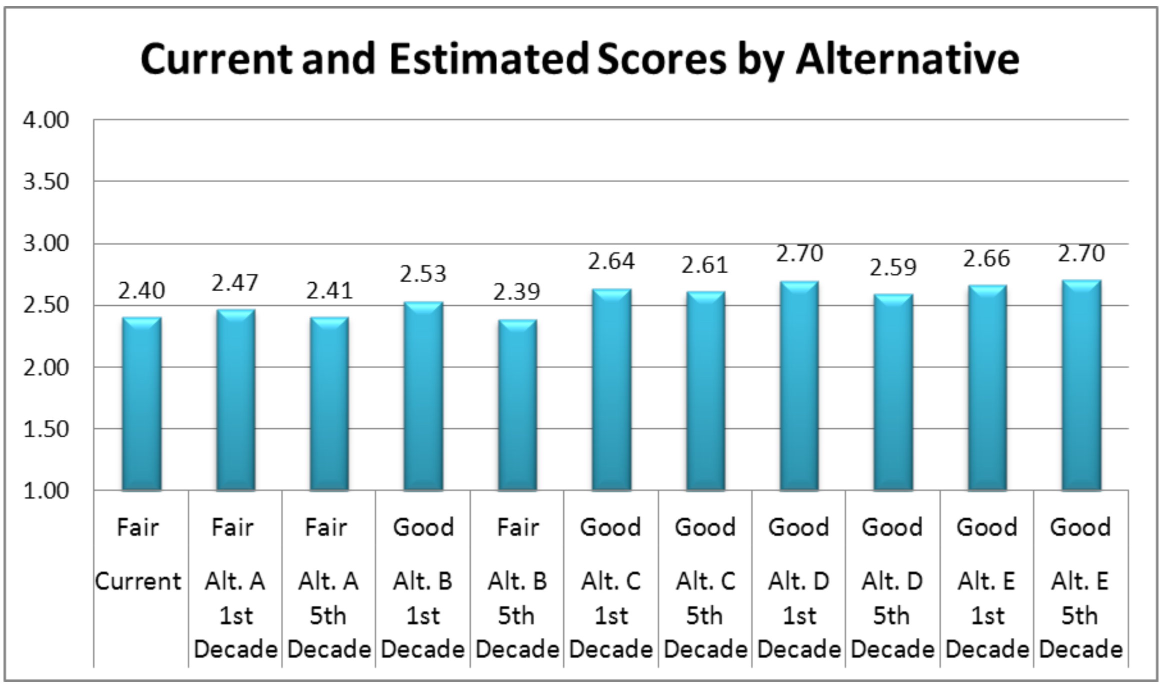


Figure 36. Forestwide upland longleaf pine forest and woodland ecological sustainability evaluation scores

The acreage being restored to upland longleaf pine ecosystem only scores “good” in even the most ambitious alternatives. These scores are due in part to the fact that less than 3 percent of the original longleaf coverage remains range-wide due to forest management practices of the 20th century. While National Forest System lands, in general, harbor more longleaf than the surrounding landscape, the National Forests in Mississippi have not been immune to longleaf decline. The amount of restoration needed to achieve and maintain a “good” rating is likely to require intensive efforts well into the 22nd century (appendix H).

Upland Longleaf Pine Forest and Woodland Environmental Effects

Restoration of this ecosystem to appropriate acres that have been previously converted to other system types or allowed to degrade is a priority in alternatives C, D, and E. The future distribution of this ecosystem on the Forests will vary across all alternatives based on management intensity and scale (acres restored through time). Restoration and maintenance activities will include prescribed fire, thinning, and offsite canopy species conversion to native longleaf.

Past management practices have favored less fire-tolerant communities normally associated with fire suppression and the introduction of offsite canopy species. Prescribed fire will alter both overstory and understory composition in favor of fire-tolerant and fire-dependent vegetative assemblages at the expense of species not normally associated with pyrogenic uplands. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with upland longleaf. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire to longleaf-associated species and communities will far outweigh any losses incurred during implementation.

Forest thinning and harvests of offsite species may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts are expected to be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals should be minimal and discountable compared to the long-term positive effects of habitat restoration.

Vehicle and machinery use and other ground disturbing activities during restoration and maintenance activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass and red-imported fire ants. Best management practices and guidelines regarding non-native invasives are expected to mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species. The proposed thinnings would reduce the average basal area of pine stands in the project area, thus reducing the risk of southern pine beetle infestation on National Forest System and private lands.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, thus lessening the risk of catastrophic fires. Habitat quality could be reduced in the vicinity restoration activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality. Changes in floral and faunal community composition can be expected as restoration sites progress through successional stages. These changes are expected to be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple seral stages.

In some cases, prescribed fire will be the only restoration method required to gradually transition mature open offsite canopies to more fire-tolerant longleaf pines. In these cases, a variety of age classes and successional stages should be present providing multiple habitat and micro-habitat opportunities for a diverse assemblage of species.

In alternatives C, D, and E the long-term effects of restoration, management, and maintenance of the ecosystem are expected to be critical to the sustainability of these communities and associated species. Over time, associated species of regional as well as local viability concern will become increasingly sustainable. In both the 1st and 5th decades of alternative A, conditions remain slightly inadequate; although associated species' populations may persist for some time, they may be subject to gradual decline. Alternative B, on the other hand, provides adequate conditions in the first decade before degrading considerably by the fifth decade.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under alternatives C, D, and E. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species. These positive impacts are less pronounced in alternative A. In alternative B, the system is expected to gradually become excessively congested with overstory and midstory densities resulting in large scale losses in abundance and diversity of important groundcover vegetation.

Considering the total amount of disturbance that has, is, and will be occurring within the Forests, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of alternatives C, D, and E will be minor while the positive impacts will be substantial.

4.4.2 Shortleaf Pine-Oak Forest and Woodland

Shortleaf Pine-Oak Forest and Woodland Alternatives and Effects

Shortleaf pine-oak forest and woodland is native to the following units:

- Ackerman
- Bienville
- Holly Springs
- Trace
- Yalobusha

A forestwide summary of ecological sustainability evaluation scores for shortleaf pine-oak forest and woodland by alternative is presented in Figure 37.

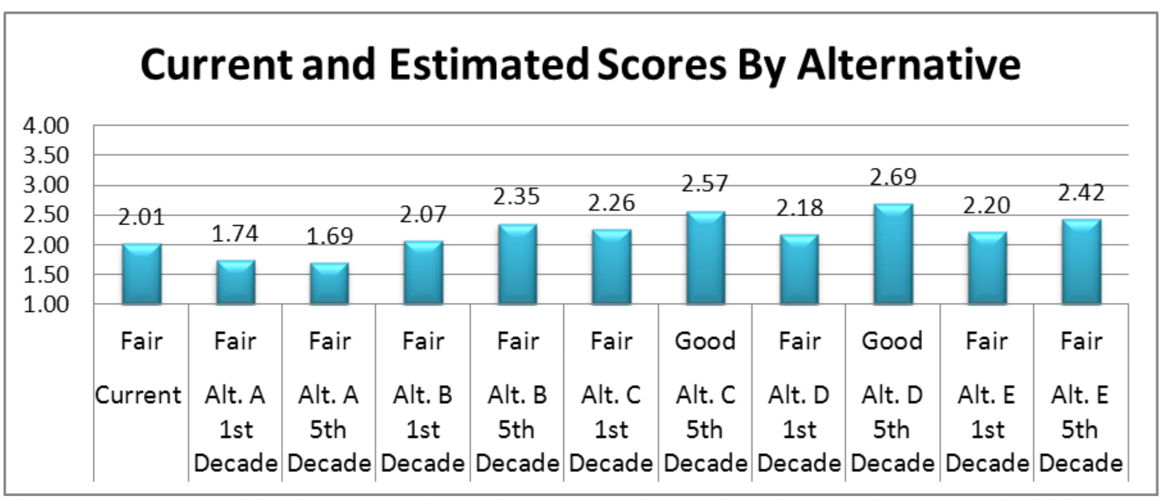


Figure 37. Forestwide shortleaf pine-oak forest and woodland ecological sustainability evaluation scores

As shown in Figure 37 alternative A contributes little to the restoration and maintenance of shortleaf-oak while alternatives B and E, shows some improvement over time but still all show a fair overall ecological sustainability evaluation score. Alternatives C and D are more successful, but will still require decades to achieve all restoration goals. Only alternatives C and D show acceptable rates of ecological sustainability by the fifth decade.

Alternative A does not increase the coverage of this ecosystem over time. In alternatives B and C, however, coverage does increase somewhat by the fifth decade. Alternatives D and E, on the other hand, contribute significantly to the increased abundance of this system (See appendix H for unit specific details).

Estimated outcomes regarding mature open conditions (appendix H) vary widely by alternative and unit. Overall, alternative D and to a lesser extent alternative E, provide the best canopy and age class conditions by the fifth decade due to more extensive thinning activities. Alternative C also provides some improvements in both decades while alternative B provides only modest improvements. Alternative A shows degradation to the system by the fifth decade.

Herbaceous-dominated understories, including grasses and forbs, are important attributes of healthy shortleaf-oak ecosystems best achieved by the application of frequent growing season fire, ideally once every one to three years (desired interval).

Shortleaf Pine-Oak Forest and Woodland Environmental Effects

Restoration of this ecosystem to appropriate acres that have been previously converted to other system types or allowed to degrade is a priority in alternatives C, D, and E. The future distribution of this ecosystem on the Forests will vary across all alternatives based on management intensity and scale (acres restored through time). Restoration and maintenance activities will include prescribed fire, thinning, and offsite canopy species conversion to native shortleaf-oak.

Past management practices have favored less fire-tolerant communities normally associated with fire suppression and the introduction of offsite canopy species. Prescribed fire will alter both overstory and understory composition in favor of fire-tolerant and fire-dependent vegetative assemblages at the expense of species not normally associated with pyrogenic uplands. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with shortleaf-oak. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire to shortleaf-oak-associated species and communities will far outweigh any losses incurred during implementation.

Forest thinning and harvests of offsite species may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat restoration.

Vehicle and machinery use and other ground disturbing activities during restoration and maintenance activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives are expected to mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species. The proposed thinnings would reduce the average basal area of pine stands in the project area, thus reducing the risk of southern pine beetle infestation on National Forest System and private lands.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, thus lessening the risk of catastrophic fires. Habitat quality could be reduced in the vicinity restoration activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality. Changes in floral and faunal community composition can be expected as restoration sites progress through successional stages. These changes are expected to be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple seral stages.

In some cases, prescribed fire will be the only restoration method required to gradually transition mature open offsite canopies to more fire-tolerant shortleaf-oak systems. In these cases, a variety of age classes and successional stages should be present providing multiple habitat and micro-habitat opportunities for a diverse assemblage of species.

In alternatives C, D, and E the long-term effects of restoration, management, and maintenance of the ecosystem are expected to be critical to the sustainability of these communities and associated species. Over time, associated species of regional as well as local viability concern will become increasingly sustainable. In both the first and fifth decades of alternative A, conditions are inadequate. Alternatives B and E provide “Fair” conditions in the first and fifth decades without achieving “good” or “very good” ratings in the foreseeable future. Alternatives C and D, on the other hand, achieve sustainable levels by the fifth decade.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under alternatives C and D. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species. These positive impacts are not present in alternative A. In alternatives B and E, ecosystem health is expected to remain relatively static with gradual declines of associated species likely.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of alternatives C and D will be minor while the positive impacts will be substantial.

4.4.3 Loblolly Forest

Loblolly Forest Alternatives and Effects

While loblolly pine trees are native to the southern and central portions of Mississippi, pure loblolly forests are historically rare and usually non-native on upland site types. Loblolly pine forest, introduced in most cases, is currently found on the following units:

- Ackerman
- Bienville
- Chickasawhay
- De Soto
- Holly Springs
- Homochitto
- Trace
- Yalobusha

A forestwide summary of ecological sustainability evaluation scores for loblolly pine forest by alternative is presented in Figure 38.

As shown in Figure 38, alternatives A and B contribute little to the restoration loblolly pine forest to native ecosystems while alternatives C, D, and E, are more successful achieving acceptable ratings forestwide by the first decade, but will still require decades to achieve all restoration goals. The intention of the attributes and indicators used to derive these scores is the reduction of this ecosystem's coverage and the restoration to native systems. Positive trends in these scores should reflect progress towards these goals.

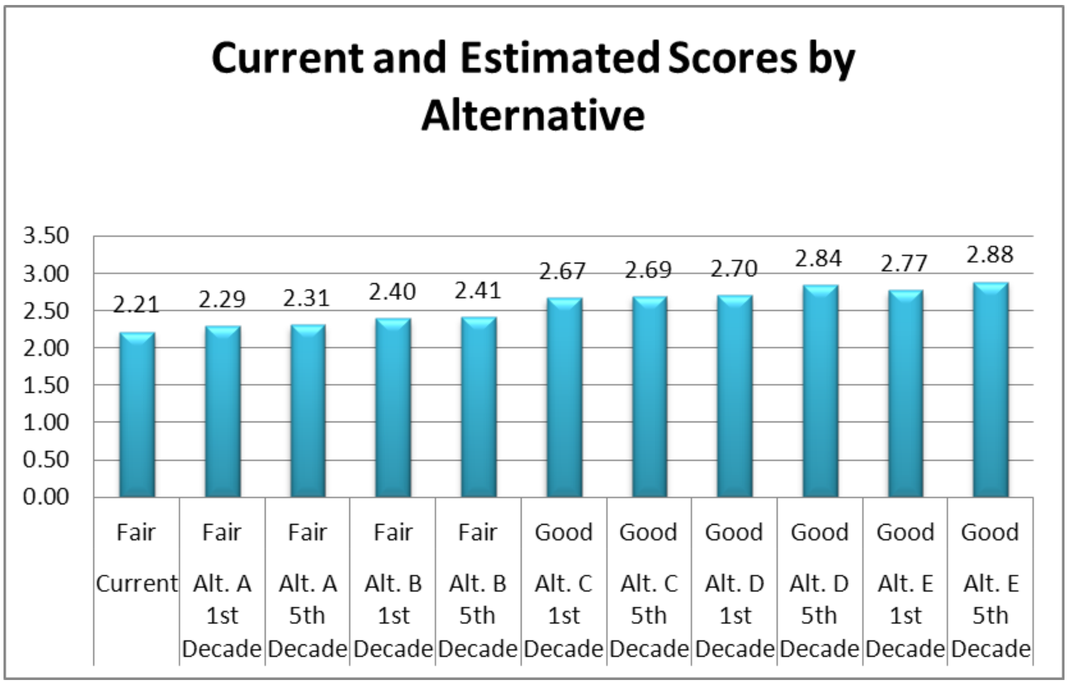


Figure 38. Forestwide loblolly pine forest ecological sustainability evaluation scores

As loblolly forests are restored to native ecosystems, the remaining loblolly forest acreage decreases becoming easier to manage for desired structural conditions. Where loblolly forest currently exists or is not yet restored at any given time, the desired condition of occurrences is canopy closure of less than 80 percent and trees 60 years old and older in order to achieve high function conditions that emulate mature native ecosystem types such as longleaf. Under all alternatives, occurrences extant at any given time are in most cases not meeting the criteria for mature open conditions based on thinning, with the exception of the Chickasawhay Unit. Due to the massive spatial extent of loblolly pine forest on most units, thinning operations are unlikely to be completed prior to restoration to longleaf. Thinned loblolly pine forest tends to revert to closed canopy conditions over time if not periodically re-thinned thus creating a cycle of thinning needs that is extremely difficult to successfully meet at the scale required.

Fire frequency and seasonality/intensity goals also become easier as loblolly forest coverage decreases.

Loblolly Forest Environmental Effects

Restoration of loblolly forest to native ecosystems is a priority in alternatives C, D, and E. The future distribution of this ecosystem on the Forests will vary across all alternatives based on management intensity and scale (acres restored through time). Restoration and maintenance activities will include prescribed fire, thinning, and restoring to native ecosystems.

Loblolly pine is less fire-tolerant, especially when young, than native upland pines. Prescribed fire will alter both overstory and understory composition in favor of fire-tolerant and fire-dependent vegetative assemblages at the expense of species not normally associated with pyrogenic uplands. Accordingly, some direct mortality of less fire-tolerant species, including loblolly, is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will far outweigh any losses incurred during implementation.

Forest thinning and loblolly harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts are expected to be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat restoration.

Vehicle and machinery use and other ground disturbing activities during restoration and maintenance activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives are expected to mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species. The proposed thinnings would reduce the average basal area of pine stands in the project area, thus reducing the risk of southern pine beetle infestation on National Forest System and private lands.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, thus lessening the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of restoration activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality. Changes in floral and faunal community composition can be expected as restoration sites progress through successional stages. These changes are expected to be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In some cases, prescribed fire will be the only restoration method required to gradually transition mature open loblolly to more fire-tolerant native systems. In these cases, a variety of age classes and successional stages should be present providing multiple habitat and micro-habitat opportunities for a diverse assemblage of species.

In alternatives C, D, and E the long-term effects of restoration, management, and maintenance of the ecosystem are expected to be critical to the sustainability of native communities and associated species. Over time, associated species of regional as well as local viability concern will become increasingly sustainable as loblolly acreage decreases and the remaining acres of loblolly are managed in a high function, mature open condition.

In both the first and fifth decades of alternative A and B, conditions are inadequate. Alternatives C, D, and E, on the other hand, achieve and maintain sustainable levels in both decades.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under alternatives C, D, and E. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species. These positive impacts are not present in alternatives A or B, where gradual declines of associated species are likely.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of alternatives C, D, and E will be minor while the positive impacts will be substantial.

4.4.4 Southern Loblolly-Hardwood Flatwoods

Southern Loblolly-Hardwood Flatwoods Alternatives and Effects

While loblolly pine trees are native to the southern and central portions of Mississippi, pure loblolly forests are historically rare and usually non-native on upland site types. Loblolly pine forest, introduced in most cases, is currently found on the following units:

- Bienville

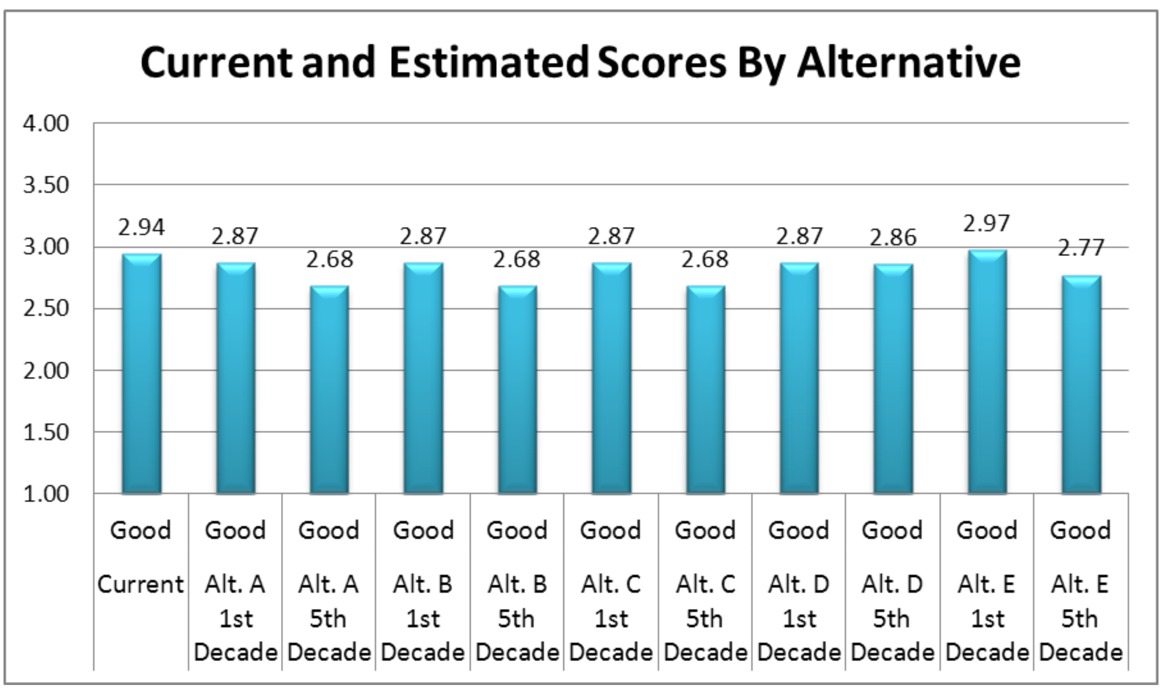


Figure 39. Forestwide southern loblolly-hardwood flatwoods forest ecological sustainability evaluation scores

The primary key attributes and corresponding actions to assure the ecological sustainability are as follows:

- Percent of occurrences in mature open canopy conditions (Figure 40)
- Percent acres burned at the desired interval and seasonality/intensity (Figure 41 and Figure 42).

A forestwide summary of ecological sustainability evaluation scores for loblolly pine forest by alternative is presented in Figure 39.

As shown in Figure 39, all alternatives are successful achieving acceptable ratings forestwide by the first and fifth decades.

The Bienville Unit contains red-cockaded woodpecker populations in loblolly forest which takes precedence over longleaf restoration. In this case, loblolly forest should not be removed until suitable mature longleaf stands are available nearby for red-cockaded woodpecker.

The number of acres in the system already meets and perhaps exceeds the desired acreage based on site type. Any overages can likely be attributed to woody encroachment from this system onto what would likely be Jackson Prairie soils. Restoration of the Jackson Prairie ecosystem may reduce coverage of southern loblolly pine-hardwood flatwoods. Any reductions in coverage will be minor and the spatial extent is expected to remain in "very good" condition across all alternatives and decades.

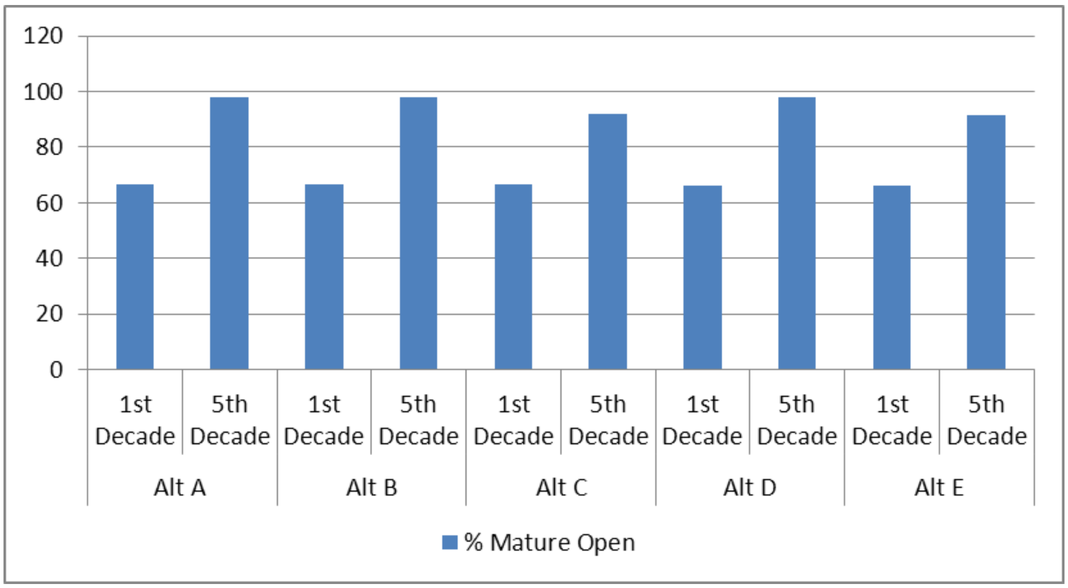


Figure 40. Southern loblolly-hardwood flatwoods forest percent mature open

The mature open canopy attributes of this ecosystem are in "fair" condition across all alternatives in the first decade (Figure 40). Because the pine dominated occurrences of this ecosystem are being managed for red-cockaded woodpecker, the mature open attribute is expected to score "very good" in all alternatives by the fifth decade.

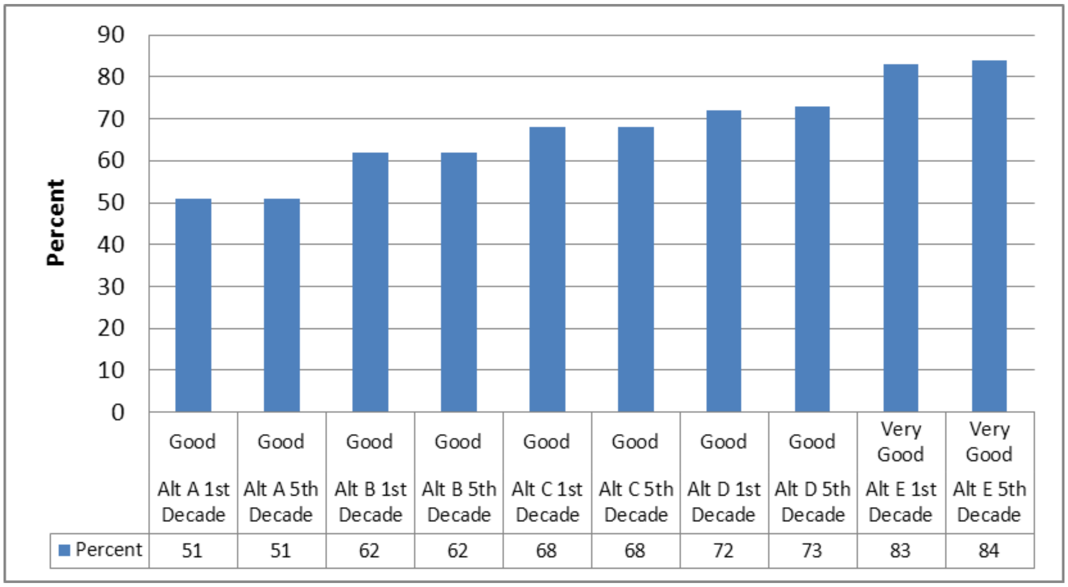


Figure 41. Percent of southern loblolly-hardwood flatwoods forest burned at desired interval by alternative

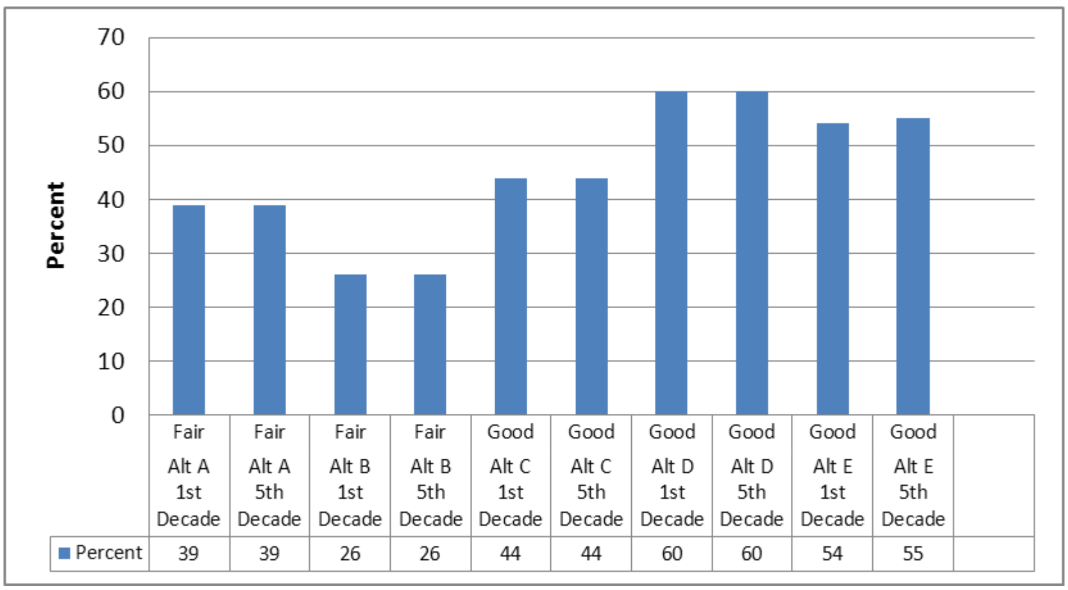


Figure 42. Percent of southern loblolly-hardwood flatwoods forest burned in the growing season by alternative

As shown in Figure 41 and Figure 42, fire frequency is “good” in alternatives A, B, C, and D for all decades. “Very good” status is achieved for alternative E for both decades. Fire seasonality is “fair” in alternatives A and B for both decades and “good” in alternatives C, D, and E.

Southern Loblolly-Hardwood Flatwoods Environmental Effects

Management of this ecosystem’s sustainability is a priority in all alternatives. Management activities will include prescribed fire, thinning, and regeneration as stands reach senescence.

Prescribed fire is assumed to be essential to maintenance of structural and compositional attributes of this ecosystem. Accordingly, some direct mortality of less fire-tolerant species, including loblolly, is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Forest thinnings and loblolly harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts are expected to be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives are expected to mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species. Thinnings would reduce the average basal area of pine stands in the project area, thus reducing the risk of southern pine beetle infestation on National Forest System and private lands.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, thus lessening the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of restoration activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality. Changes in floral and faunal community composition can be expected as regeneration sites progress through successional stages. These changes are expected to be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In all alternatives, the long-term effects of ecosystem management are expected to be critical to the sustainability of native communities and associated species. Over time, associated species of regional as well as of local viability concern are expected to remain sustainable.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of all alternatives will be minor while the positive impacts will be substantial.

4.4.5 Slash Pine Forest

Slash Pine Forest Alternatives and Effects

While slash pine trees are native to the southern portions of Mississippi, pure slash forests are historically very rare and non-native on upland site types. Slash pine forest, introduced in most cases, is currently found on the following units:

- Ackerman
- Chickasawhay
- De Soto
- Trace
- Yalobusha

The primary key attributes and corresponding actions to assure the ecological sustainability are as follows:

- Percent acres in appropriate system type (including acres restored to native system types.
- Percent of occurrences in mature open canopy conditions.

A forestwide summary of ecological sustainability evaluation scores for slash pine forest by alternative is presented in Figure 43.

The intention of the attributes and indicators used to derive these scores is the reduction of this ecosystem’s coverage and the restoration to native systems. Positive trends in these scores should reflect progress towards these goals.

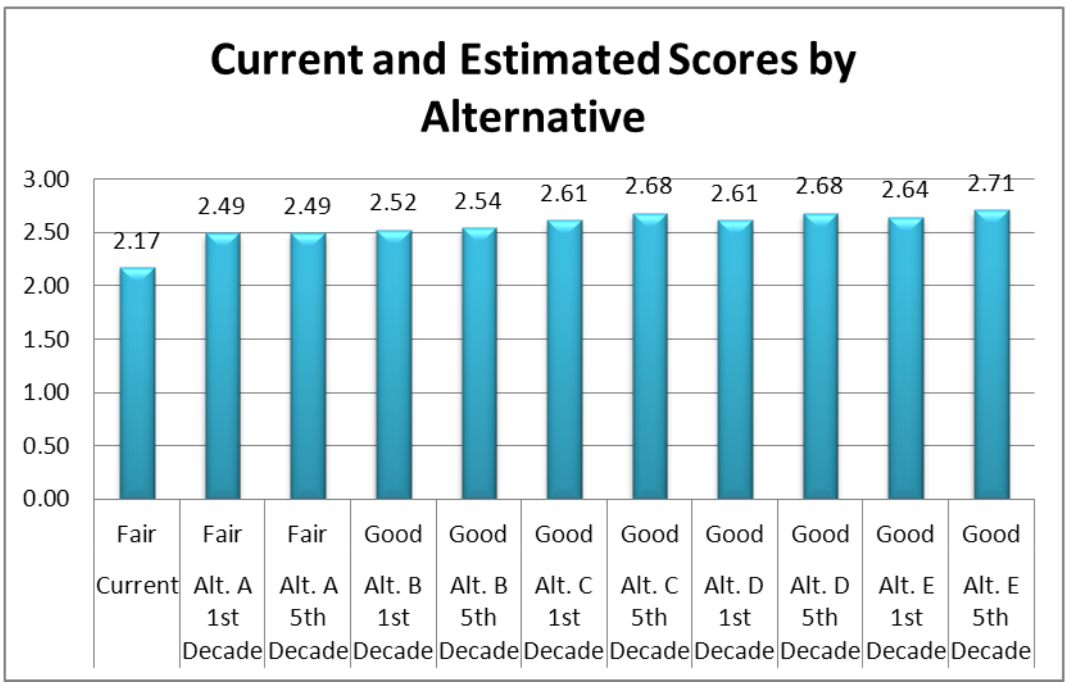


Figure 43. Forestwide slash pine forest ecological sustainability evaluation scores

As shown in Figure 43, alternative A contributes little to the restoration of slash pine forest to native ecosystems while alternatives B, C, D, and E, are more successful achieving acceptable ratings forestwide by the 1st decade, but will still require decades to achieve all restoration goals.

As slash pine forests are restored to native ecosystems, the remaining slash pine forest acreage decreases becoming easier to manage for desired structural conditions. Where slash pine forest currently exists or is not yet restored at any given time, the desired condition of occurrences is canopy closure of less than 80 percent and trees 60 years old and older in order to achieve high function conditions that emulate mature native ecosystem types such as longleaf. Under all alternatives, occurrences extant at any given time do not, in most cases, meet the criteria for mature open conditions based on thinning, with the exception of the Chickasawhay Unit in the fifth decade of alternative E (appendix H). Due to the massive spatial extent of slash pine forest on some southern units, thinning operations are unlikely to be completed prior to restoration of longleaf. Thinned slash pine forest tends to revert to closed canopy conditions over time if not periodically re-thinned thus creating a cycle of thinning needs that is extremely difficult to successfully meet at the scale required.

Fire frequency and seasonality/intensity goals also become easier as slash pine forest coverage decreases. Frequency goals are met with all alternatives on both units scoring “good” or “very good” with the highest scores concentrated in alternatives C, D, and E. Alternative A meets “good” status by the fifth decade for seasonality/intensity. Alternative B achieves only “fair” status for fire seasonality and intensity. All other alternatives show general improvement in fire seasonality and intensity by the first decade achieving “good” scores and in some cases “very good” by the fifth decade (appendix H).

Slash Pine Forest Environmental Effects

Restoration of slash pine forest to native ecosystems is a priority in alternatives C, D, and E. The future distribution of this ecosystem on the Forests will vary across all alternatives based on management intensity and scale (acres restored through time). Restoration and maintenance activities will include prescribed fire, thinning, and restoring to native ecosystems.

Slash pine is less fire-tolerant, especially when young, than native upland pines. Prescribed fire will alter both overstory and understory composition in favor of fire-tolerant and fire-dependent vegetative assemblages at the expense of species not normally associated with fire-dependent uplands. Accordingly, some direct mortality of less fire-tolerant species, including slash pine, is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will far outweigh any losses incurred during implementation.

Forest thinning and slash pine harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts are expected to be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat restoration.

Vehicle and machinery use and other ground disturbing activities during restoration and maintenance activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives are expected to mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species. The proposed thinnings would reduce the average basal area of pine stands in the project area, thus reducing the risk of southern pine beetle infestation on National Forest System and private lands.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, thus lessening the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of restoration activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality. Changes in floral and faunal community composition can be expected as restoration sites progress through successional stages. These changes should be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In some cases, prescribed fire will be the only restoration method required to gradually transition mature open slash pine to more fire-tolerant native systems. In these cases, a variety of age classes and successional stages should be present providing multiple habitat and micro-habitat opportunities for a diverse assemblage of species.

In alternatives B, C, D, and E the long-term effects of restoration, management, and maintenance of the ecosystem are expected to be critical to the sustainability of native communities and associated species. Over time, associated species of regional as well as local viability concern will become increasingly sustainable as slash pine acreage decreases and the remaining acres receive appropriate fire frequency and seasonality/intensity. No alternative meets the percent mature open canopy requirements based on estimated thinning.

In both the first and fifth decades of alternative A, conditions are inadequate. Alternatives B, C, D, and E, on the other hand, achieve and maintain sustainable levels in both decades.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under alternatives B, C, D, and E. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species. These positive impacts are not present in alternative A, where gradual declines of associated species are possible.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of alternatives B, C, D, and E will be minor while the positive impacts will be substantial.

4.4.6 Northern Dry Upland Hardwood Forest

Northern Dry Upland Hardwood Forest Alternatives and Effects

Northern dry upland hardwood forest is currently found on the following units:

- Ackerman
- Holly Springs
- Trace
- Yalobusha

A forestwide summary of ecological sustainability evaluation scores for northern dry upland hardwood forest by alternative is presented in Figure 44.

As shown in Figure 44, alternatives A and E will only rate as “fair” for both decades and contribute little to the management of northern dry upland hardwood forest. Alternatives B, C, and D will all reach a rating of “good” by the fifth decade with alternative C having the highest overall score value.

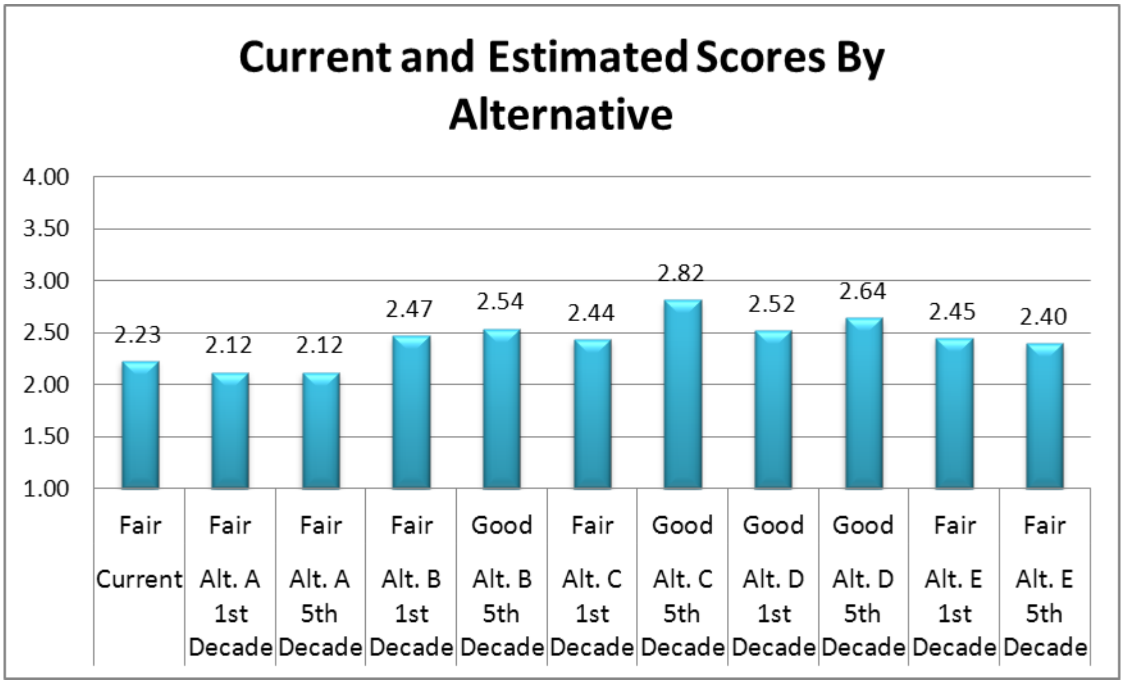


Figure 44. Forestwide northern dry upland hardwood forest ecological sustainability evaluation scores

Northern dry upland hardwoods are generally intermingled among the dominant pine ecosystems. As a result, this system will be exposed to prescribed fire with the same frequency and seasonality/intensity. Because this system burns less readily than the surrounding pine dominated systems, it is difficult to predict whether or not upland hardwoods will actually burn when exposed to fire. While it is fairly easy to predict interval of fire exposure, the actual burn rates may vary. It is especially difficult to predict seasonality and intensity due to the differences in ground cover moisture regimes between upland hardwoods and surrounding pine systems. It is considered natural and an ecologically appropriate attribute of fire behavior for embedded hardwood communities to burn at rates lower than fire exposure rates. Due to the challenges described above, fire frequency and seasonality cannot be predicted with confidence and is not estimated. Alternative A includes no prescribed fire for this ecosystem. Alternative B meets the lower end of “fair” on the Holly Springs and Yalobusha Units while meeting the upper end of “fair” on the Ackerman and Trace Units concerning burn interval. Alternative C allows for increased fire frequency compared to the latter alternatives but only reaches the upper end of “fair” value. Alternative D meets the upper end of “fair” on the Holly Springs and Yalobusha Units while meeting “good” on the Ackerman and Trace Units concerning burn interval. Alternative E meets “good” on all units (appendix H).

Northern Dry Upland Hardwood Forest Environmental Effects

Management activities will include prescribed fire, thinning, and regeneration. Prescribed fire is assumed to be essential to maintenance of structural and compositional attributes of this ecosystem. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Forest thinnings and harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts are expected to be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives are expected to mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, thus lessening the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality. Changes in floral and faunal community composition can be expected as regeneration sites progress through successional stages. These changes are expected to be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In alternatives B, C, and D, the long-term effects of ecosystem management should be sustainable for native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable. In alternatives A and E, this system will not achieve sustainability of native communities and associated species.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives except alternative A which includes no management to this system. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species in alternatives B, C, and D.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of alternatives B, C, and D will be minor while the positive impacts will be substantial. Alternatives A and E will have negative impacts on species and communities in the long run due to little management of the system in alternative A and too much regeneration in alternative E.

4.4.7 Southern Dry Upland Hardwood Forest

Southern Dry Upland Hardwood Forest Alternatives and Effects

Southern dry upland hardwood forest is currently found on the following units:

- Bienville
- Chickasawhay
- De Soto
- Homochitto

The primary key attributes and corresponding actions to assure the ecological sustainability are as follows:

- Percent acres in appropriate system type (including acres restored from previously converted system types).

A forestwide summary of ecological sustainability evaluation scores for southern dry upland hardwood forest by alternative is presented in Figure 45.

As shown in Figure 45, all alternative scores by decade remain with a "good" overall ecological sustainability evaluation score despite little management due to few management needs for this system.

The percent of southern dry upland hardwood forest in appropriate system does not change in each unit by alternative and time (appendix H). This ecosystem is not the highest priority to restore to appropriate system on the Forests. The Bienville, Chickasawhay, and De Soto Units are all rated "very good" for this attribute. The Homochitto will remain poor concerning percent of ecosystem in appropriate system due to priority on this unit is upland longleaf restoration.

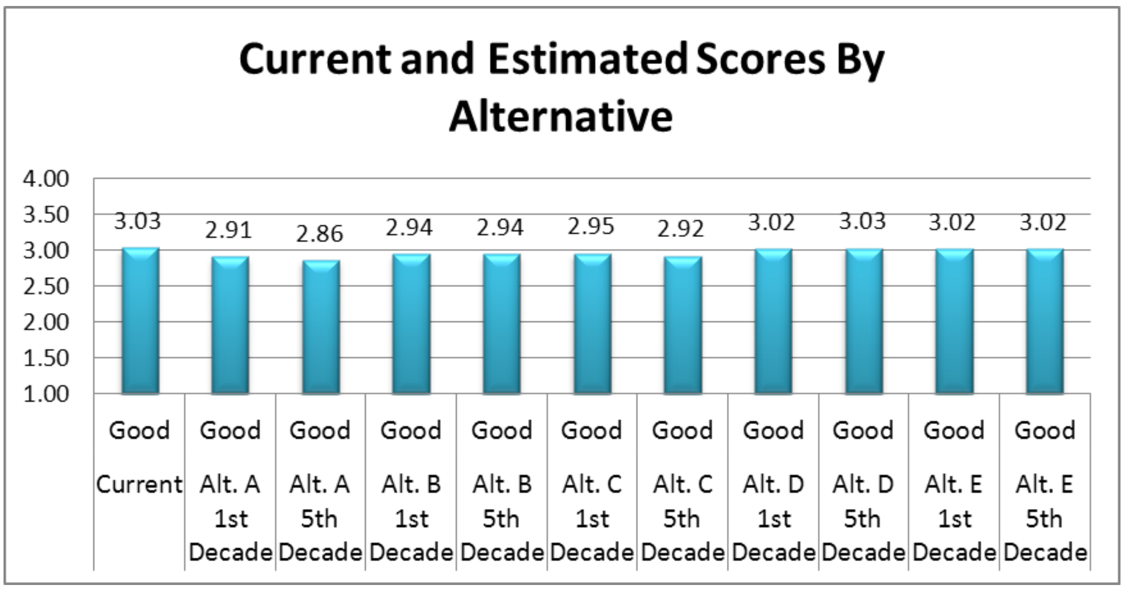


Figure 45. Forestwide southern dry upland hardwood forest ecological sustainability evaluation scores

Southern Dry Upland Hardwood Forest Environmental Effects

Management activities will include prescribed fire and maintaining the ecosystem at its current abundance across the Forests over time. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Regeneration will be primarily allowed to occur naturally or as a result of salvage operations in the wake of natural disturbances. In cases where managed regeneration may be required, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to manage this ecosystem (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals should be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

4.4.8 Southern Loess Bluff Forest

Southern Loess Bluff Forest Alternatives and Effects

Southern loess bluff forest is currently found on the following unit:

- Homochitto

The primary key attribute and corresponding action to assure ecological sustainability for this ecosystem is as follows:

- Percent acres in appropriate system type (including acres restored from previously converted system types).

A forestwide summary of ecological sustainability evaluation scores for southern loess bluff forest by alternative is presented in Figure 46.

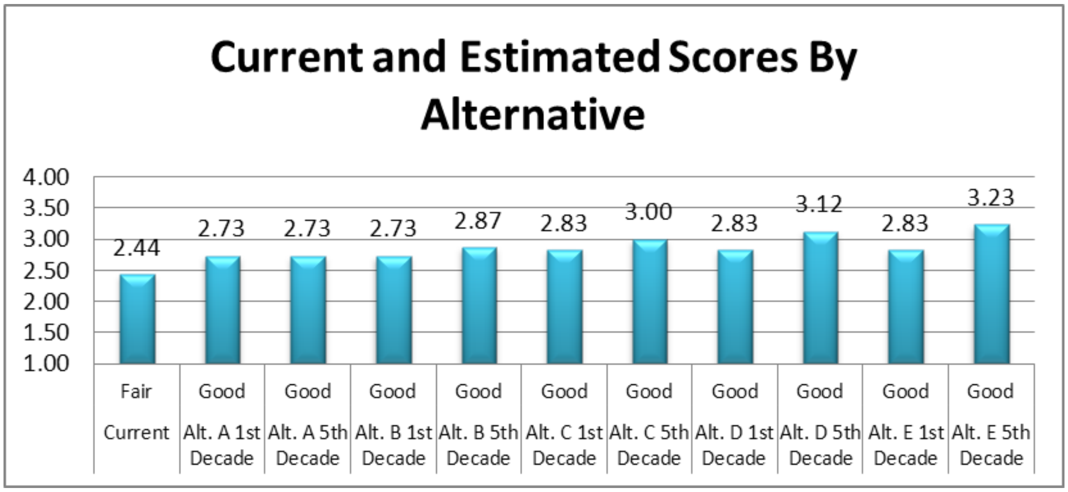


Figure 46. Forestwide southern loess bluff forest ecological sustainability evaluation scores by alternative

As shown in Figure 46, all alternative scores by decade remain with a good overall ecological sustainability evaluation score despite little management due to few management needs for this system.

The percent of southern loess bluff forest in appropriate system (Figure 47) remains in poor condition for all alternatives in the first decade. By the fifth decade, however, alternative A is the only alternative that remains in the same state because the alternative's management strategy favors natural succession and low intensive forest health management strategies. Alternative B increases its rating to fair while alternative C improves to a good rating and alternatives D and E both increase to a rating of very good. By the fifth decade, alternative B has begun to increase in acres while this attribute has become sustainable in alternative C. Alternatives D and E have reached overall percent in appropriate system goals due to each alternative's increased restoration activities compared to other alternatives.

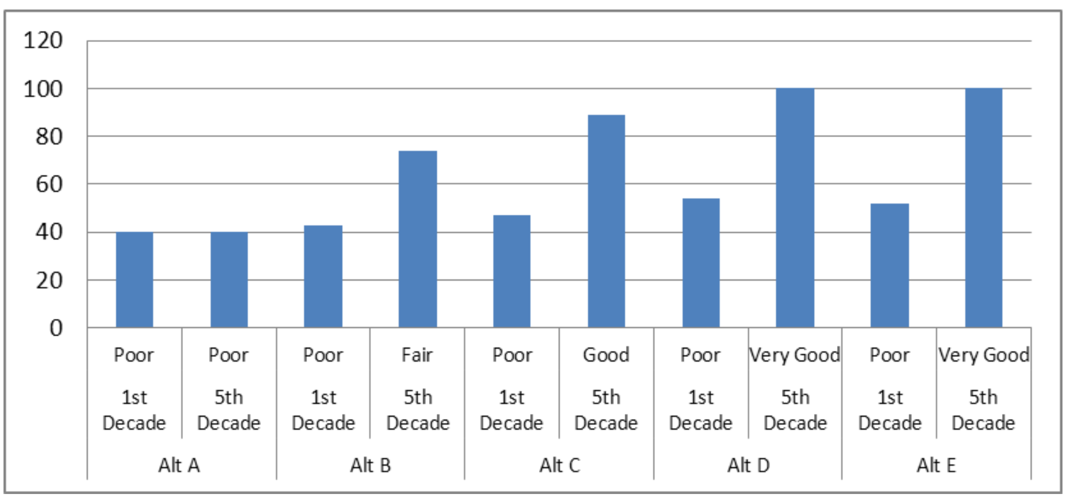


Figure 47. Percent of southern loess bluff forest at appropriate system by alternative

Southern Loess Bluff Forest Environmental Effects

Management activities will include prescribed fire and maintaining ecosystem abundance across the Forests over time. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Regeneration will be primarily natural or as a result of salvage operations in the wake of natural disturbances. In cases where managed regeneration may be required, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to manage this ecosystem (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals should be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern should remain sustainable.

4.4.9 Southern Mesic Slope Forest

Southern Mesic Slope Forest Alternatives and Effects

Southern mesic slope forest is currently found on the following units:

- Bienville
- Chickasawhay
- De Soto
- Homochitto

The primary key attribute and corresponding action to assure ecological sustainability for this ecosystem is as follows:

- Percent acres in appropriate system type (including acres restored from previously converted system types).

A forestwide summary of ecological sustainability evaluation scores for southern mesic slope forest by alternative is presented in Figure 48.

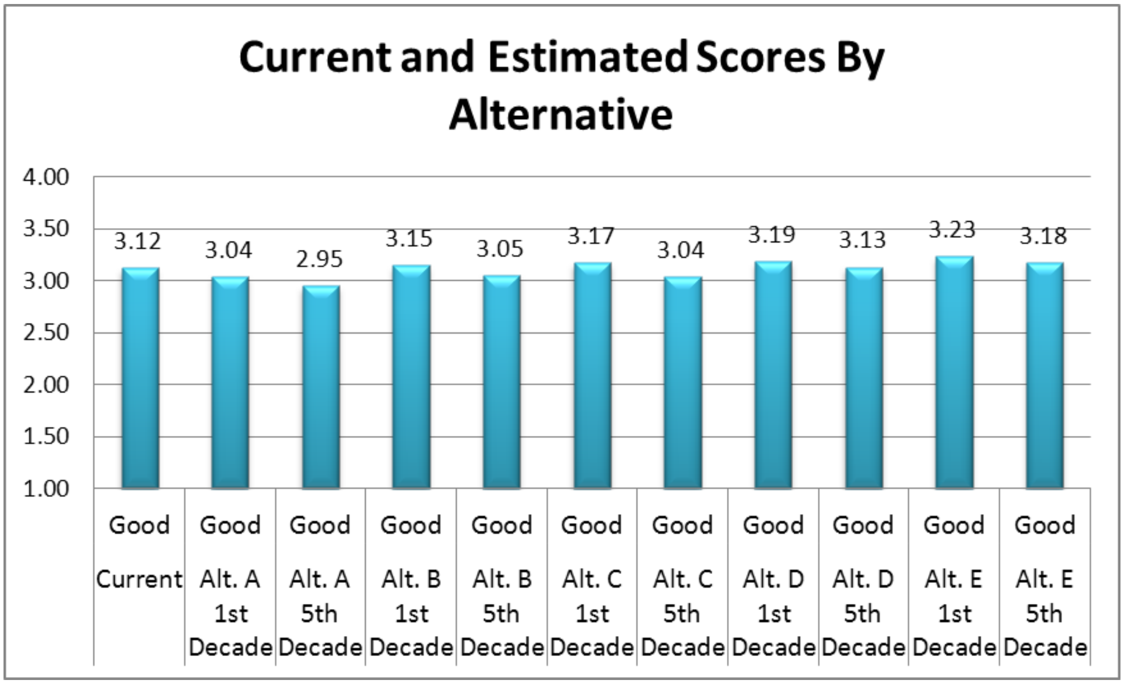


Figure 48. Forestwide southern mesic slope forest ecological sustainability evaluation scores

All alternative scores by decade remain with a good overall ecological sustainability evaluation score despite little management due to few management needs for this system.

The ratings for percent of southern mesic slope forest in appropriate system do not change from fair on the Chickasawhay and Homochitto Units by alternative and time. This ecosystem is not a high priority to restore to appropriate system on these units. This attribute remains poor in alternatives A and B on the Desoto Unit and becomes fair in alternatives C, D, and E which can be attributed to conversion from slash pine forest to appropriate systems in the latter alternatives. On the Bienville Unit, alternatives A, B, and C are all rated as good for each time interval because the system on this unit is already in good condition and no change is expected. Alternatives D and E become very good through time since both alternatives are driven by increased restoration or increased timber management (appendix H).

Southern Mesic Slope Forest Environmental Effects

Management activities will include prescribed fire and maintaining ecosystem abundance across the Forests over time. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Regeneration will be primarily allowed to occur naturally or as a result of salvage operations in the wake of natural disturbances. In cases where managed regeneration may be required, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used during management of this ecosystem (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals should be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Prescribed burnings would reduce the forest fuel, thus lessening the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern should remain sustainable.

4.4.10 Northern Mesic Hardwood Forest

Northern Mesic Hardwood Forest Alternatives and Effects

Northern mesic slope forest is currently found on the following units:

- Ackerman
- Holly Springs
- Trace
- Yalobusha

The primary key attribute and corresponding action to assure ecological sustainability for this ecosystem is as follows:

- Percent acres in appropriate system type (including acres restored from previously converted system types).

A forestwide summary of ecological sustainability evaluation scores for northern mesic slope forest by alternative is presented in Figure 49.

All overall ecological sustainability evaluation alternative scores by decade remain with a good overall ecological sustainability evaluation score despite little management due to few management needs for this system (Figure 49).

The primary key attribute and corresponding action to assure ecological sustainability for this ecosystem is percent acres in appropriate system type (including acres restored from previously converted system types).

The ratings for percent of northern mesic slope forest in appropriate system do not change from poor in alternative A while changes are seen with this attribute to fair in alternatives B, C, D, and E on the Ackerman and Trace Units in the fifth decade. This attribute remains very good in all alternatives on the Holly Springs and Yalobusha Units through time since the percent of this system in appropriate acres goals have already been reached and will not significantly change by alternative and time (appendix H).

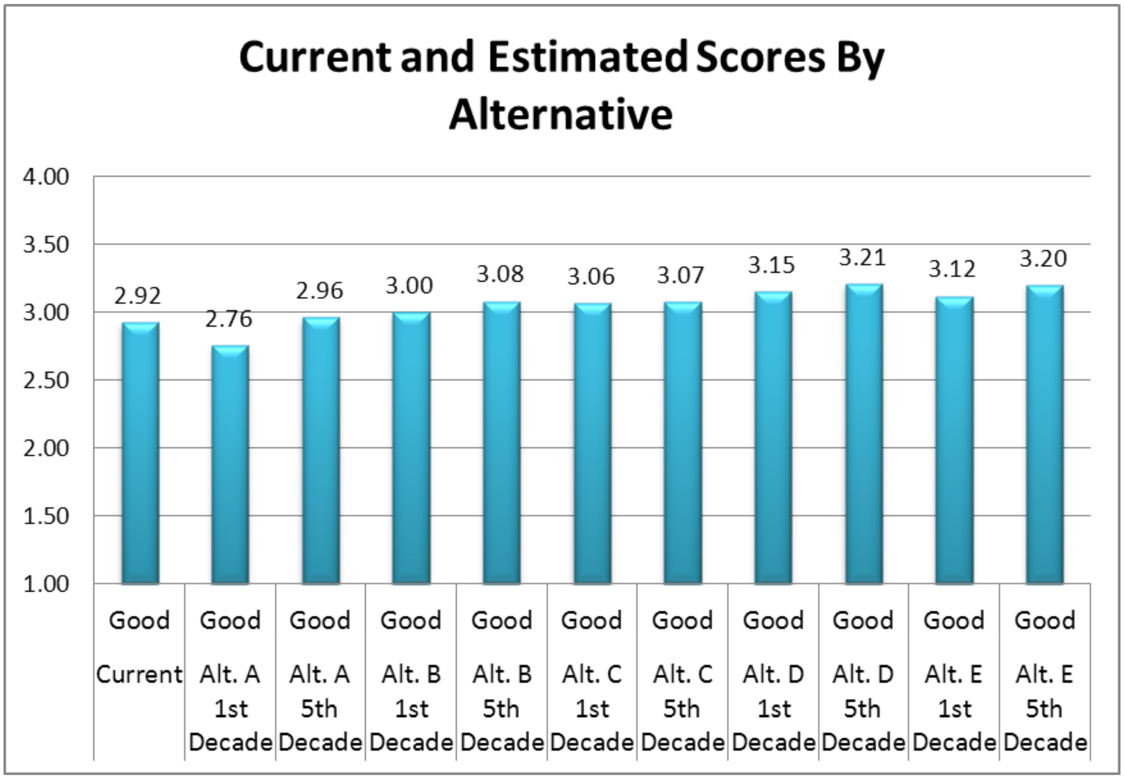


Figure 49. Forestwide northern mesic hardwood forest ecological sustainability evaluation scores

Northern Mesic Hardwood Forest Environmental Effects

Management activities will include prescribed fire and maintaining ecosystem abundance across the Forests over time. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Regeneration will be primarily allowed to occur naturally or as a result of salvage operations in the wake of natural disturbances. In cases where managed regeneration may be required, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used in the management of this ecosystem (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals should be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Prescribed burning would reduce the forest fuel, thus lessening the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

4.4.11 Floodplain Forest

Floodplain Forest Alternatives and Effects

Floodplain forest is currently found on the following units:

- Ackerman
- Bienville
- Chickasawhay
- De Soto
- Holly Springs
- Homochitto
- Trace
- Yalobusha

The primary key attribute and corresponding action to assure ecological sustainability for this ecosystem is as follows:

- Percent acres in appropriate system type (including acres restored from previously converted system types).

A forestwide summary of ecological sustainability evaluation scores for floodplain forest by alternative is presented in Figure 50.

All overall ecological sustainability evaluation alternative scores by decade remain with a good overall ecological sustainability evaluation score despite little management due to few management needs for this system (Figure 50).

The ratings for percent of floodplain forest in appropriate system do not change from poor in all alternatives on the Ackerman, De Soto, and Trace Units and remain fair on the Bienville for all alternatives. These units show no change by alternative because floodplain forest restoration is not a priority for these units. On the Holly Springs and Yalobusha Units, this attribute remains at poor in alternatives A, B, and C while and becomes fair condition in alternatives D and E which shows that some offsite pine will be restored to this ecosystem in these accelerated restoration and enhanced forest health alternatives. Alternative C shows changes in the Homochitto and Chickasawhay Units from poor to fair which is expected with the all of the offsite pine being restored to natural systems. The Homochitto Unit also shows a rating of fair in alternative D for the same reason. Since priorities are to restore offsite pine to appropriate systems in alternatives C, D, and E and to some extent in alternative B, this ecosystem is not expected to change much in relation to this attribute in the next half century (appendix H).

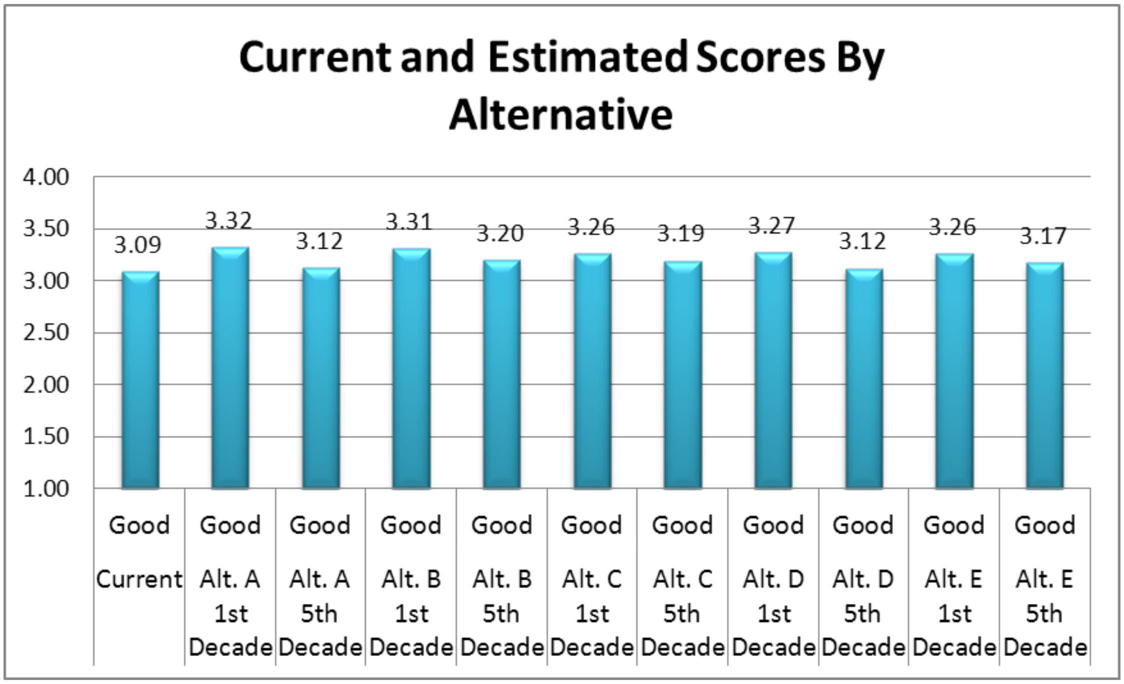


Figure 50. Forestwide floodplain forest ecological sustainability evaluation scores

Floodplain Forest Environmental Effects

Management activities will include low intensity prescribed fire over a relatively long interval and maintaining ecosystem abundance across the Forests over time. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Regeneration will be primarily allowed to occur naturally or as a result of salvage operations in the wake of natural disturbances. In cases where managed regeneration may be required, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used during management of this ecosystem (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals should be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern should remain sustainable.

4.4.12 Lower Mississippi River Bottomland and Floodplain Forest

Lower Mississippi River Bottomland and Floodplain Forest Alternatives and Effects

Lower Mississippi bottomland and floodplain forest is currently found on the following unit:

- Delta

The primary key attributes and corresponding actions to assure ecological sustainability for this ecosystem are as follows:

- Percent occurrence in regeneration
- Percent occurrence in mature forest

A forestwide summary of ecological sustainability evaluation scores for lower Mississippi bottomland and floodplain forest by alternative is presented in Figure 51.

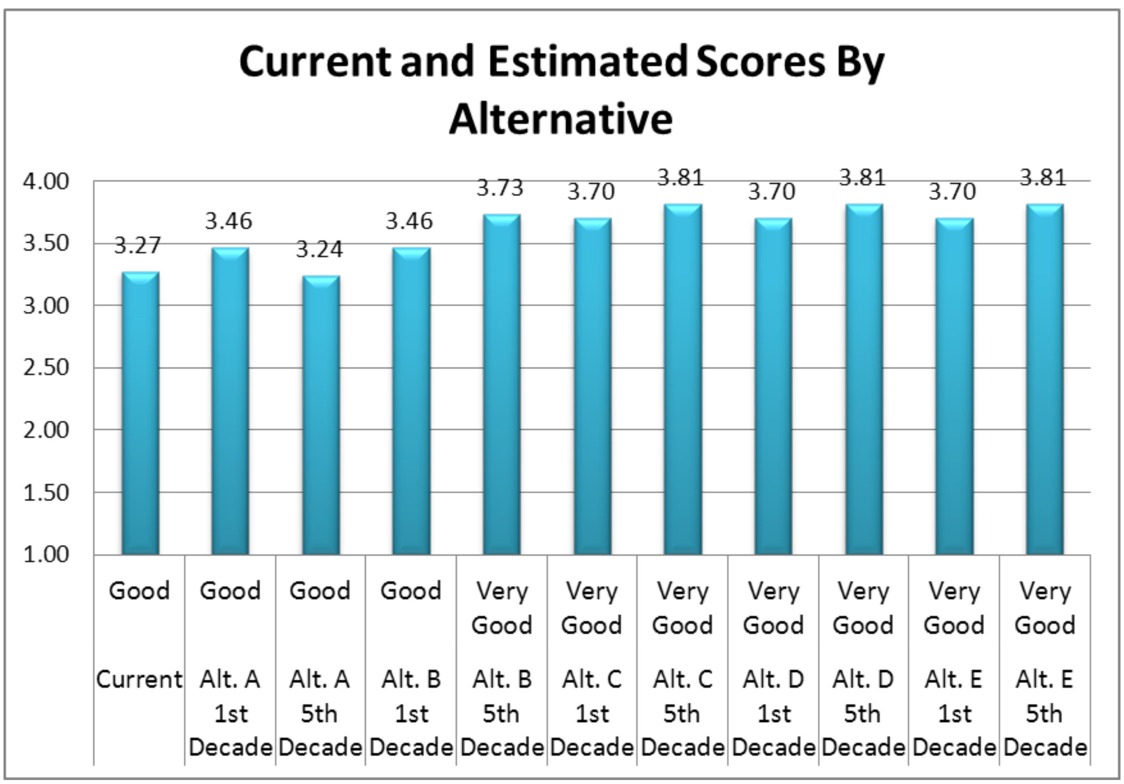


Figure 51. Forestwide lower Mississippi bottomland and floodplain forest ecological sustainability evaluation scores

As shown in Figure 51, alternative scores by decade remain with a good overall ecological sustainability evaluation score in alternative A, while rated as very good by the fifth decade in alternatives B, C, D, and E. This change is can be correlated to differences in percent regeneration and percent mature forest between these alternatives.

As seen in Figure 52, the ratings for percent regenerating lower Mississippi bottomland and floodplain forest remain poor in alternative A. This system is not a priority in alternative A which can also be seen in Figure 53 where it is shown that the percent of system in mature forest is also in poor condition by the fifth decade showing the trend that no management is being accomplished and age diversity decreases with time. Alternative B shows an increase in regeneration shifting from poor in the first decade to good by the fifth decade thus allowing for age diversity which is portrayed with a very good rating in the percent mature attribute. Alternatives C, D, and E all rate very good by the fifth decade for both attributes showing balanced management in the system creating regenerating forest and age diversity.

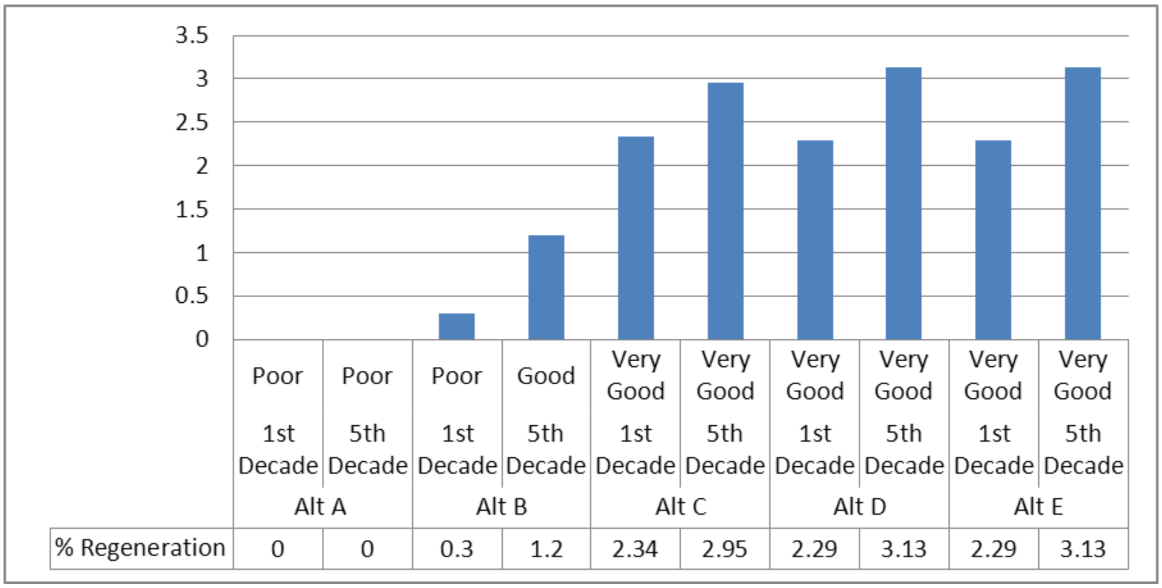


Figure 52. Forestwide lower Mississippi bottomland and floodplain percent regeneration by alternative

Lower Mississippi River Bottomland and Floodplain Forest Environmental Effects

Management activities will include a variety of regeneration practices and maintaining ecosystem abundance across the Forests over time. Accordingly, some direct mortality may occur to achieve community structures normally found in association with native ecosystems. Regeneration will be allowed to occur naturally and through thinnings, gap creation, irregular even-aged regeneration, and uneven-aged management regeneration were identified as important management activities to promote and maintain the desired ecological system structural conditions. In cases where managed regeneration is required, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used during management of this ecosystem (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

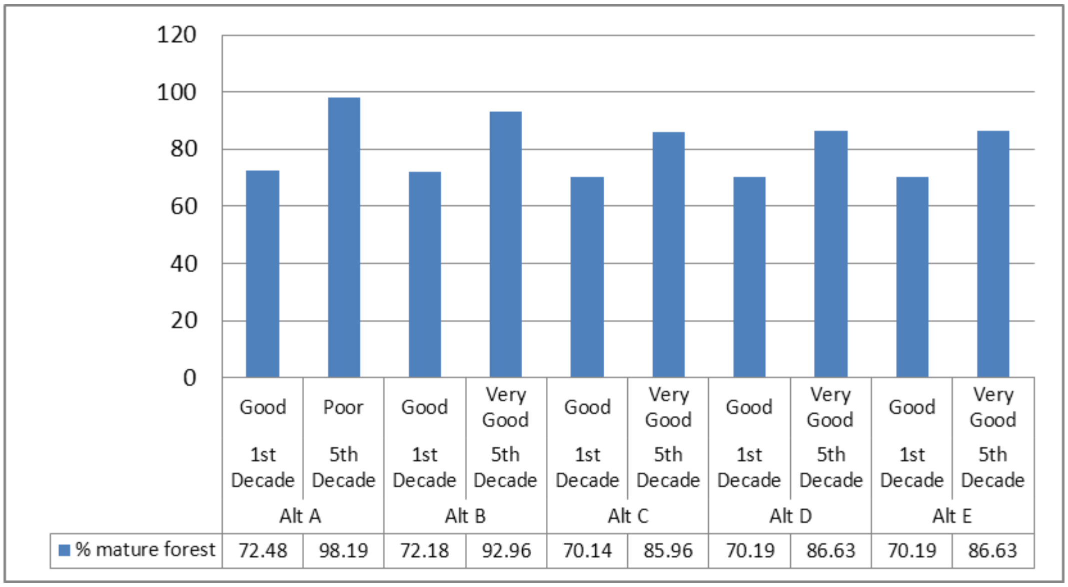


Figure 53. Forestwide lower Mississippi bottomland and floodplain percent mature forest by alternative

In all cases, short-term negative effects to individual plants and animals should be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality.

In alternative A, the long-term effects of ecosystem management should result in sustainable native communities and associated species. In alternatives B, C, D, and E, the long-term effects of management for this system are optimal; associated species' populations should remain robust and potentially even expand locally and aid with the species' sustainability regionally.

4.4.13 Near-coast Pine Flatwoods

Near-coast Pine Flatwoods Alternatives and Effects

Near-coast pine flatwoods is currently found on the following unit:

- De Soto

A forestwide summary of ecological sustainability evaluation scores for near-coast pine flatwoods by alternative is presented in Figure 54.

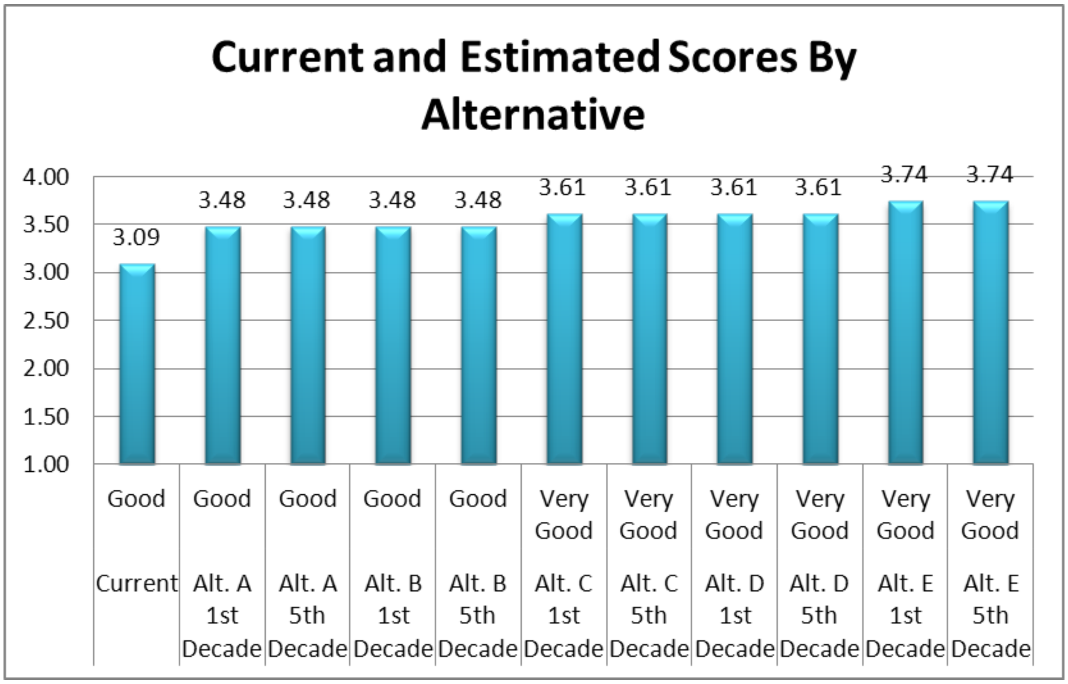


Figure 54. Forestwide near-coast pine flatwoods forest ecological sustainability evaluation scores

As shown in Figure 54, alternatives A and B remain in good condition as are current conditions while alternatives C, D, and E, are more successful achieving very good overall ecological sustainability evaluation scores by the fifth decade. Although good and very good ratings are reached by all alternatives in overall ecological sustainability evaluation scores, this system will still require decades to achieve all restoration goals such as percent open canopy (Figure 55) which remains in poor condition for all alternatives although alternatives C, D, and E seem to show a trend of increasing percent open canopy through thinning operations and ecosystem restoration.

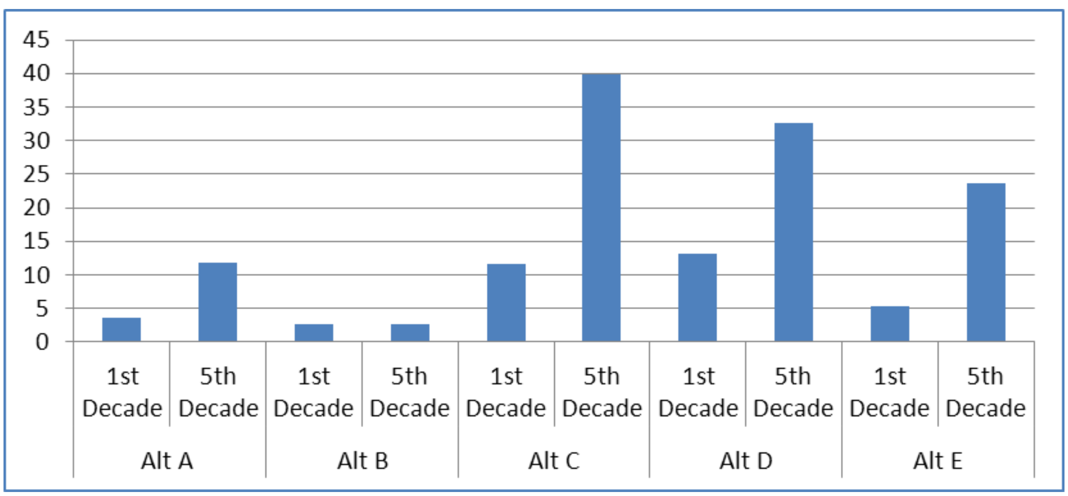


Figure 55. Percent of near-coast pine flatwoods in mature open canopy condition

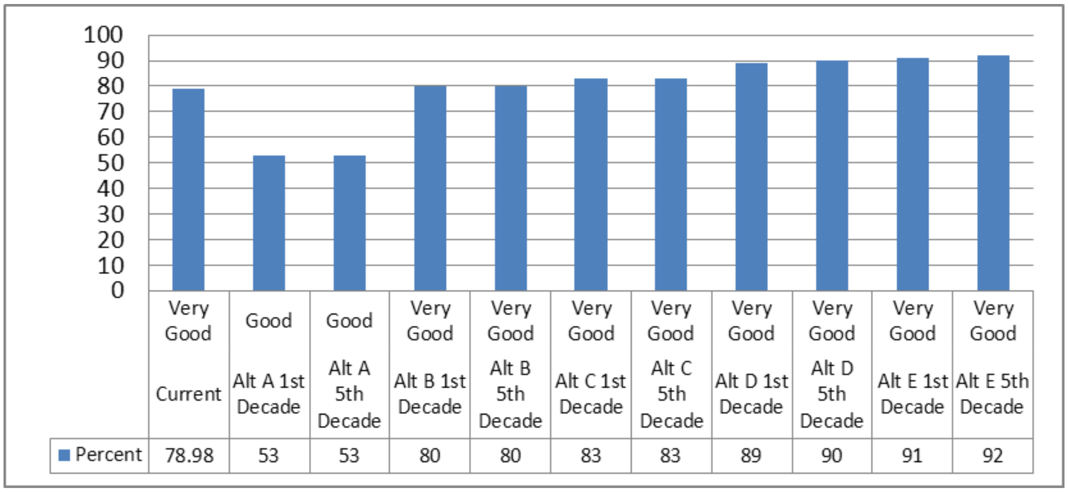


Figure 56. Percent of near-coast pine flatwoods forest burned at desired interval by alternative

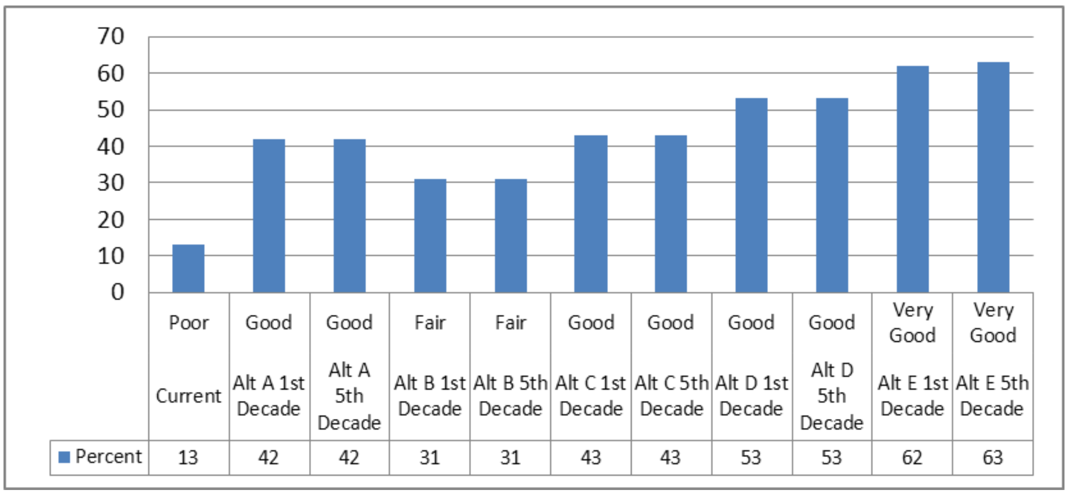


Figure 57. Percent of near-coast pine flatwoods forest burned during the growing season by alternative

Figure 56 and Figure 57 show fire regime variables by alternative. Herbaceous-dominated under-stories, including grasses and forbs, are important attributes of healthy near-coast pine ecosystems best achieved by the application of frequent growing season fire, ideally once every one to three years (desired interval). These data show that both fire frequency and seasonality and intensity, in most cases, are well within the good to very good range except alternative B which only reaches a fair growing season burn condition. Growing season prescribed fire is in good condition in alternatives A, C, and D while alternative E reached a very good condition.

Near-coast Pine Flatwoods Environmental Effects

Management activities will include prescribed fire, thinning, and regeneration. Prescribed fire is assumed to be essential to maintenance of structural and compositional attributes of this ecosystem. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Forest thinnings and harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts are expected to be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals should be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burning would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality. Changes in floral and faunal community composition can be expected as regeneration sites progress through successional stages. These changes are expected to be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In alternatives A and B, the long-term effects of ecosystem management are expected to result in sustainable native communities and associated species. In alternatives C, D, and E, the long-term effects of management for this system are optimal; associated species' populations should remain robust and potentially even expand locally and aid with the species' sustainability regionally.

4.4.14 Xeric Sandhills

Xeric Sandhills Alternatives and Effects

Xeric sandhills are native to the following units:

- Chickasawhay
- De Soto

The primary key attributes and corresponding actions to assure the ecological sustainability are as follows:

- Percent acres burned at the desired interval and seasonality/intensity.

A forestwide summary of ecological sustainability evaluation scores for xeric sandhills by alternative is presented in Figure 58.

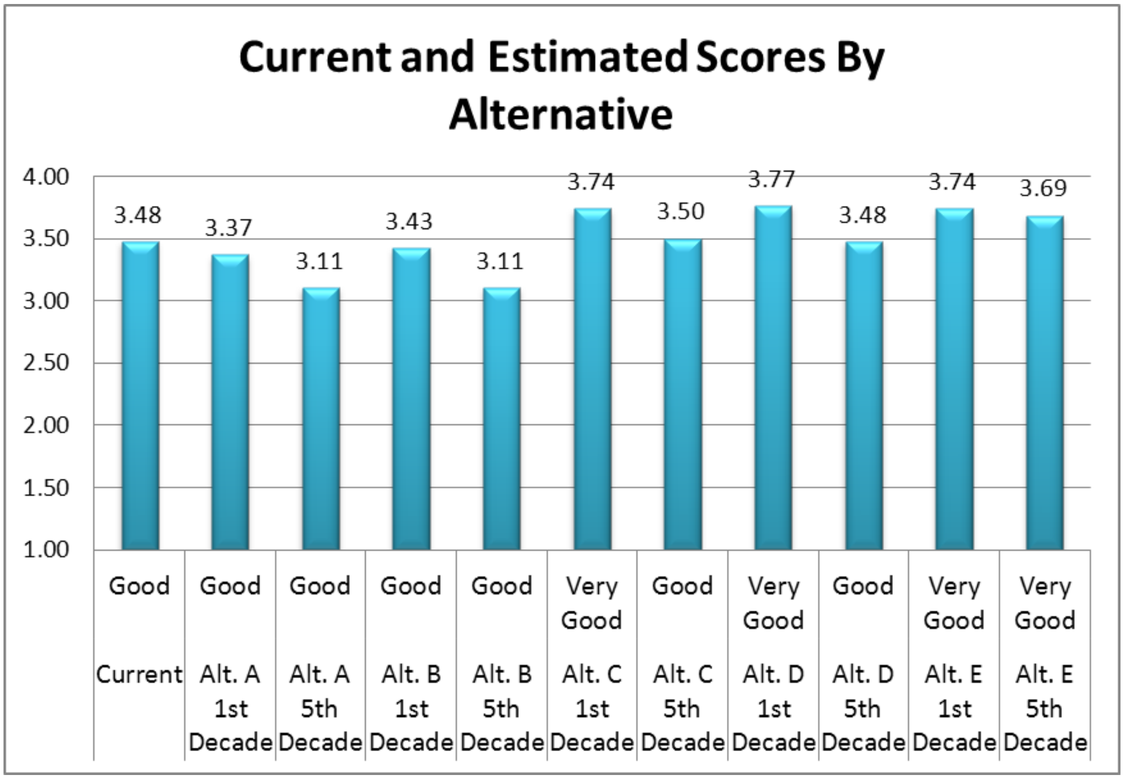


Figure 58. Forestwide xeric sandhills ecological sustainability evaluation scores

As shown in Figure 58, alternatives A, B, C, and D contribute to the restoration and maintenance of this system with overall ecological sustainability evaluation scores of good. Alternative E is even more successful, but will still require decades to achieve all restoration goals. All alternatives show acceptable rates of ecological sustainability by the fifth decade.

Herbaceous dominated under-stories, including grasses and forbs, are important attributes of healthy longleaf ecosystems best achieved by the application of frequent growing season fire, ideally once every one to three years (desired interval). Data show that both fire frequency and seasonality and intensity, in most cases, are well within the good to very good range and increase respectively from alternatives C thru E.

Xeric Sandhills Environmental Effects

Management activities will include prescribed fire, thinning, and regeneration. Prescribed fire is assumed to be essential to maintenance of structural and compositional attributes of this ecosystem. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Forest thinnings and harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals should be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives should mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burning would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality. Changes in floral and faunal community composition can be expected as regeneration sites progress through successional stages. These changes should be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In alternatives A, B, C, and D, the long-term effects of ecosystem management are expected to result in sustainable native communities and associated species. In alternative E, the long-term effects of management for this system are optimal; associated species' populations should remain robust and potentially even expand locally and aid with the species' sustainability regionally.

4.4.15 Rock Outcrops

Rock Outcrops Alternatives and Effects

Rock outcrops are native to the following units:

- Ackerman
- Bienville
- Holly Springs
- Homochitto
- Trace
- Yalobusha

All overall ecological sustainability evaluation scores were calculated as very good for this system for all alternatives and all time intervals, but there are many data needs for this system including distribution, frequency, and occurrence across the Forests.

Rock Outcrops Environmental Effects

Management activities will include low intensity prescribed fire over a relatively long interval at the same frequency as the surrounding matrix community and maintaining ecosystem abundance across the Forest over time. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems in which this community is embedded. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Where timber operations including thinning, regeneration, and salvage operations in the wake of natural disturbances in the surrounding matrix community may be required, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used during management of this ecosystem (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties. Note that where this embedded ecosystem is found, it will be protected by National Forests in Mississippi.

In all cases, short-term negative effects to individual plants and animals should be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities in surrounding matrix communities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives are expected to mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern should remain sustainable.

4.4.16 Black Belt Calcareous Prairie and Woodland

Black Belt Calcareous Prairie and Woodland Alternatives and Effects

Black belt calcareous prairie and woodland is native to the Trace Unit.

The primary key attributes and corresponding actions to assure the ecological sustainability are as follows:

- Percent acres in appropriate system type (including acres restored to native system types)
- Percent acres burned at the desired interval, seasonality and intensity

A forestwide summary of ecological sustainability evaluation scores for black belt calcareous prairie and woodland by alternative is presented in Figure 59.

As shown in Figure 59, alternative A contributes little to the restoration of black belt calcareous prairie and woodlands while alternatives B, C, D, and E, are more successful achieving acceptable ratings. Alternative A does not allow for any restoration of the system through time. All other alternatives will completely restore this prairie system to appropriate acres by the first decade (Figure 60).

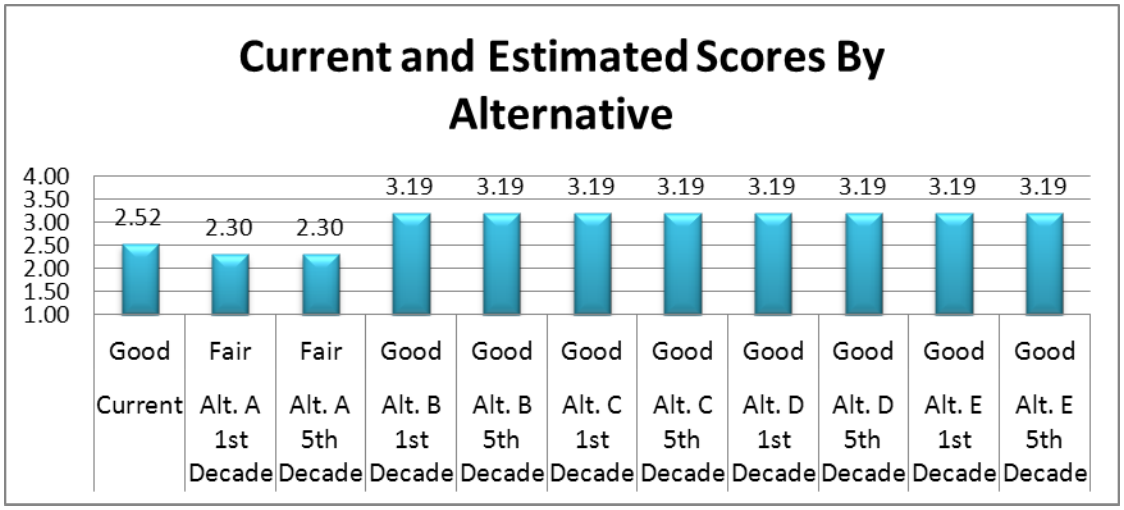


Figure 59. Forestwide black belt calcareous prairie and woodland ecological sustainability evaluation scores

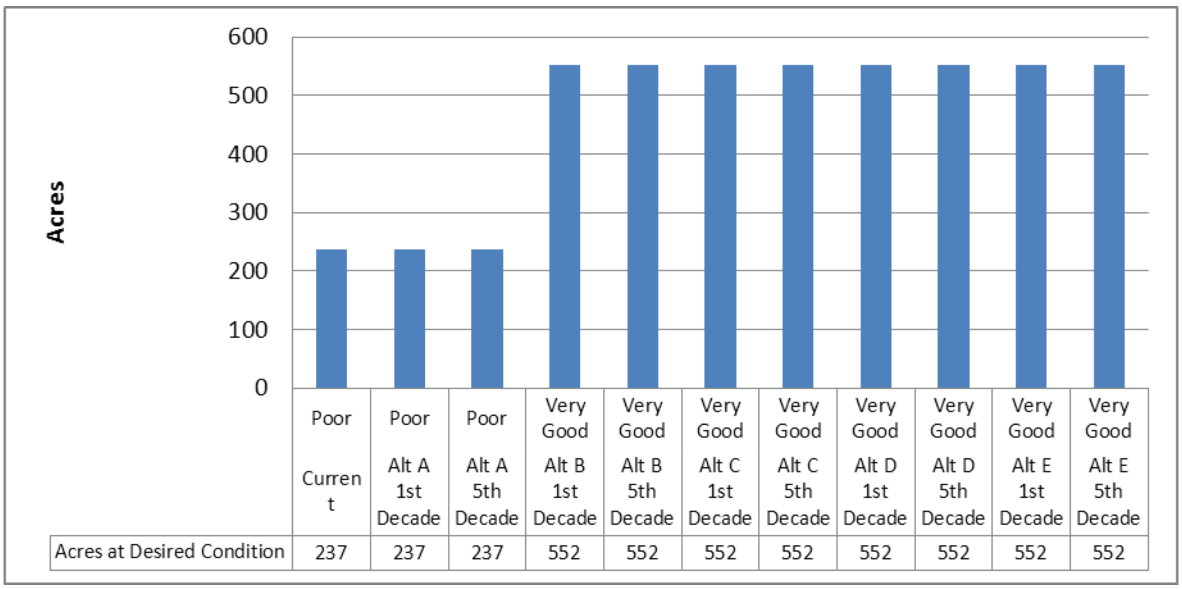


Figure 60. Black belt calcareous prairie and woodland acres by alternative

Prescribed fire, as stated previously, plays an integral part of restoring this ecosystem. Again, alternative A does not accomplish objectives concerning this attribute. No management of this ecosystem will be attempted in this alternative. All other alternatives show this system as a priority in respect to burn interval attaining a score of very good (Figure 61). Growing season prescribed fire (Figure 62), however, differs between alternatives. Alternatives B and C both score fair although alternative C's actual value of 40 percent does meet minimum desired condition. Both alternatives D and E obtain a good rating for this attribute.

Black Belt Calcareous Prairie and Woodland Environmental Effects

Restoration of this ecosystem to appropriate acres that have been previously converted to other system types or allowed to degrade, is a priority in alternatives B, C, D, and E. The future conditions of this ecosystem will vary little based on management intensity and scale (acres restored through time) excluding alternative A which shows no restoration goals. Restoration and maintenance activities will include prescribed fire and offsite species conversion to native vegetation.

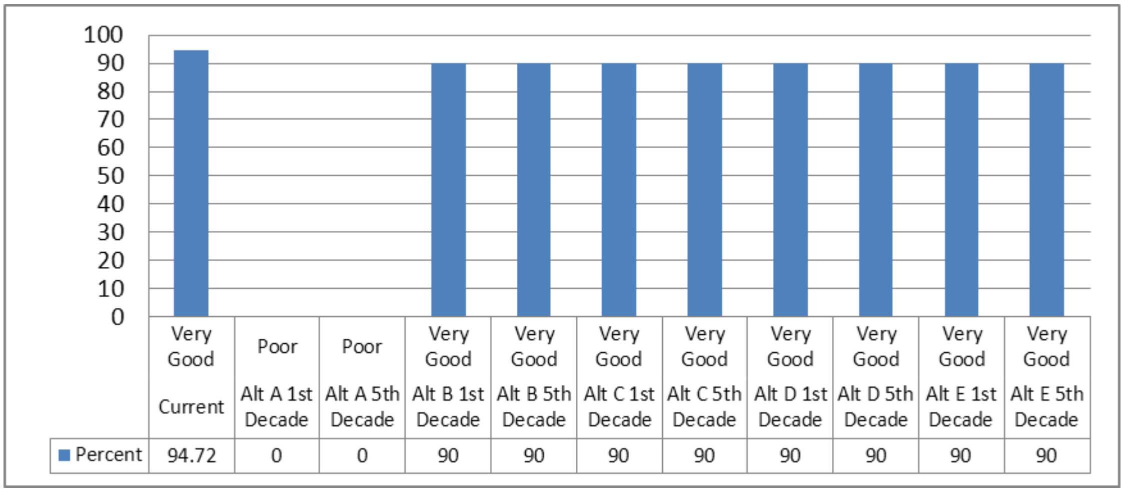


Figure 61. Black belt calcareous prairie and woodland percent acres burned at desired interval

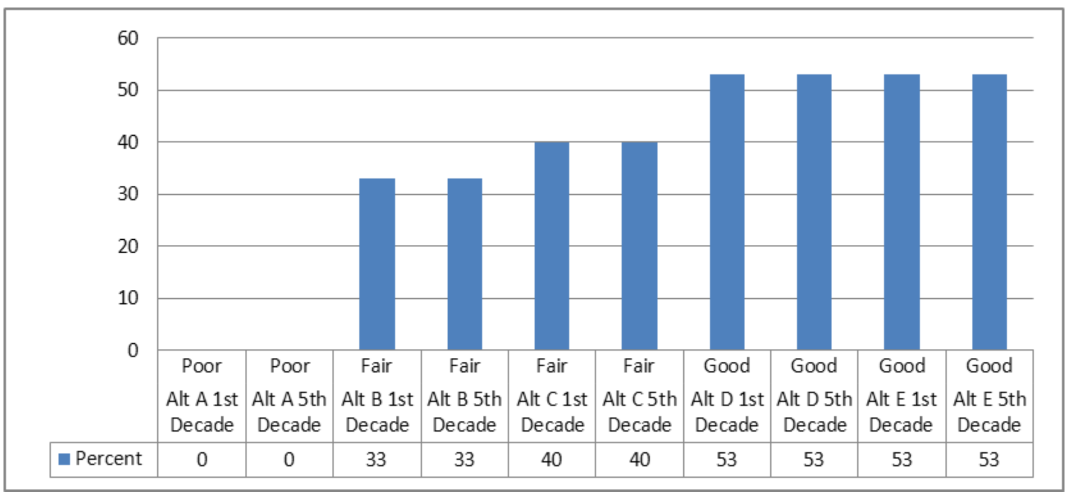


Figure 62. Black belt calcareous prairie and woodland percent acres burned during the growing season

Past management practices have favored less fire-tolerant communities normally associated with fire suppression and the introduction of offsite canopy species. Prescribed fire will alter both overstory and understory composition in favor of fire-tolerant and fire-dependent vegetative assemblages at the expense of species not normally associated with fire-adapted uplands. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with this system. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire to prairie associated species and communities, will far outweigh any losses incurred during implementation.

Forest harvests of offsite species may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals should be minimal and discountable compared to the long-term positive effects of habitat restoration.

Vehicle and machinery use and other ground disturbing activities during restoration and maintenance activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from restoration activities and prescribed fire through increased soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Habitat quality could be reduced in the vicinity of restoration activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality. Changes in floral and faunal community composition can be expected as restoration sites progress through time. These changes should be gradual and are considered natural in response to the variety of habitat characteristics.

In alternatives B, C, D, and E the long-term effects of restoration, management, and maintenance of the ecosystem are critical to the sustainability of this system and associated species. Over time, associated species of regional as well as local viability concern will become increasingly sustainable. In both the first and fifth decades of alternative A, conditions are inadequate.

4.4.17 Jackson Prairie and Woodland

Jackson Prairie and Woodland Alternatives and Effects

Jackson prairie and woodland is native to the Bienville Unit.

The primary key attributes and corresponding actions to assure the ecological sustainability are as follows:

- Percent acres in appropriate system type (including acres restored to native system types)
- Percent acres burned at the desired interval, seasonality and intensity

A forestwide summary of ecological sustainability evaluation scores for Jackson prairie and woodland by alternative is presented in Figure 63.

As shown in Figure 63, all alternative scores by decade increase to a good overall ecological sustainability evaluation score from a fair current score. As shown in Figure 64, alternative A contributes some to the restoration of Jackson prairie and woodlands changing from poor overall score of percent in appropriate system by acres to fair by the fifth decade. Although restoration goals are met by the fifth decade, alternative B does not reach this attribute goal by the first decade while alternatives C, D, and E, are more successful achieving this by the end of the first decade.

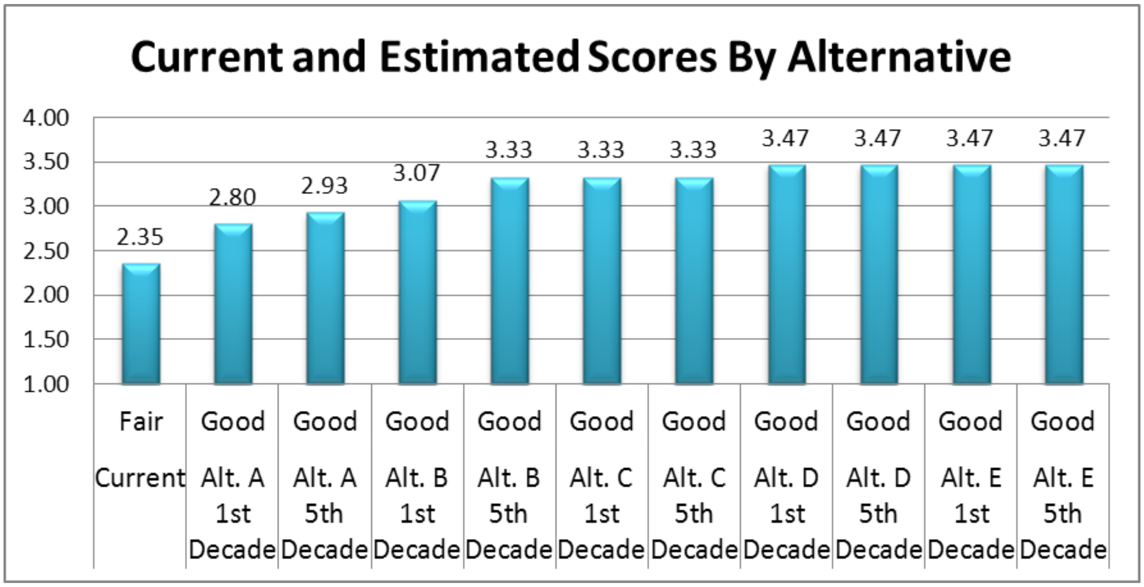


Figure 63. Forestwide Jackson prairie and woodland ecological sustainability evaluation scores

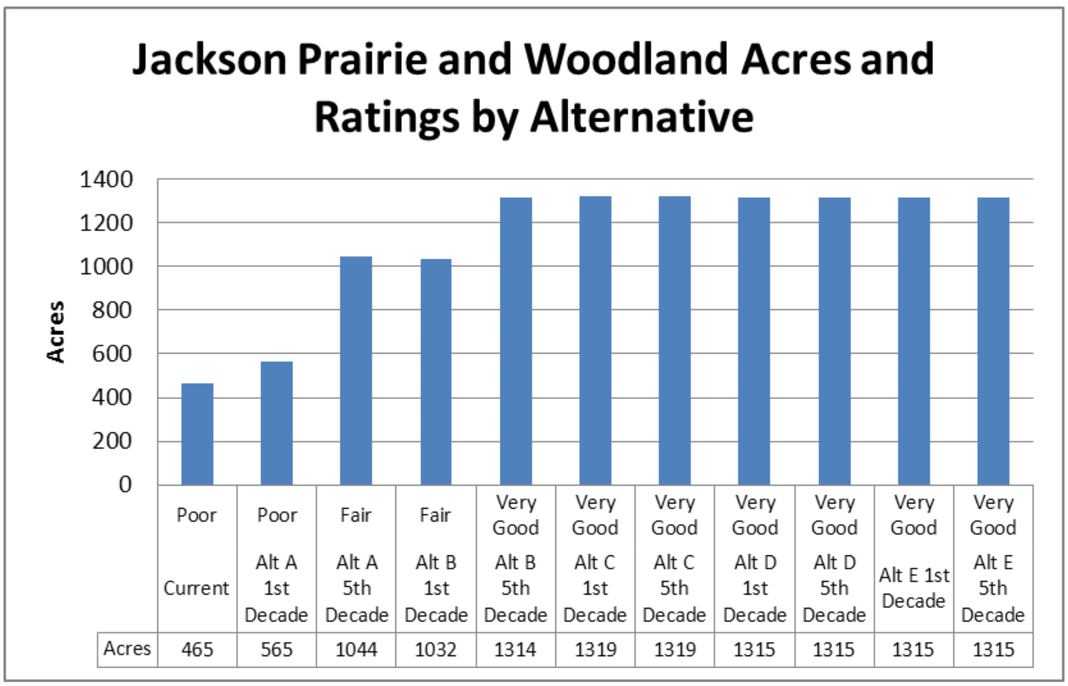


Figure 64. Jackson prairie and woodland acres in appropriate system by alternative

Figure 65 and Figure 66 show fire regime variables by alternative. Herbaceous dominated under-stories, including grasses and forbs, are important attributes of healthy prairie ecosystems best achieved by the application of frequent growing season fire, ideally once every one to three years (desired interval). These data show that fire frequency and seasonality/intensity, in most cases, are well within the good to very good range and increase respectively from alternatives C thru E.

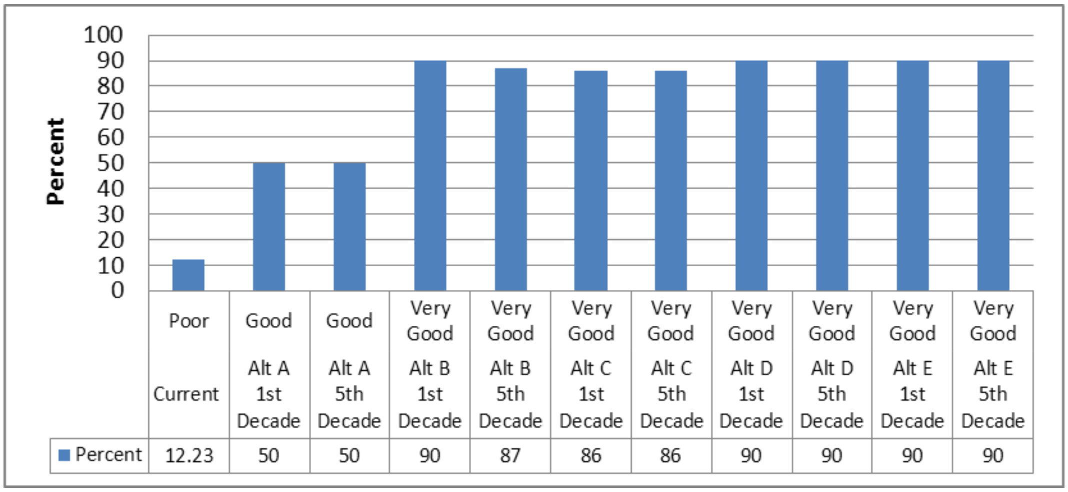


Figure 65. Jackson prairie and woodland percent acres burned at desired interval by alternative

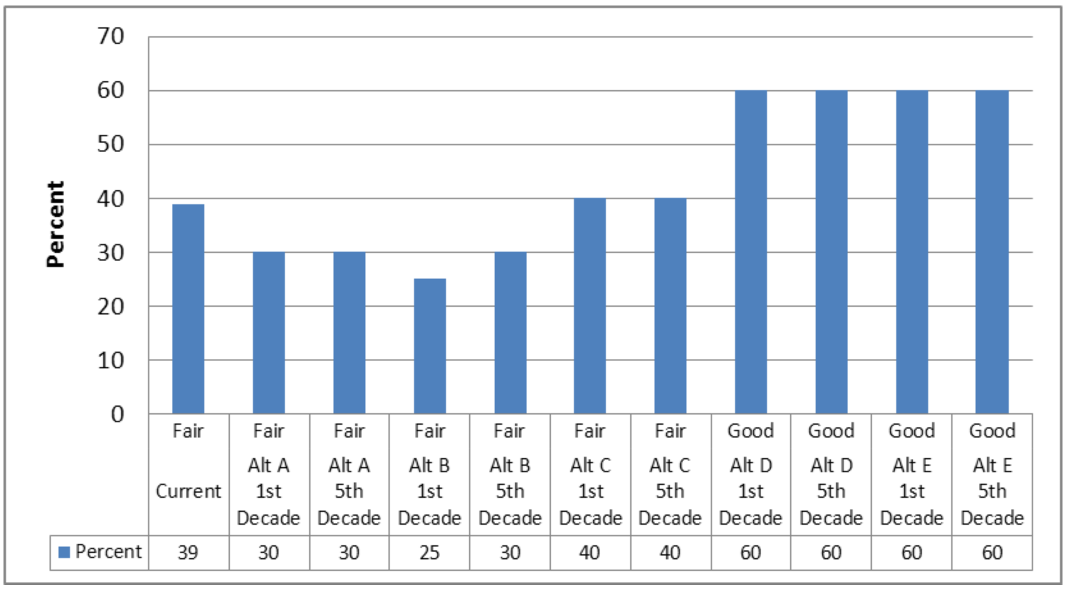


Figure 66. Percent Jackson prairie and woodland burned during the growing season

Prescribed fire, as stated previously, plays an integral part of restoring this ecosystem. Again, alternative A only reaches a good status, while all other alternatives show this system as a priority in respect to burn interval attaining a score of very good (Figure 65). Growing season prescribed fire (Figure 66), however, differs between alternatives. Alternatives A, B and C score fair although alternative C's actual value of 40 percent does meet minimum desired condition. Both alternatives D and E obtain a good rating for this attribute.

Jackson Prairie and Woodland Environmental Effects

The future conditions of this ecosystem will vary little based on overall score of the system when all variables are taken in account. Restoration of this ecosystem to appropriate acres that have been previously converted to other system types or allowed to degrade, though, is a priority in alternatives C, D, and E in the first decade while alternative B does not meet restoration goals until the fifth decade. Restoration and maintenance activities will include prescribed fire and offsite species conversion to native vegetation.

Past management practices have favored less fire-tolerant communities normally associated with fire suppression and the introduction of offsite canopy species. Prescribed fire will alter both overstory and understory composition in favor of fire-tolerant and fire-dependent vegetative assemblages at the expense of species not normally associated with fire-adapted uplands. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with this system. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire to prairie associated species and communities, will far outweigh any losses incurred during implementation.

Forest harvests of offsite species may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals should be minimal and discountable compared to the long-term positive effects of habitat restoration.

Vehicle and machinery use and other ground disturbing activities during restoration and maintenance activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from restoration activities and prescribed fire through increased soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Habitat quality could be reduced in the vicinity of restoration activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality. Changes in floral and faunal community composition can be expected as restoration sites progress through time. These changes should be gradual and are considered natural in response to the variety of habitat characteristics.

In all alternatives, the long-term effects of restoration, management, and maintenance of the ecosystem are critical to the sustainability of this system and associated species. Over time, associated species of regional as well as local viability concern will become increasingly sustainable.

4.4.18 Ephemeral ponds and emergent wetlands

Ephemeral ponds and emergent wetlands Alternatives and Effects

Ephemeral ponds and emergent wetlands are native to the following units:

- Ackerman
- Bienville
- Chickasawhay
- De Soto
- Holly Springs
- Homochitto
- Trace
- Yalobusha

A forestwide summary of ecological sustainability evaluation scores for ephemeral ponds and emergent wetlands by alternative is presented in Figure 67.

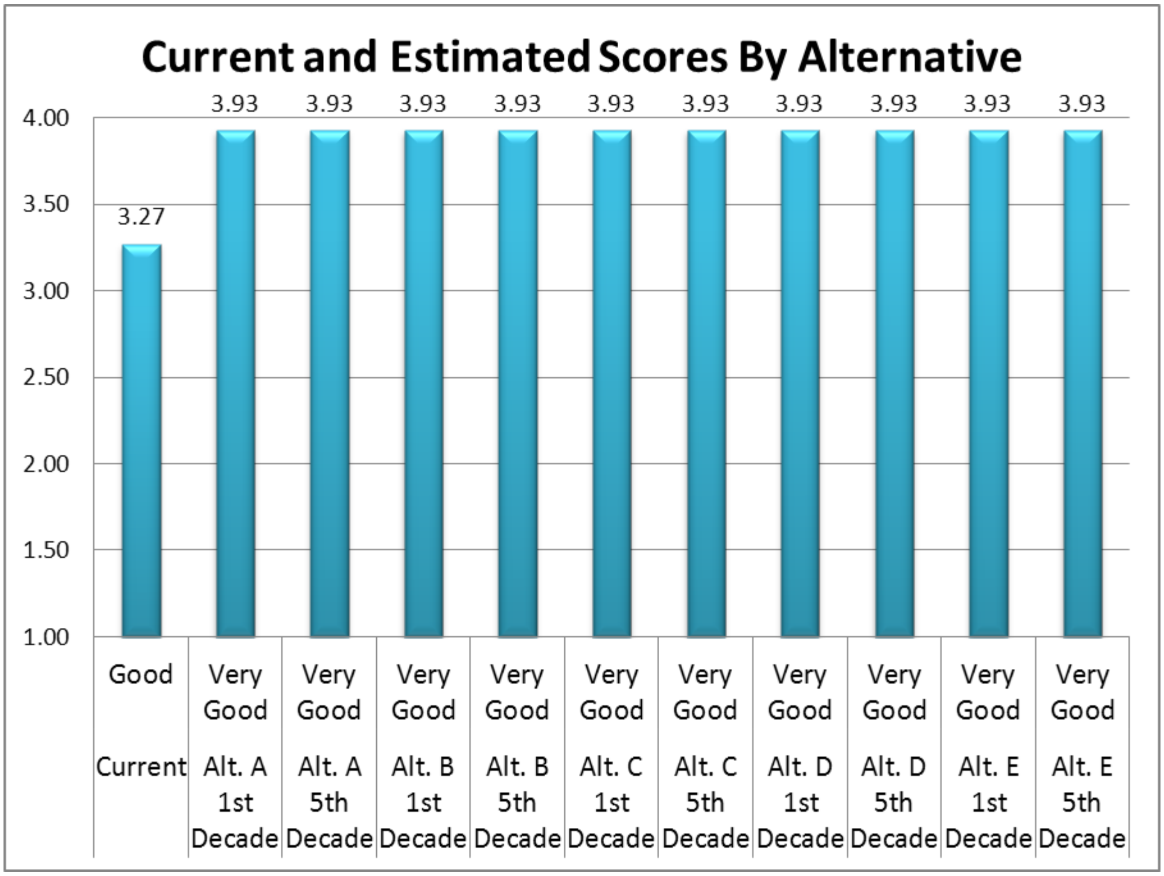


Figure 67. Forestwide ephemeral ponds and emergent wetlands ecological sustainability evaluation scores

All overall ecological sustainability evaluation scores were calculated as very good for this system for all alternatives and all time intervals, but there are many data needs for this system including distribution, frequency, and occurrence across the Forests (Figure 67).

Ephemeral Ponds and Emergent Wetlands Environmental Effects

Management activities will include prescribed fire at the same frequency and intensity as the surrounding matrix community and maintaining ecosystem abundance across the Forests over time. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems in which this community is embedded. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Where timber and restoration operations including pond creation or restoration, thinning, and regeneration; and salvage operations in the wake of natural disturbances in the surrounding matrix community may be required; harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used during management of this ecosystem (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties. Note that where this embedded ecosystem is found, it will be protected by the National Forests in Mississippi.

In all cases, short-term negative effects to individual plants and animals should be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management and protection should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

4.4.19 Cypress Dominated Wetlands

Cypress Dominated Wetlands Alternatives and Effects

Cypress dominated wetlands are native to the following units:

- Bienville
- Delta
- Holly Springs
- Homochitto
- Yalobusha

A forestwide summary of ecological sustainability evaluation scores for cypress dominated wetlands by alternative is presented in Figure 68.

All overall ecological sustainability evaluation scores were calculated as very good for this system for all alternatives and all time intervals, while units where data was available are rated as good. There are many data needs for this system including distribution, frequency, and occurrence across the Forests (Figure 68).

Cypress Dominated Wetlands Environmental Effects

Where restoration operations including system creation or restoration, regeneration, harvest of offsite species, and salvage operations in the wake of natural disturbances in the surrounding matrix community may be required, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used during management of this ecosystem (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts are expected to be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties. Note that where this embedded ecosystem is found, it will be protected by the National Forests in Mississippi.

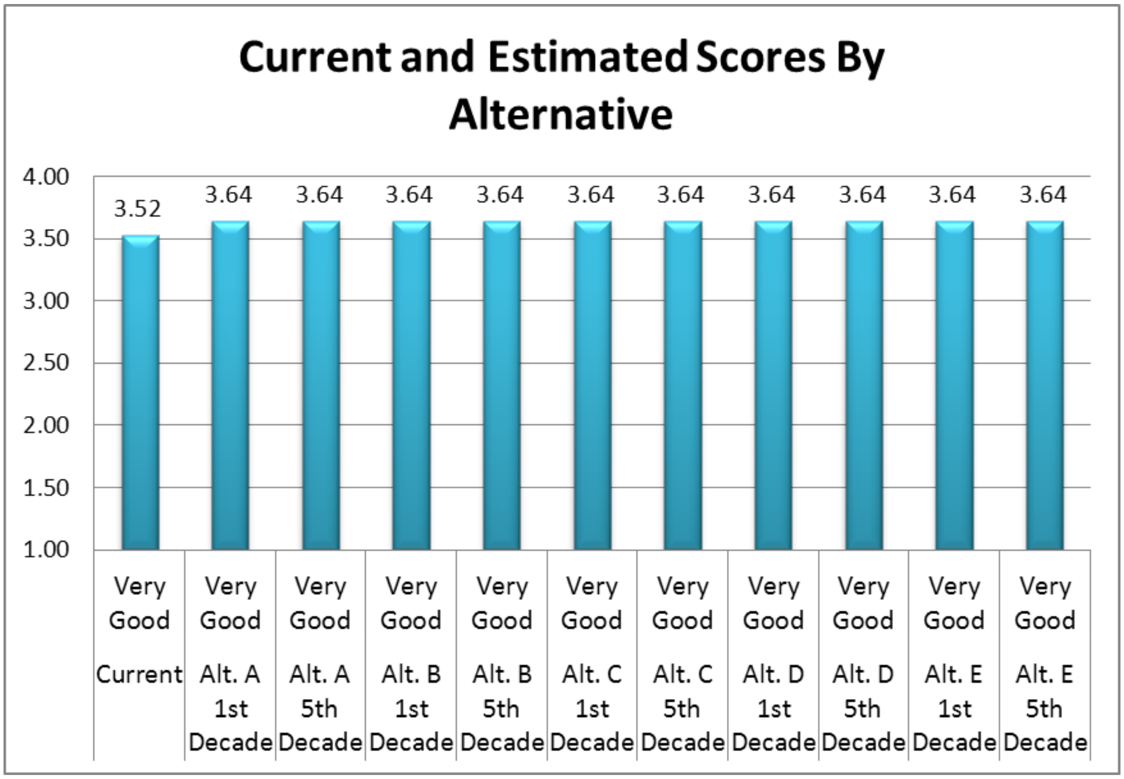


Figure 68. Forestwide cypress dominated wetlands ecological sustainability evaluation scores

In all cases, short-term negative effects to individual plants and animals should be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management and protection should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern should remain sustainable.

4.4.20 Wet Pine Savanna

Wet Pine Savanna Alternatives and Effects

Wet pine savanna is native to the De Soto Unit.

The primary key attributes and corresponding actions to assure the ecological sustainability are as follows:

- Percent acres in appropriate system type (including acres restored to native system types) Percent acres burned at the desired interval and seasonality/intensity

A forestwide summary of ecological sustainability evaluation scores for wet pine savanna by alternative is presented in Figure 69.

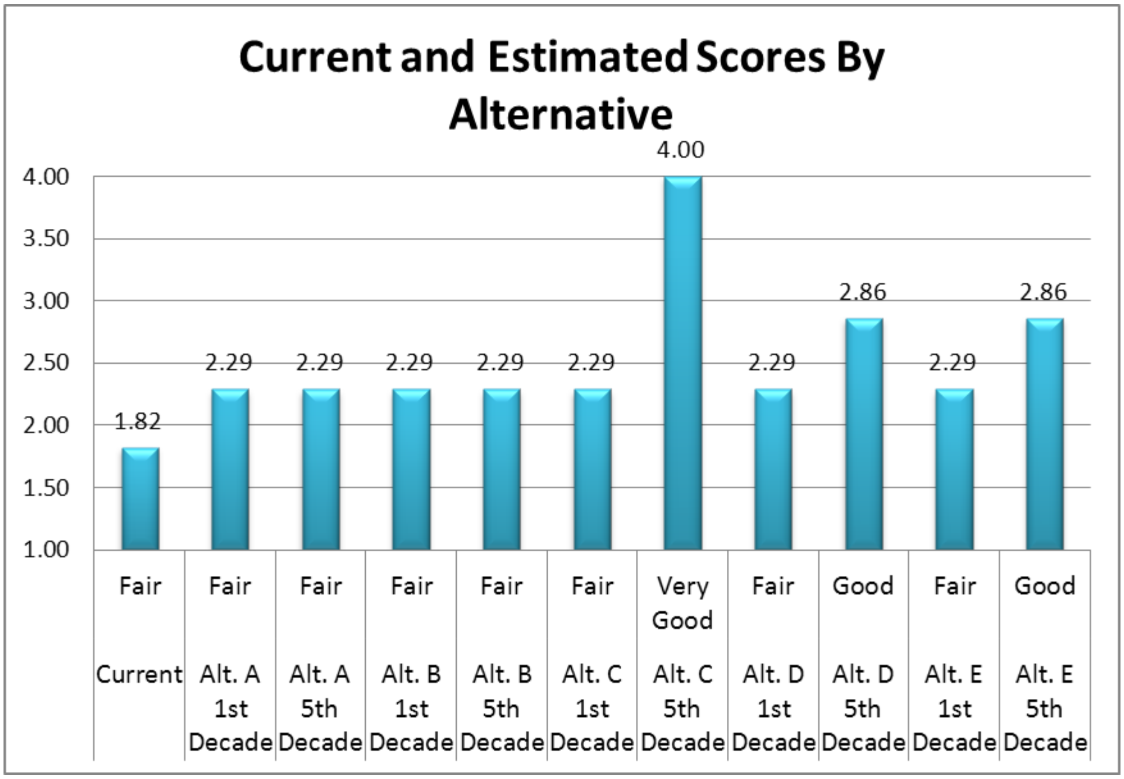


Figure 69. Forestwide wet pine savanna ecological sustainability evaluation scores

Although restoration work does begin in the first decade in some alternatives, the overall ecological sustainability evaluation scores were calculated as fair for all alternatives in this time frame (Figure 69). Differences between alternatives can truly be seen in the overall scores by the fifth decade showing alternatives A and B to be fair, alternatives D and E good, while alternative C shows the greatest restoration reaching very good. These values seem to be directly correlated to the primary key attributes and corresponding actions shown in Figure 70, Figure 71, and Figure 72.

As stated earlier, restoration work begins in the first decade in some alternatives, but ratings did not change from poor during this time frame concerning percent of ecosystem in appropriate system (Figure 70). Differences between alternatives are apparent in the fifth decade showing alternatives A and B remaining poor, alternatives D and E increasing restoration acres to fair, while alternative C shows the greatest restoration efforts and reaches very good with all acres.

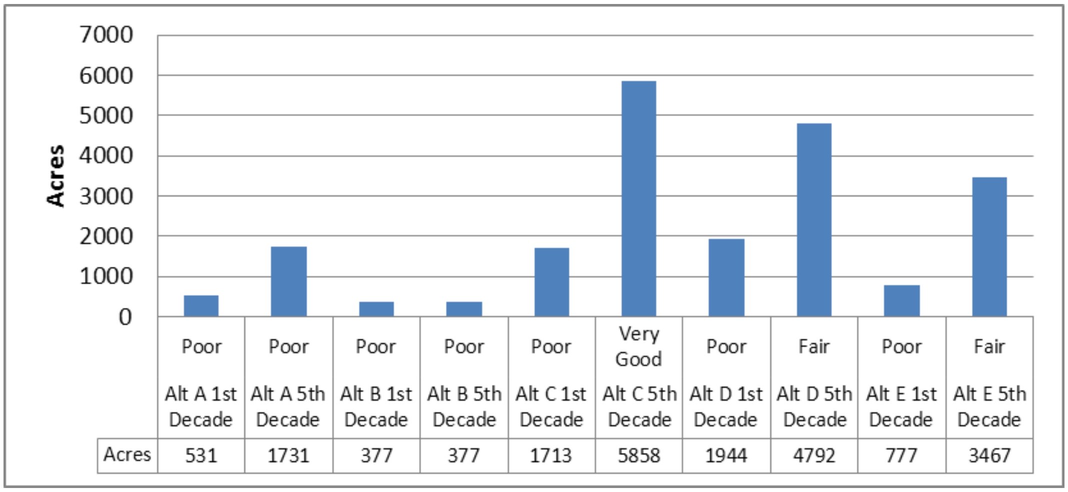


Figure 70. Wet pine savanna acres in appropriate system by alternative

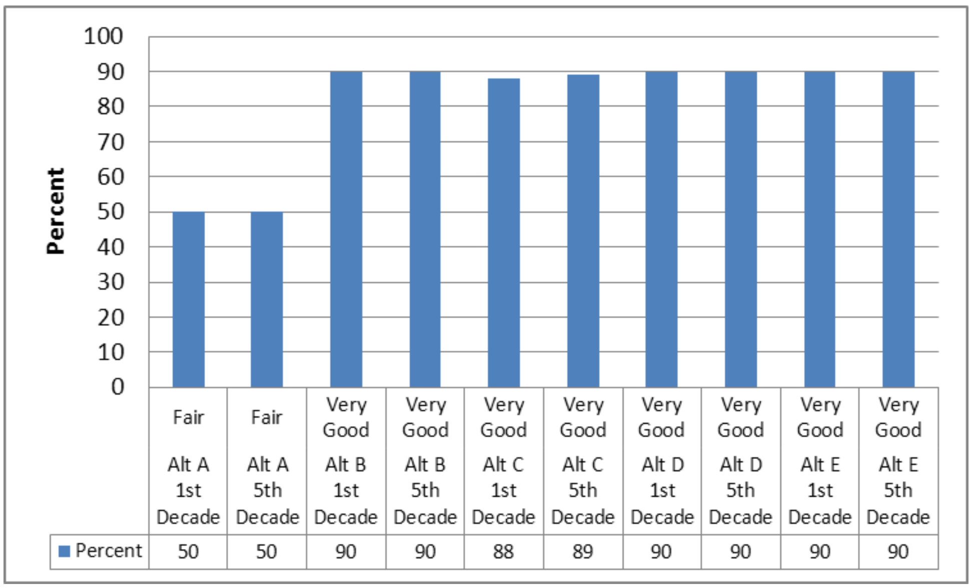


Figure 71. Percent of wet pine savanna burned at desired interval by alternative

Figure 71 and Figure 72 show fire regime variables by alternative. Low density long leaf pine and herbaceous dominated under-stories, including grasses and forbs, are important attributes of healthy wet pine savanna ecosystems best achieved by the application of frequent fire, ideally once every one to three years (desired interval). Figure 71 shows that fire frequency is well within the very good range in alternatives B thru E while alternative A only reaches Fair.

Prescribed fire, as stated previously, plays an integral part of restoring this ecosystem. Growing season prescribed fire (Figure 72), however, differs between alternatives. Alternatives A, B and C score fair although alternative C’s actual value of 40 percent does meet minimum desired condition. Both alternatives D and E obtain a good rating for this attribute.

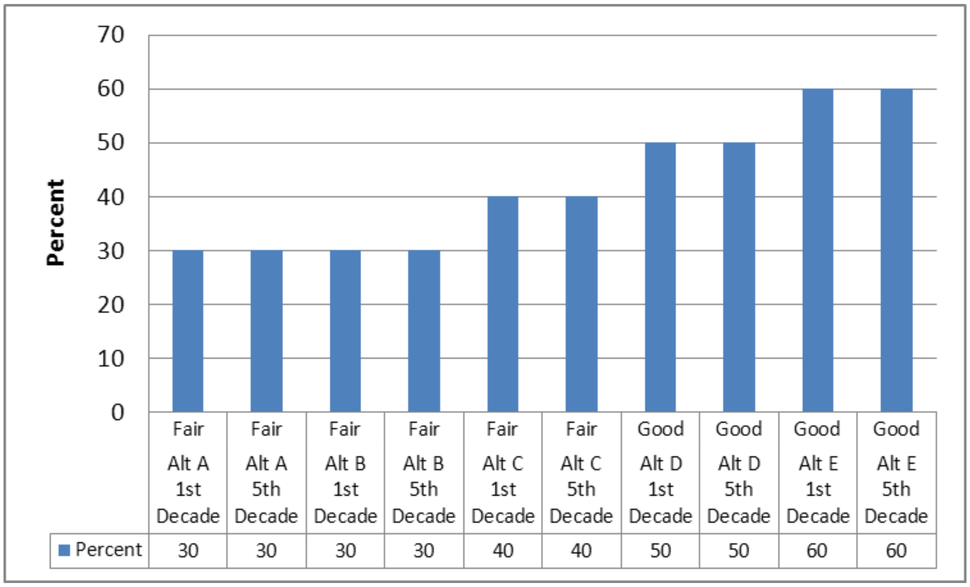


Figure 72. Percent of wet pine savanna burned in the growing season by alternative

Wet Pine Savanna Environmental Effects

Restoration of this ecosystem to appropriate acres that have been previously converted to other system types or allowed to degrade, is a priority for this system in alternatives C, D, and E with alternative C having the greatest amount of restoration. The future distribution of this ecosystem on the Forests will vary across all alternatives based on management intensity and scale (acres restored through time). Restoration and maintenance activities will include prescribed fire, thinning, and offsite canopy species conversion to native longleaf, native herbaceous understory, and protection and in some cases restoring hydrologic function.

Past management practices have favored less fire-tolerant communities normally associated with fire suppression and the introduction of offsite canopy species. Prescribed fire will alter both overstory and understory composition in favor of fire-tolerant and fire-dependent vegetative assemblages at the expense of species not normally associated with fire-adapted uplands. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with wet pine savanna. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire to longleaf-associated species and communities will far outweigh any losses incurred during implementation.

Forest thinning and harvests of offsite species may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat restoration.

Vehicle and machinery use and other ground disturbing activities during restoration and maintenance activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species. The proposed thinnings would reduce the average basal area of pine stands in the project area, thus reducing the risk of southern pine beetle infestation on National Forest System and private lands.

Wildlife would benefit from thinning, harvest, restoration and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire and change in hydrology of the system. Prescribed burning would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of restoration activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components and hydrology should increase in coverage and quality. Changes in floral and faunal community composition and hydrology can be expected as restoration sites progress through successional stages. These changes should be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple seral stages.

In alternatives C, D, and E the long-term effects of restoration, management, and maintenance of the ecosystem are expected to be critical to the sustainability of these communities and associated species. Over time, associated species of regional as well as local viability concern will become increasingly sustainable and become robust and potentially expand under alternative C. In both alternatives A and B, conditions remain slightly inadequate; although associated species’ populations may persist for some time, they may be subject to gradual decline.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under alternatives C, D, and E. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species. In alternative B, the system would gradually become excessively congested with overstory and midstory densities resulting in large-scale losses in abundance and diversity of important groundcover vegetation.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of alternatives C, D, and E will be minor while the positive impacts will be substantial.

4.4.21 Seeps, Springs, and Seepage Swamps

Seeps, Springs, and Seepage Swamps Alternatives and Effects

Seeps, springs, and seepage swamps are native to the following units:

- Ackerman
- Bienville
- Chickasawhay
- De Soto
- Holly Springs
- Homochitto
- Trace
- Yalobusha

A forestwide summary of ecological sustainability evaluation scores for seeps, springs, and seepage swamps by alternative is presented in Figure 73.

All overall ecological sustainability evaluation scores were calculated as good for this system for all alternatives and all time intervals, while units where data was available are rated as good and very good with no differences for each between alternatives (appendix H). There are many data needs for this system including distribution, frequency, and occurrence across the Forests.

Seeps, Springs, and Seepage Swamps Environmental Effects

Management activities will include prescribed fire at the same frequency and intensity as the surrounding matrix community and maintaining ecosystem abundance across the Forests over time. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems in which this community is embedded although fire in this system would only occur during periods of drought. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

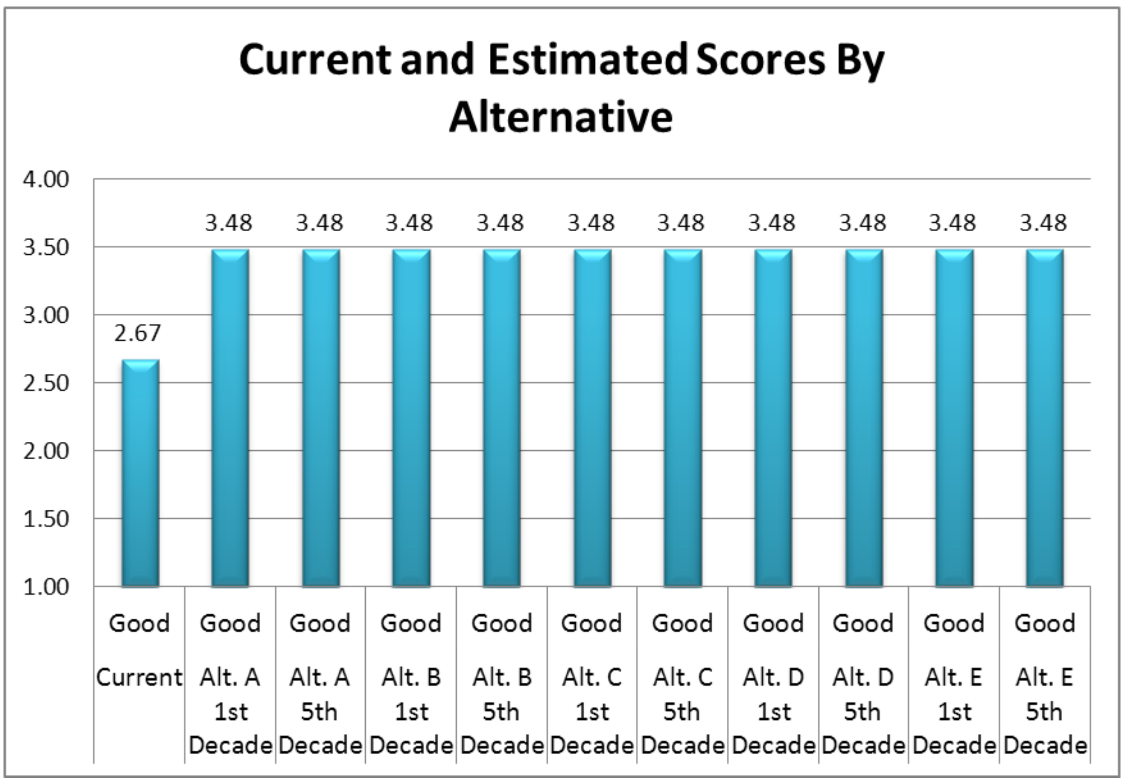


Figure 73. Forestwide seeps, springs, and seepage swamps ecological sustainability evaluation scores

Where timber and restoration activities in surrounding matrix communities are warranted, this ecosystem and its hydrology should be protected using guidelines and best management practices. Where thinning, regeneration, and salvage operations in the wake of natural disturbances in the surrounding matrix community may be required, harvests may expose some species and communities, especially those in transition zones, to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. However, this system will be protected from machinery disturbance due to soil moisture and protection measures aimed at maintaining hydrologic integrity. Herbicides may also be used during management of this ecosystem (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts would be temporary and, to the extent possible, mitigated by best management practices and guidelines. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties. Note that where this embedded ecosystem is found, it will be protected by the National Forests in Mississippi.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management and protection should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern should remain sustainable.

4.4.22 Herbaceous Seepage Bogs and Flats

Herbaceous Seepage Bogs and Flats Alternatives and Effects

Herbaceous seepage bogs and flats are native to the following units:

- Chickasawhay
- De Soto

A forestwide summary of ecological sustainability evaluation scores for herbaceous seepage bogs and flats by alternative is presented in Figure 74.

All overall ecological sustainability evaluation scores were calculated as very good for this system for all alternatives and all time intervals, while units (where data was available) are rated as good with no differences between alternatives (appendix H). There are many data needs for this system including distribution, frequency, and occurrence across the Forests.

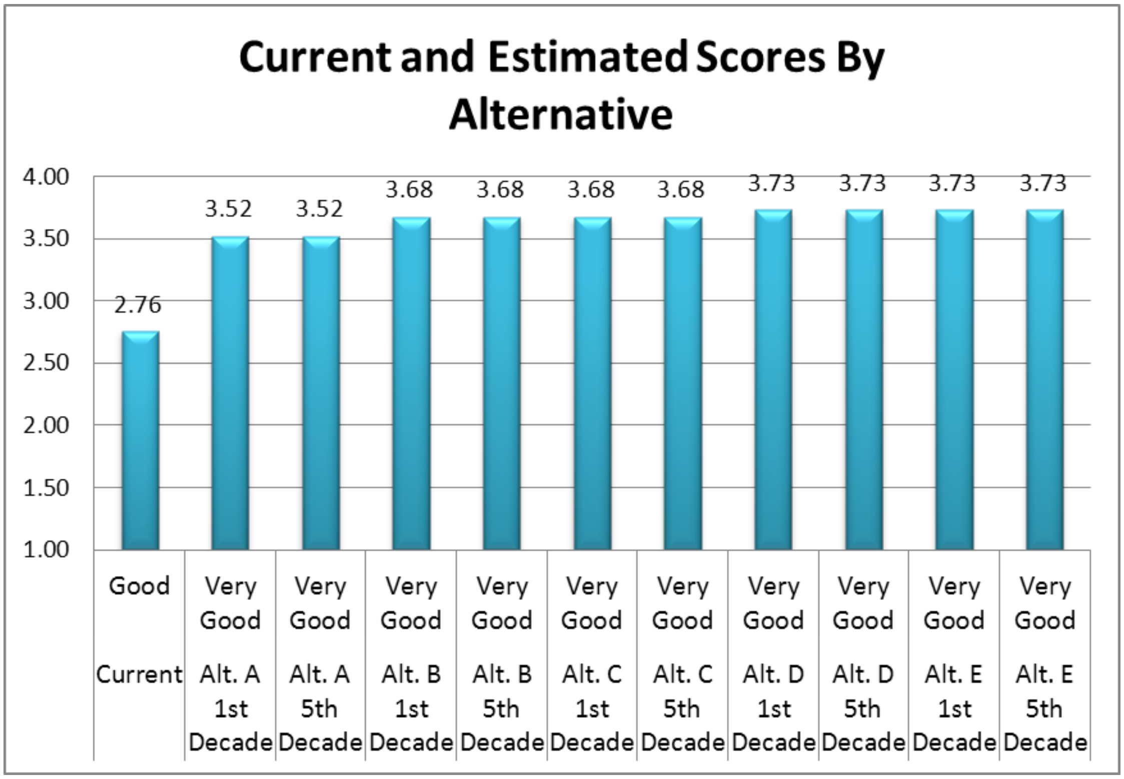


Figure 74. Forestwide herbaceous seepage bogs and flats ecological sustainability evaluation scores

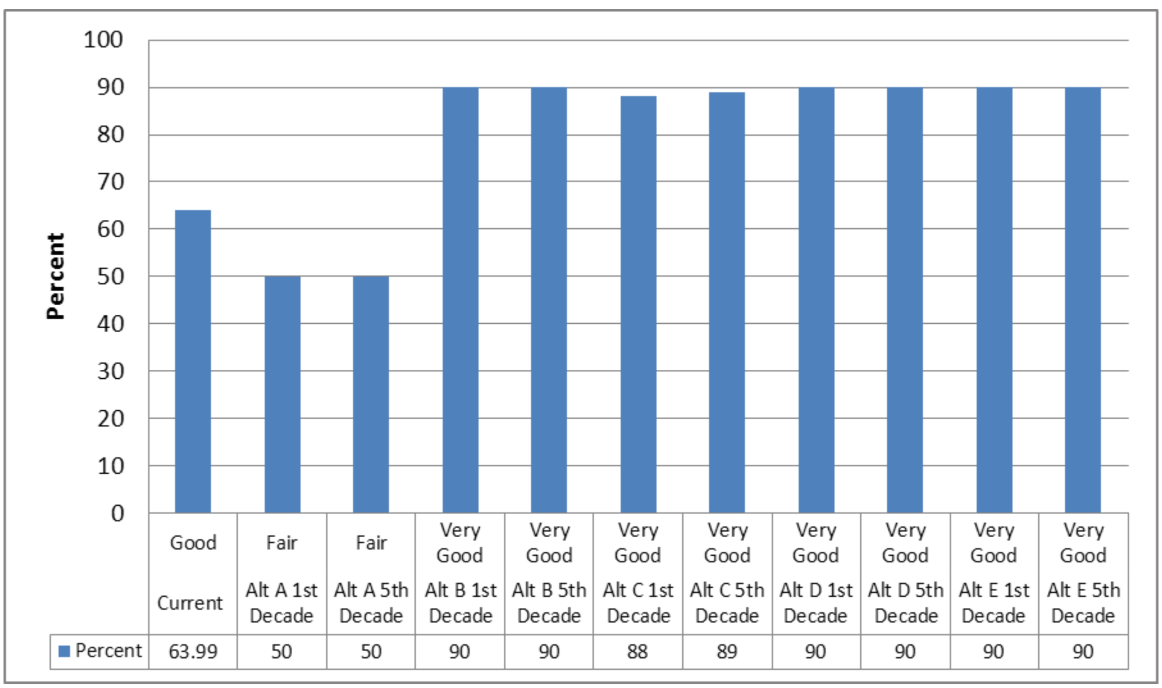


Figure 75. Percent of herbaceous seepage bogs and flats burned at desired interval by alternative

Figure 75 and Figure 76 show fire regime variables by alternative. Open canopy and herbaceous dominated understories, including grasses and forbs, are important attributes of healthy herbaceous seepage bogs and flats best achieved by the application of frequent fire, ideally once every one to three years (desired interval). Figure 75 shows that fire frequency is well within the very good range in alternatives B thru E while alternative A only reaches fair.

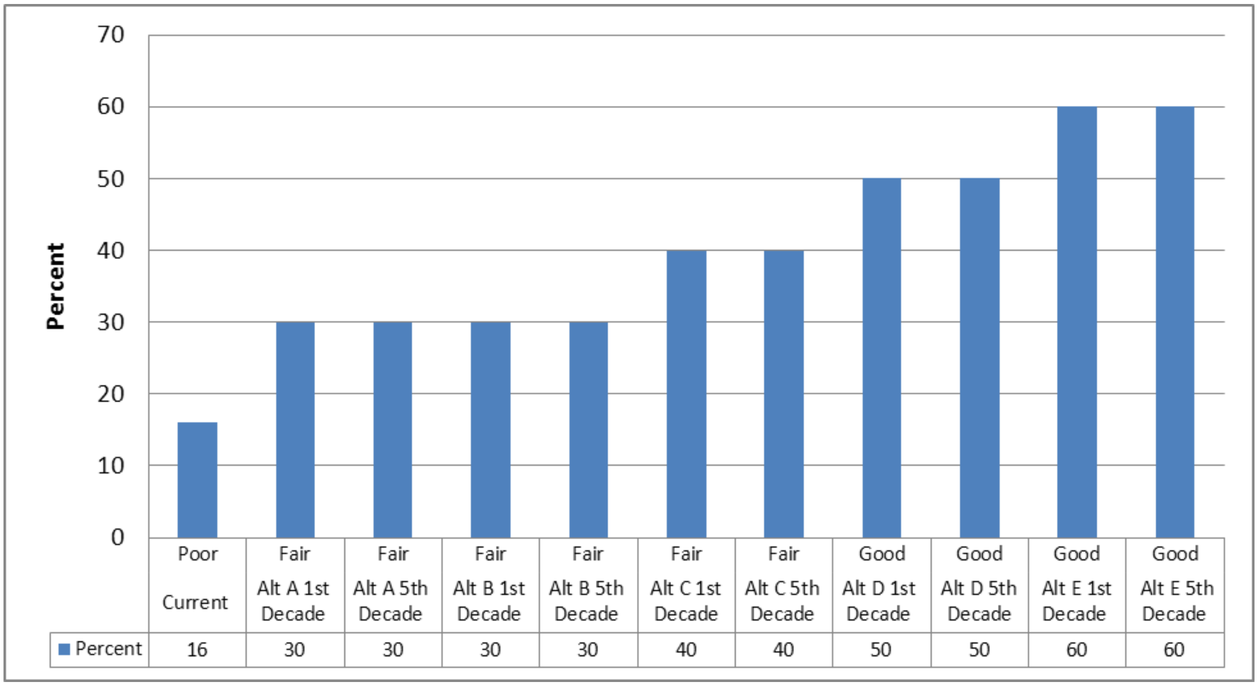


Figure 76. Percent of herbaceous seepage bogs and flats burned in the growing season by alternative

Prescribed fire, as stated previously, plays an integral part of restoring this ecosystem. Growing season prescribed fire (Figure 76) differs between alternatives. Alternatives A, B and C score fair although the actual value of alternative C, of 40 percent, does meet minimum desired condition. Both alternatives D and E obtain a good rating for this attribute.

Herbaceous Seepage Bogs and Flats Environmental Effects

Protection of this ecosystem is a priority in all alternatives. Restoration will be based on management intensity and scale (acres restored through time). Restoration and maintenance activities will include prescribed fire, thinning, and offsite canopy species conversion to native canopy species, native herbaceous understory, restoring hydrologic function, and protection of the system.

Past management practices have favored less fire-tolerant communities normally associated with fire suppression and the introduction of offsite canopy species. Prescribed fire will alter both overstory and understory composition in favor of fire-tolerant and fire-dependent vegetative assemblages at the expense of species not normally associated with fire-adapted uplands. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with this system. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire to longleaf-associated species and communities will far outweigh any losses incurred during implementation.

Forest thinning and harvests of offsite species within this system and within the surrounding matrix communities may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Use of herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat restoration.

Vehicle and machinery use and other ground disturbing activities during restoration and maintenance activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass and red-imported fire ants. Best management practices and guidelines regarding non-native invasives should mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species. The proposed thinnings would reduce the average basal area of pine stands in the project area, thus reducing the risk of southern pine beetle infestation on National Forest System and private lands.

Wildlife would benefit from thinning, harvest, restoration and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire and change in hydrology of the system. Prescribed burning would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity restoration activity due to loss of important structural components (canopy levels within the Forests and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components and hydrologic function should increase in coverage and quality. Changes in floral and faunal community composition and hydrology can be expected as restoration sites progress through successional stages. These changes should be gradual and are considered natural responses to the variety of habitat characteristics and components provided by multiple seral stages.

In all alternatives, the long-term effects of ecosystem management and protection should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern should remain sustainable.

4.5 Threatened and Endangered Species

This section covers threatened and endangered species which may require protection under the Endangered Species Act (36 CFR 219.16). Ecological conditions that are needed to conserve threatened and endangered species are provided by the forest plan components for ecosystem diversity.

The US Fish and Wildlife Service (USFWS) is responsible for listing proposed, threatened and endangered species. The Forest Service cooperates with that agency’s efforts in conserving these species through protection and habitat management. The Forest Service conducts activities and programs to assist in the identification, conservation, and protection of proposed, threatened, and endangered species and their habitats. Site specific evaluations are conducted for any proposed activity that may take place within habitat for these species or near known populations. The National Forests in Mississippi threatened and endangered species program priorities include:

- Implementing Forest Service actions as recommended in recovery plans for federally listed species. In the absence of an approved recovery plan, implement and, if necessary develop interim Forest Service guidelines. Update interim guidelines as needed when new science becomes available.

- Working with the US Fish and Wildlife Service and other conservation partners to develop recovery plans for federally listed species and candidate conservation agreements for species proposed for listing.
- Coordinating with partners to implement measures to resolve conflicts with proposed, threatened, and endangered species and their habitats.
- Monitoring trends in population or habitat of federally listed species.

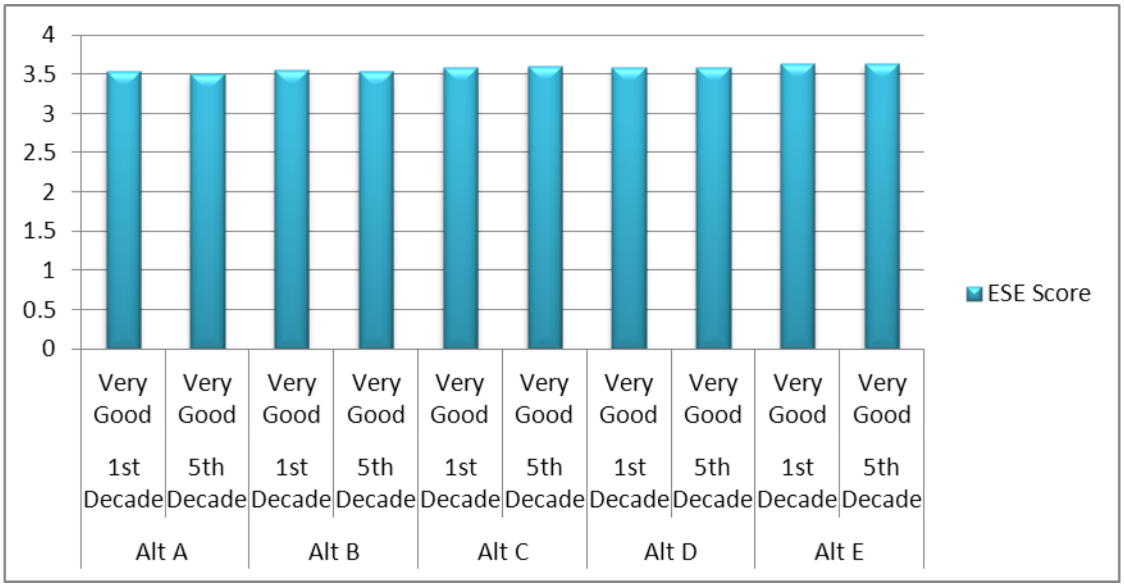


Figure 77. Forestwide ecological sustainability evaluation scores for the Mississippi gopher frog

The National Forests in Mississippi used species groups as an evaluation and analysis tool to improve planning efficiency and for development of management strategies. Each species was grouped according to its habitat needs, limiting factors, threats, and specific associated habitat elements. All federally listed threatened and endangered species are included in species groups because although they have individual species requirements for management, their management is connected by ecosystem and species diversity. Because of the diverse habitat and protection needs of each species, an individual species may occur in multiple groups.

Using the ecological sustainability evaluation process, key ecological attributes and indicators were determined for each species group associated with this species. Algorithms were developed taking into account all weights, rankings, and scores associated with this species to derive composite current scores and estimated scores by alternative for first and fifth decade intervals. These composite scores were calculated aggregately across the Forests.

4.5.1 Mississippi Gopher Frog

Mississippi Gopher Frog Effects and Alternatives

The Mississippi gopher frog is currently associated with the following species groups:

- Species sensitive to soil disturbance
- Mature open pine-grass associates
- Terrestrial and non-riverine aquatic species sensitive to recreational traffic

- Ponds and emergent wetlands associates
- Species sensitive to hydrologic modification of wetlands
- Downed wood associates
- Stump and stump-hole associates

All overall ecological sustainability evaluation scores were calculated as very good for this species for all alternatives and all time intervals (Figure 77).

Mississippi Gopher Frog Environmental Effects

Ecological sustainability evaluation scores were calculated for this species based on habitat needs and protection measures associated with species groups that this species was linked to. All alternatives would create optimal habitat conditions for the species. Direct effects of all alternatives could include mortality of individuals from ground disturbing activities associated with habitat management. Ground disturbing activities that could potentially harm Mississippi gopher frogs include tree harvest during thinning operations and ecosystem restoration activities including longleaf conversion and creation of ephemeral ponds, fireline maintenance or construction, and road maintenance. Prescribed fire can also cause direct mortality to individuals. Direct effects to individuals can be minimized through protection of escape cover such as stumps and stump-holes and associated gopher tortoise burrows and following guidelines created for associated species groups. Timing prescribed fire to when individuals are less likely to be moving during a breeding period will also minimize effects to the species. A burn matrix within gopher frog habitat has been developed to minimize effects of prescribed fire (Table 61).

Table 61. Mississippi gopher frog burn matrix

Forest Service burn conditions[a]	Burn uplands	Burn pond basin
Adult Frogs not in pond (Jan – Mar)	YES	NO
Adult Frogs in pond	NO	NO
Adult Frogs not in pond (Apr – Sep)	YES	YES
Burning Oct-Dec	NO	NO
Most (> 75%) Adult frogs left pond (>7 days since last movement at drift fence)	YES	NO
Tadpoles present and after April 1st	NO	NO

a - Burn parameters to be defined by Forest Service using existing standards

Generally, the indirect effects of forest management activities will be beneficial to the Mississippi gopher frog in all alternatives. In those alternatives that include the cooperative management unit, detrimental habitat isolation and fragmentation effects will be reduced as suitable areas enlarged and joined within the cooperative management unit. Population expansion will be fostered by restoration of off-site pine species, thinning of mid-successional and mature pine, prescribed fire to remove encroaching woody vegetation and restore herbaceous groundcover, chemical and mechanical treatment of encroaching mid-story where fire is not a viable management tool. Capturing, banding and monitoring individuals and egg masses will facilitate monitoring of the population and translocation of frogs as necessary will optimize reproduction and population expansion.

Cumulative effects to Mississippi gopher frog populations over the long-term in all alternatives are expected to be population growth, and ultimately, recovery of the species. Management of this species and its habitat will be in accordance with the Endangered Species Act, cooperation with the US Fish and Wildlife Service, Mississippi Department of Wildlife, Fisheries and Parks and the Mississippi Gopher

Frog Group. When a recovery plan is written, it will be incorporated into management of this species on the National Forests in Mississippi.

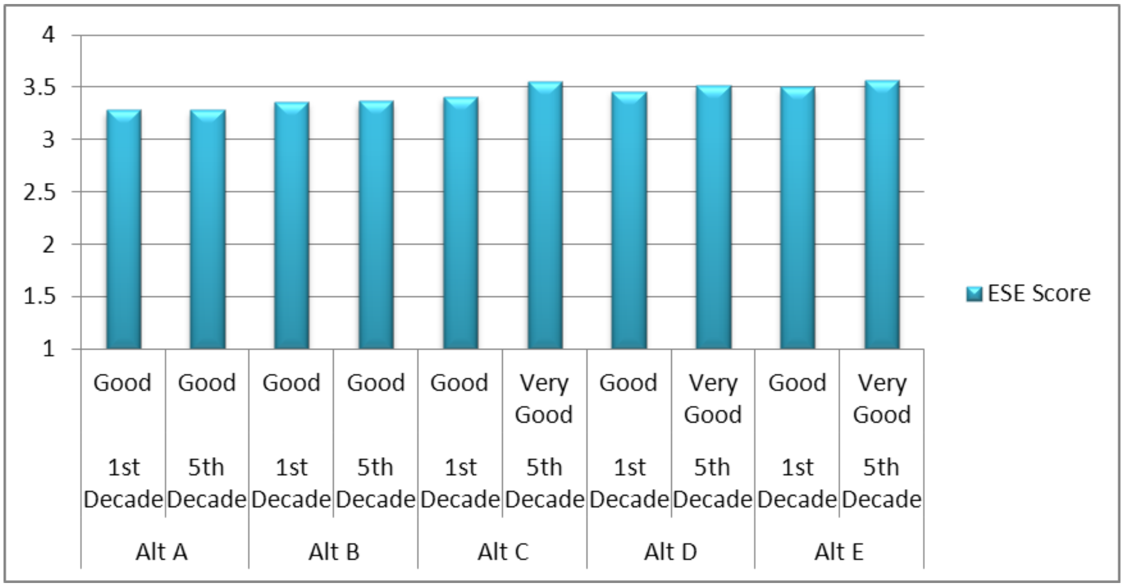


Figure 78. Forestwide ecological sustainability evaluation scores for the Mississippi sandhill crane

Mississippi Gopher Frog Cooperative Management Unit Alternatives and Effects

Alternative B does not incorporate the Mississippi gopher frog cooperative management unit while all other alternatives adopt the cooperative management unit described above. Establishing a cooperative management unit in alternatives A, C, D, and E allows an ecosystem approach to this species' recovery. There should be no direct and indirect effects of establishing boundaries of a cooperative management unit. Direct and indirect effects of management within the cooperative management unit will not change by alternative although management intensity may. Effects of ecosystem management will be further discussed within ecosystem and species sections of this document. Cumulative effects of establishing a cooperative management unit should be positive for all alternatives. The ecosystem approach would provide needed habitat restoration and species management at the landscape level which should help in successful dispersal of the species.

4.5.2 Mississippi Sandhill Crane

Mississippi Sandhill Crane Effects and Alternatives

The Mississippi sandhill crane is currently associated with the following species groups:

- Terrestrial and non-riverine aquatic species sensitive to recreational traffic
- Wet pine savanna associates
- Ponds and emergent wetlands associates
- Species sensitive to hydrologic modification of wetlands
- Species dependent on fire to maintain habitat

All overall ecological sustainability evaluation scores were calculated for Mississippi sandhill crane for all alternatives and time intervals (Figure 78). All alternatives rate as good for sandhill crane by the first decade while alternatives C, D, and E obtain a very good rating by the fifth decade.

Mississippi Sandhill Crane Environmental Effects

Although breeding populations of this species do not currently occur on the Forests, it is possible that some areas of the southeastern portion of the De Soto Ranger District have been used for foraging purposes. Ecological sustainability evaluation scores were calculated for this species based on habitat needs and protection measures associated with species groups that this species was linked to. All alternatives would create acceptable habitat conditions during the first decade while alternatives C, D, and E would create optimal habitat conditions for the species. Direct effects to Mississippi sandhill crane, in the form of fatalities to individual birds, are not likely to occur through management actions and activities occurring on the National Forests in Mississippi.

Generally, the indirect effects of forest management activities will be beneficial to the Mississippi sandhill crane in all alternatives. In those alternatives that include the cooperative management unit, detrimental habitat isolation and fragmentation effects could be reduced as suitable areas are enlarged and joined within the cooperative management unit. Population expansion to the National Forests in Mississippi could be fostered by restoration of off-site pine species, thinning of mid-successional and mature pine to desired wet pine savanna conditions, protection of hydrologic function, prescribed fire to remove encroaching woody vegetation and restore herbaceous groundcover, and chemical and mechanical treatment of encroaching mid-story where fire is not a viable management tool.

Cumulative effects to Mississippi sandhill crane populations over the long-term in all alternatives are expected to be population expansion, and ultimately, recovery of the species. Management of this species and its habitat will be in accordance with the Endangered Species Act and the most current US Fish and Wildlife Service recovery plan will be incorporated into management of this species on the National Forests in Mississippi as populations occur.

Mississippi Sandhill Crane Cooperative Management Unit Alternatives and Effects

Alternative B does not incorporate the Mississippi sandhill crane cooperative management unit while all other alternatives adopt the cooperative management unit described above. Establishing a cooperative management unit in alternatives A, C, D, and E allows an ecosystem approach to this species' recovery. There should be no direct and indirect effects of establishing boundaries of a cooperative management unit. Direct and indirect effects of management within the cooperative management unit will not change by alternative and effects of ecosystem management will be further discussed within ecosystem and species sections of this document. The amount of restoration within this cooperative management unit does change between alternatives and is shown in the ecosystem section of this document. Cumulative effects of establishing a cooperative management unit should be positive for all alternatives. The ecosystem approach would provide for nesting and foraging habitat and should allow Mississippi sandhill crane social interaction at the landscape level which should help in successful dispersal of the species. Inclusion of private in holdings within cooperative management unit boundaries may lead to some habitat fragmentation, but it should not lead to demographic isolation.

4.5.3 Red-cockaded Woodpecker

Red-cockaded Woodpecker Effects and Alternatives

The red-cockaded woodpecker is currently associated with the following species groups:

- Mature open pine-grass associates
- Den tree associates
- Xeric sandhill associates
- Terrestrial and non-riverine aquatic species sensitive to recreational traffic
- Species dependent on fire to maintain habitat

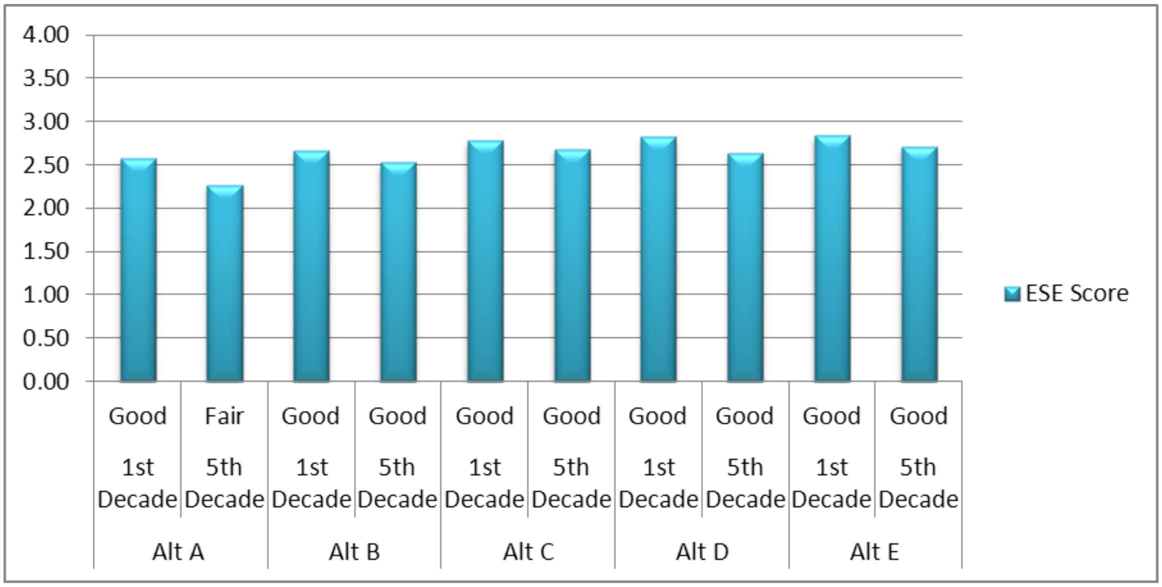


Figure 79. Forestwide ecological sustainability evaluation scores for the red-cockaded woodpecker

All overall ecological sustainability evaluation scores were calculated as good for this species for all alternatives and all time intervals except alternative A which exhibits a fair rating by the fifth decade (Figure 79).

Red-cockaded Woodpecker Environmental Effects

Ecological sustainability evaluation scores were calculated for this species based on habitat needs and protection measures associated with species groups that this species was linked to. All alternatives would create acceptable habitat conditions for the species during the first decade. Each alternative maintains this condition except for alternative A where conditions are slightly inadequate. Direct effects to red-cockaded woodpeckers could include mortality of individuals during capture, handling, translocation, or prescribed fire. Prescribed fire, even when employed within prescription and revised recovery plan guidelines, could result in the loss of individuals if nest trees are burned during nesting season. The revised recovery plan increases the protection standard (area raked around each roost tree); therefore, the potential for mortality to red-cockaded woodpeckers during nesting season due to prescribed fire is deemed insignificant and discountable, with standard mitigations given in the recovery plan. Losses of individual cavity trees to fire can be compensated by installation of artificial cavities. Avoidance of prescribed fires during the nesting season is not recommended, since nesting season coincides with timing favorable for other important ecological fire effects.

Indirect effects to red-cockaded woodpeckers occur at the landscape level and at the population level. There will be beneficial effects from the habitat management actions to red-cockaded woodpecker habitats and populations. Detrimental habitat isolation and fragmentation effects will be reduced as suitable habitat areas are enlarged and joined across the habitat management areas. Population expansion will be fostered by: restoration of off-site pine stands with native pine species; regeneration of limited mature pine stands with retention of potential roost trees; thinning of mid-successional and mature pine and pine-hardwood stands; prescribed fire to remove encroaching woody vegetation and restore herbaceous groundcovers; chemical and mechanical treatment of encroaching mid-story where fire is not a viable management tool; installation of artificial roosting and nesting cavities; protection of artificial and natural cavities from competitors through the installation of excluder devices; capture, banding and monitoring of individual birds to facilitate monitoring of the population; and translocation of birds as necessary to optimize annual reproduction.

Cumulative effects to red-cockaded woodpecker populations over the long-term (all alternatives) are expected to be population growth at rates prescribed in the recovery plan, recovery plan population objective attainment, and ultimately, recovery of the species. Management of red-cockaded woodpecker populations will be according to the most recent recovery plan and will not vary by alternative. Habitat management areas for red-cockaded woodpeckers have been established through direction in the EIS Record of Decision and the most current recovery plan.

Beneficial management actions required to implement the current recovery plan include:

- Harvesting timber, including thinning and regeneration;
- Using mechanical and chemical methods and prescribed fire for control of mid-story and hardwood encroachment;
- Installing artificial roosting and nesting cavities;
- protecting artificial and natural cavities from competitors through the installation of excluder devices;
- capturing, banding, and monitoring individual birds;
- translocating birds from donor populations to recipient populations; and
- Translocating birds intra-population, as necessary to optimize annual reproduction.

Protective measures required under the recovery plan for habitat management include:

- Protecting active and inactive cavity trees within burn units;
- Establishing rotation ages of not less than 120 years for shortleaf pine;
- limiting regeneration area size; and
- limiting the operable season to avoid nesting and brood-rearing periods in active clusters.

Potential risks to individuals after full implementation of protective measures are insignificant and discountable. Additional site-specific analysis would be conducted on all projects with the potential to affect this species.

Red-cockaded Woodpecker Habitat Management Areas

Red-cockaded Woodpecker Habitat Management Area Alternatives and Effects

The red-cockaded woodpecker has become a symbol of the native, mature and old growth, fire maintained open pineland ecosystems that previously covered much of the landscape in the southeastern states. Over the last 20 years, the habits and habitat of the red-cockaded woodpecker have been extensively studied, and scientists have found that it is one of the best, and to the trained eye, most visible indicators of a healthy longleaf pine forest. Presence of the red-cockaded woodpecker is a good sign that other plant and animal species native to these forests, such as the gopher tortoise, the pine snake, Bachman's sparrow, and the brown-headed nuthatch to name just a few, will most likely be present as well.

Much of the vegetative manipulation (prescribed burning, timber harvest or thinning, hardwood mid-story control, etc.) done in pine forests on the National Forests in Mississippi is done specifically to benefit red-cockaded woodpeckers. Assuring that the most appropriate management is utilized in planning and implementing these projects is critical to optimizing habitat for red-cockaded woodpeckers and for associated residents of longleaf pine communities.

Alternative B retains and establishes the tentative habitat management area boundaries described in the Final Environmental Impact Statement for the Management of Red-cockaded Woodpecker and it's habitat on National Forest lands in the Southern Region (1995) while all other alternatives adopt the revised habitat management area delineations described above. Establishing habitat management areas in all alternatives allows an ecosystem approach to red-cockaded woodpecker recovery. Habitat management area size is dependent on population objectives and habitat quality. Habitat management areas should contain contiguous blocks of suitable habitat. This is why, for example, in alternatives A, C, D, and E, the entire Chickasawhay District is included, excluding only the habitat not conducive to the species and its survival. The continuity of red-cockaded woodpecker habitat over large areas should preclude isolation of clusters and allow for dispersal of red-cockaded woodpecker across the landscape. Since the delineation of tentative habitat management areas included in alternative B, better information concerning red-cockaded woodpecker population demographics and understanding of ecosystem management and sustainability on the National Forests in Mississippi has been acquired; which is why the tentative habitat management areas were revised for all other alternatives. There should be no direct and indirect effects of establishing boundaries of habitat management areas. Direct and indirect effects of management within habitat management areas will not change by alternative and effects of ecosystem management will be further discussed within ecosystem and species sections of this document. Cumulative effects of establishing habitat management areas should be positive for all alternatives. The ecosystem approach would provide for nesting and foraging habitat and should allow red-cockaded woodpecker social interaction at the landscape level which should help in successful dispersal of sub-adults. Inclusion of private in holdings within habitat management area boundaries may lead to some habitat fragmentation, but it should not lead to demographic isolation.

4.5.4 Gulf Sturgeon

Gulf Sturgeon Effects and Alternatives

The Gulf sturgeon is currently associated with the following species groups:

- Aquatic species sensitive to stream sediment
- Aquatic species sensitive to stream toxins
- Species sensitive to modification of instream flow
- Aquatic species sensitive to non-point source pollution
- Aquatic species sensitive to non-native invasive species
- Riverine aquatic species sensitive to recreational traffic

All overall ecological sustainability evaluation scores were calculated as good for this species for all alternatives and all time intervals (Figure 80).

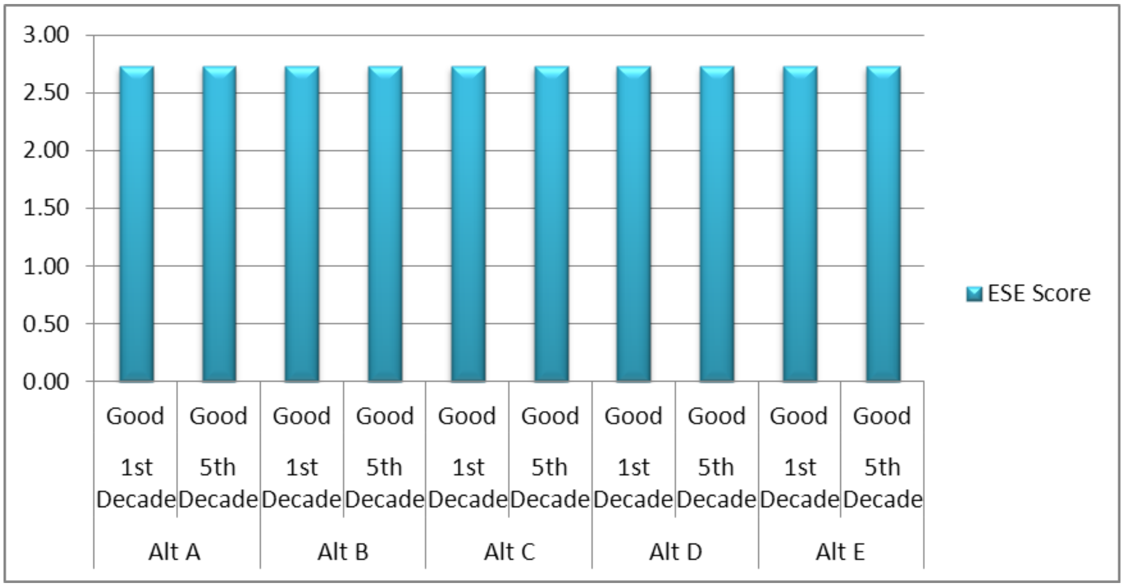


Figure 80. Forestwide ecological sustainability evaluation scores for the Gulf sturgeon

Gulf Sturgeon Environmental Effects

Ecological sustainability evaluation scores were calculated for this species based on habitat needs that the National Forests in Mississippi can actually provide for this species and protection measures associated with species groups that this species was linked to. All alternatives are conducive to acceptable habitat conditions for the species during all time intervals.

No direct effects from management in all alternatives are anticipated. Most hydrologic alterations on National Forests in Mississippi watersheds occur on privately owned adjacent lands and are outside of Forest Service control. The National Forests in Mississippi are not expected to contribute negative impacts to hydrologic regimes. The National Forests in Mississippi do not contribute to nor manage for non-point source pollution therefore no effects to this species are anticipated. Forest activities, such as thinning, regeneration, prescribed fire, and oil and gas leasing may contribute temporary low levels of sediment risk. Maintenance of National Forest System roads contribute varying levels of elevated sediment depending on slope, elevation, aspect, soil type, and road management regimes. Since many National Forest System roads are important for public and intra-agency access, these effects are unlikely to abate significantly. In other cases, National Forest System roads may fall under shared jurisdiction with other agencies and entities. Here again, these impacts are unlikely to abate significantly. Some forest management practices may require the application of herbicides and pesticides which may impact aquatic systems. In most watersheds, the Forests' sediment contributions are minor when compared to neighboring land uses. Cumulatively, sedimentation and herbicide and pesticides from the National Forests in Mississippi are predicted to have no or discountable effects on Gulf sturgeon habitat due to forestwide standards and guidelines designed to protect water quality and aquatic habitats. In all cases, best management practices and guidelines intended to minimize sediment risk levels should minimize risks to this species. With protective measures and guidelines implemented, all alternatives will have no direct effects and insignificant indirect and cumulative effects on the Gulf sturgeon.

4.5.5 Pallid Sturgeon

Pallid Sturgeon Effects and Alternatives

The Pallid sturgeon is currently associated with the following species groups:

- Aquatic species sensitive to stream sediment
- Aquatic species sensitive to stream toxins
- Species sensitive to modification of in-stream flow
- Aquatic species sensitive to non-point source pollution
- Aquatic species sensitive to non-native invasive species
- Riverine aquatic species sensitive to recreational traffic

All overall ecological sustainability evaluation scores were calculated as fair for this species for all alternatives and all time intervals (Figure 81).

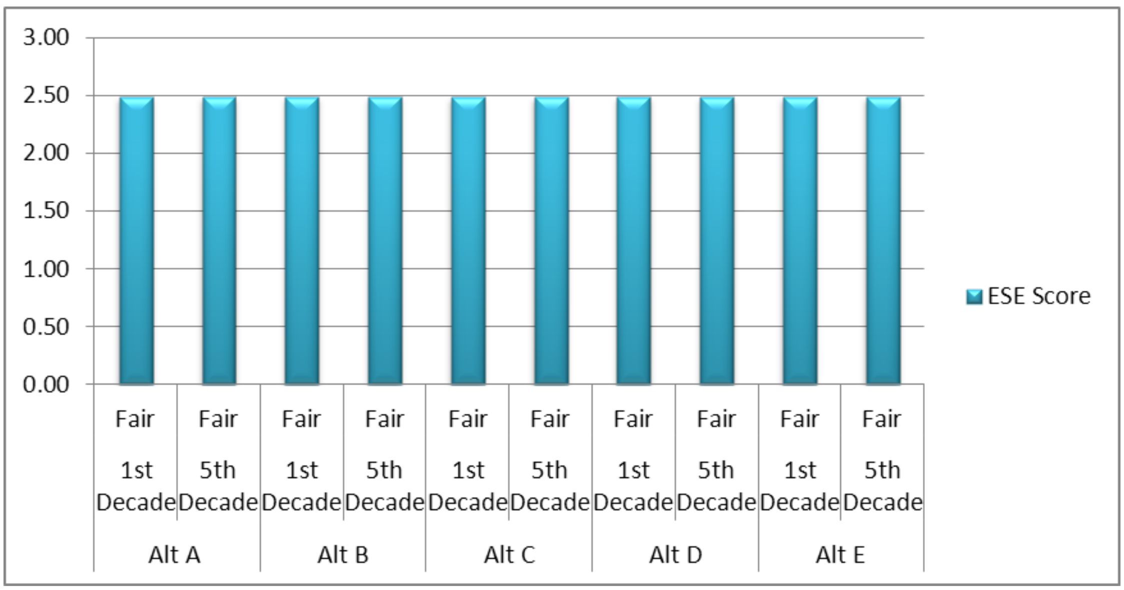


Figure 81. Forestwide ecological sustainability evaluation scores for the pallid sturgeon

Pallid Sturgeon Environmental Effects

Ecological sustainability evaluation scores were calculated for this species based on habitat needs that the National Forests in Mississippi can actually provide for this species and protection measures associated with species groups that this species was linked to. The resulting scores of the analysis described above, which are measured watershed-wide regardless of ownership profiles, result in a fair rating for current status and all alternatives. These scores were calculated based on the spatial extent of each watershed in non-forested land uses, particularly urban and agricultural areas. These scores are at a lower level due to non-point source pollution and stream toxin levels. While neighboring landowners may contribute varying and unpredictable levels of risk to watershed health, the National Forests in Mississippi will continue to maintain a positive contribution to aquatic sustainability. As a result, watershed health is expected to remain relatively stable, at least to the extent that the National Forests in Mississippi can control based on ownership profiles. National Forests in Mississippi lands do not contribute to non-point source or stream toxin risk levels therefore no effects are anticipated.

No direct effects from management in all alternatives are anticipated. Most hydrologic alterations on the Forests watersheds occur on privately owned adjacent lands and are outside of Forest Service control. The National Forests in Mississippi are not expected to contribute negative impacts to hydrologic regimes. The Forests do not contribute to nor manage for non-point source pollution therefore no effects to this species from Forest Service activities are anticipated. Forest activities, such as thinning, regeneration, prescribed fire, and oil and gas leasing may contribute temporary low levels of sediment risk. Maintenance of National Forest System roads contribute varying levels of elevated sediment depending on slope, elevation, aspect, soil type, and road management regimes. Since many National Forest System roads are important for public and intra-agency access, these effects are unlikely to abate significantly. In other cases, National Forest System roads may fall under shared jurisdiction with other agencies and entities. Here again, these impacts are unlikely to abate significantly. Some forest management practices may require the application of herbicides and pesticides which may impact aquatic systems. In most watersheds, the Forests' sediment contributions are minor when compared to neighboring land uses. Cumulatively, sedimentation and herbicide and pesticides from the National Forests in Mississippi is predicted to have no or discountable effects on pallid sturgeon habitat due to forestwide standards and guidelines designed to protect water quality and aquatic habitats. In all cases, best management practices and guidelines intended to minimize sediment risk levels should minimize risks to this species. With protective measures and guidelines implemented, all alternatives will have no direct effects and insignificant indirect and cumulative effects on the pallid sturgeon.

4.5.6 Louisiana Black Bear

Louisiana Black Bear Effects and Alternatives

The Louisiana black bear is currently associated with the following species groups:

- Den tree associates
- Mature riparian forest associates
- Terrestrial and non-riverine aquatic species sensitive to recreational traffic

All overall ecological sustainability evaluation scores were calculated as good for this species for all alternatives and all time intervals (Figure 82). Although small fluctuations do occur between the first and fifth decades in all alternatives, the differences are insignificant and are expected over time with varying management strategies.

Louisiana Black Bear Environmental Effects

Ecological sustainability evaluation scores were calculated for this species based on habitat needs that the National Forests in Mississippi can actually provide for this species and protection measures associated with species groups that this species was linked to. All alternatives are conducive to acceptable habitat conditions for the species during all time intervals.

Direct effects of all alternatives could include temporary disturbance, possible displacement of bears and prey species, and loss of potential den trees during forest management activities. Direct effects to individuals will be minimized through protection of the species, following the most current recovery plan, and following guidelines created for associated species groups. Guidelines to protect this individual species were also created and are as follows:

- For as long as they remain suitable, known black bear den sites should be protected by prohibiting vegetation management and ground-disturbing activities within a minimum of 100 feet around the den.

- Potential black bear den trees should be retained during all vegetation management treatments occurring in habitats suitable for bears. Potential den trees are those that are greater than 36 inches d.b.h. containing visible cavities.

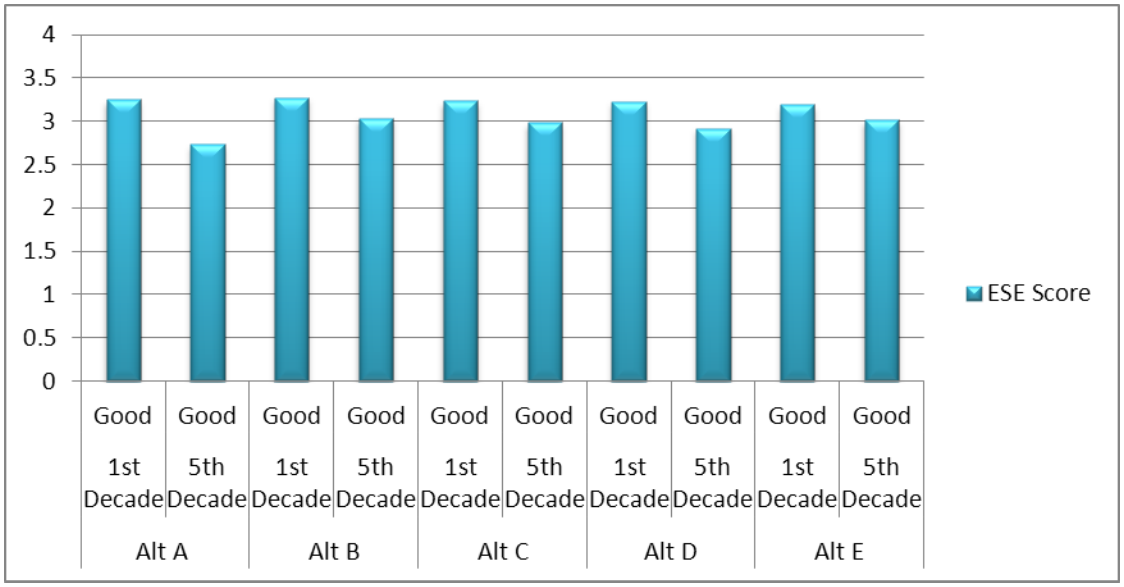


Figure 82. Forestwide ecological sustainability evaluation scores for the Louisiana black bear

Habitat quality could be reduced in the vicinity of development activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects. The benefits to Louisiana black bears by managing and restoring the habitat will far outweigh any negative effects.

Habitat quality could be reduced in the vicinity of development activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects. Cumulatively, implementation of any alternative is predicted to have no or discountable negative effects on Louisiana black bear due to forestwide standards, guidelines, and direction which were designed to protect the species and restore its habitat. With protective measures and guidelines implemented, all alternatives will have insignificant negative direct, indirect, and cumulative effects on the Louisiana black bear.

4.5.7 Gopher Tortoise

Gopher Tortoise Effects and Alternatives

The gopher tortoise is currently associated with the following species groups:

- Species sensitive to soil disturbance
- Mature open pine-grass associates
- Terrestrial and non-riverine aquatic species sensitive to recreational traffic
- Xeric sandhill associates

All overall ecological sustainability evaluation scores were calculated as good for this species for all alternatives and all time intervals (Figure 83). Although small fluctuations do occur between the first and fifth decades in all alternatives, the differences are insignificant and are expected over time with varying management strategies.

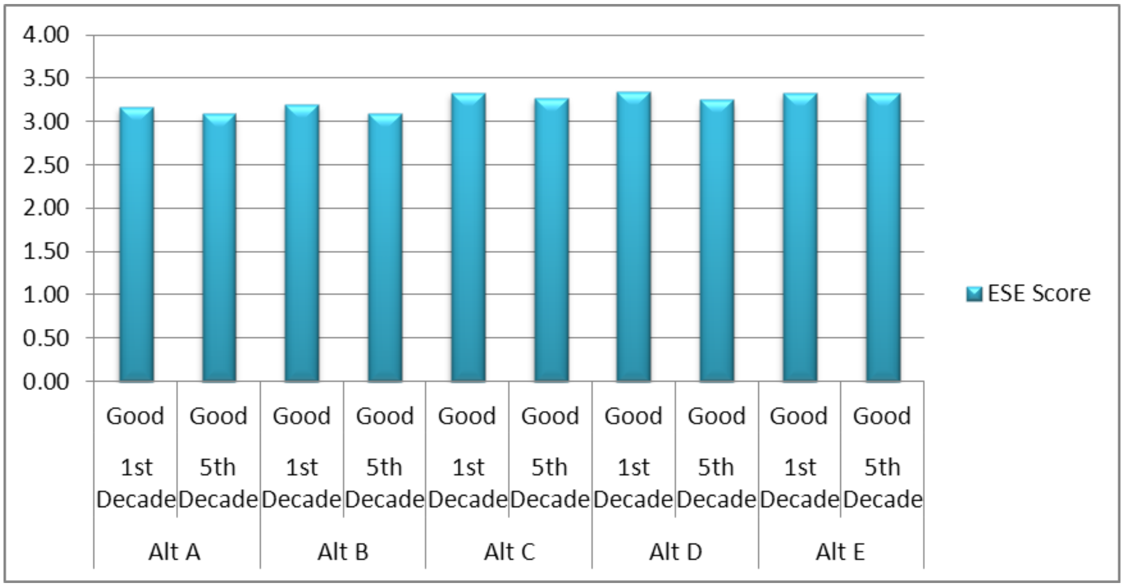


Figure 83. Forestwide ecological sustainability evaluation scores for the gopher tortoise

Gopher Tortoise Environmental Effects

Ecological sustainability evaluation scores were calculated for this species based on habitat needs and protection measures associated with species groups that this species was linked to. All alternatives would create acceptable habitat conditions for the species. Direct effects of all alternatives could include mortality of individuals from ground disturbing activities associated with habitat management. Ground disturbing activities that could potentially harm gopher tortoises include tree harvest during thinning operations and ecosystem restoration activities including longleaf conversion, fireline maintenance and construction, and road maintenance. Prescribed fire can also cause direct mortality to individuals. Direct effects to individuals can be minimized through protection of escape cover such as gopher tortoise burrows and following guidelines created for associated species groups.

Generally, the indirect effects of forest management activities will be beneficial to the gopher tortoise in all alternatives. Population expansion will be fostered by restoration of off-site pine species, thinning of mid-successional and mature pine, prescribed fire to remove encroaching woody vegetation and restore herbaceous groundcover, and chemical and mechanical treatment of encroaching mid-story where fire is not a viable management tool.

Cumulative effects to gopher tortoise populations over the long-term in all alternatives are expected to be population growth, and ultimately, recovery of the species. Management of this species and its habitat will be in accordance with the Endangered Species Act, cooperation with the US Fish and Wildlife Service, Mississippi Department of Wildlife, Fisheries and Parks and the Mississippi National Guard on Camp Shelby. The most current recovery plan will be incorporated into management of this species on the National Forests in Mississippi.

4.5.8 Louisiana Quillwort

Louisiana Quillwort Effects and Alternatives

The Louisiana quillwort is currently associated with the following species groups:

- Species sensitive to soil disturbance
- Mature riparian forest associates
- Seeps, springs, and seepage swamp associates
- Terrestrial and non-riverine aquatic species sensitive to recreational traffic
- Aquatic species sensitive to stream sediment
- Species sensitive to modification of in-stream flow
- Aquatic species sensitive to non-point source pollution
- Aquatic species sensitive to non-native invasive species
- Pine flatwood associates
- Species sensitive to hydrologic modification of wetlands
- Species dependent on fire to maintain habitat

All overall ecological sustainability evaluation scores were calculated as good for this species for all alternatives and all time intervals (Figure 84).

Louisiana Quillwort Environmental Effects

Ecological sustainability evaluation scores were calculated for this species based on habitat needs and protection measures associated with species groups that this species was linked to. All alternatives would create acceptable habitat conditions for the species. No direct effects from management in all alternatives are anticipated. Louisiana quillwort would be protected according to measures in the most current Louisiana Quillwort Recovery Plan and site-specific conditions based upon input from the US Fish and Wildlife Service.

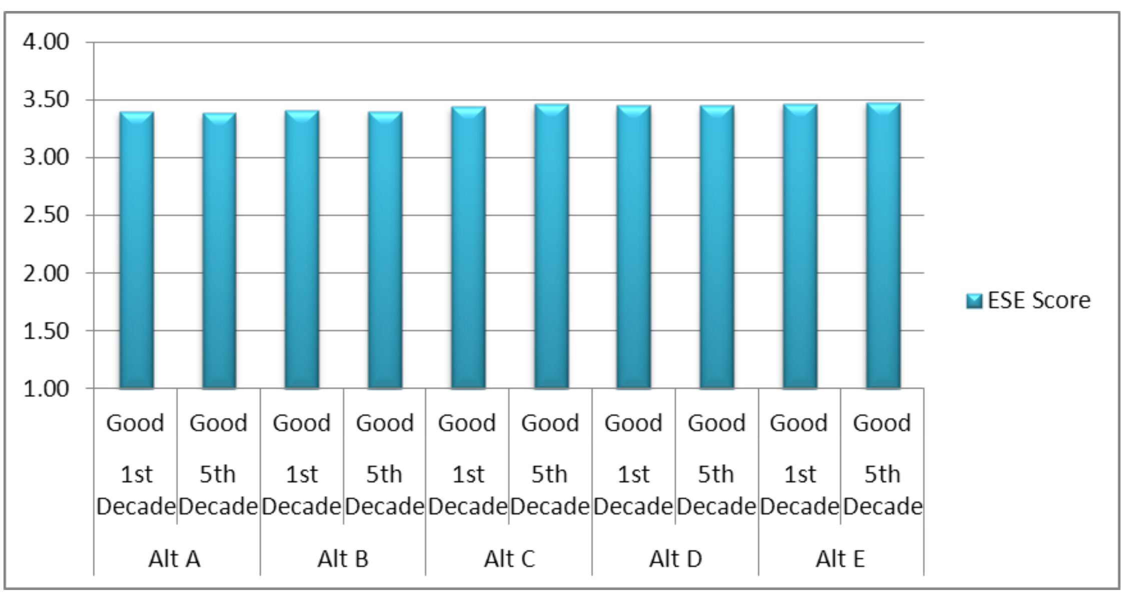


Figure 84. Forestwide ecological sustainability evaluation scores for the Louisiana quillwort

Most hydrologic alterations on the National Forests in Mississippi watersheds occur on privately owned adjacent lands and are outside of Forest Service control. The Forests are not expected to contribute negative impacts to hydrologic regimes. The Forests do not contribute to nor manage for non-point source pollution therefore no effects to this species are anticipated. Forest activities, such as thinning, regeneration, prescribed fire, and oil and gas leasing may cause indirect effects contributing temporary low levels of sediment risk. Maintenance of National Forest System roads also contribute varying levels of elevated sediment depending on slope, elevation, aspect, soil type, and road management regimes. Since many National Forest System roads are important for public and intra-agency access, these effects are unlikely to abate significantly. In other cases, National Forest System roads may fall under shared jurisdiction with other agencies and entities. Here again, these impacts are unlikely to abate significantly. Some forest management practices may require the application of herbicides and pesticides which also may impact aquatic systems. In most watersheds, the Forests' sediment contributions are minor when compared to neighboring land uses. Cumulatively, the Forests' management is predicted to have no or discountable effects on Louisiana quillwort habitat due to forestwide standards and guidelines designed to protect water quality and aquatic habitats, minimize sediment risk levels, and protect species occurrence should minimize risks to this species. With protective measures and guidelines implemented, all alternatives will have no direct effects and insignificant indirect and cumulative effects on the Louisiana Quillwort.

4.5.9 Pondberry

Pondberry Effects and Alternatives

The pondberry is currently associated with the following species groups:

- Species sensitive to soil disturbance
- Mature riparian forest associates
- Terrestrial and non-riverine aquatic species sensitive to recreational traffic
- Species sensitive to canopy cover modification

All overall ecological sustainability evaluation scores were calculated as good for this species for all alternatives and all time intervals (Figure 85).

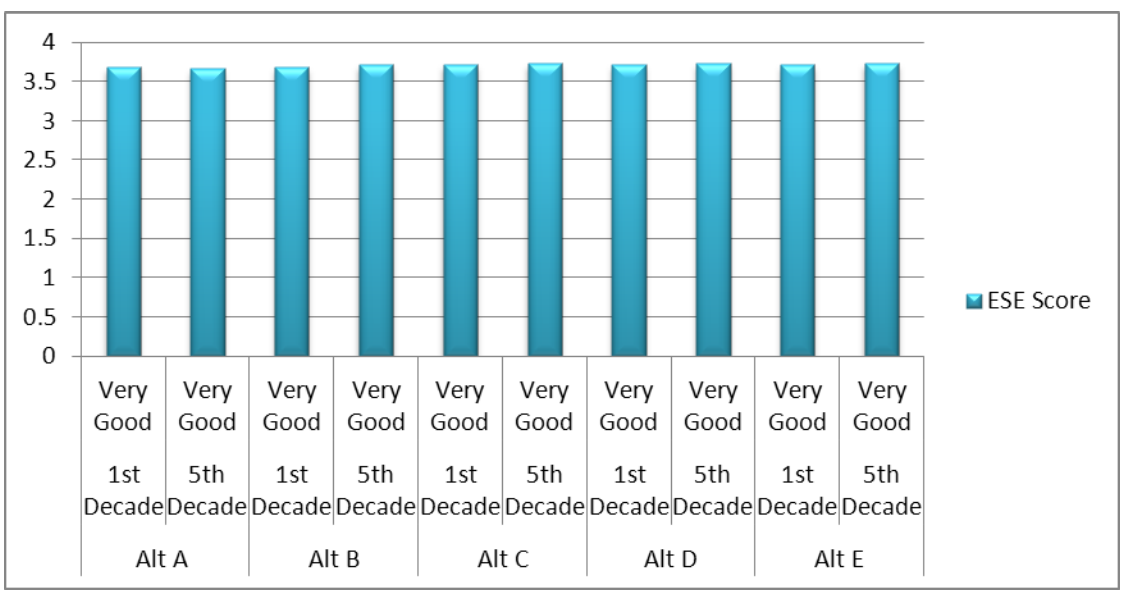


Figure 85. Forestwide ecological sustainability evaluation scores for the pondberry

Pondberry Environmental Effects

Ecological sustainability evaluation scores were calculated for this species based on habitat needs and protection measures associated with species groups that this species was linked to. All alternatives would create optimal habitat conditions for the species. No direct effects from management in all alternatives are anticipated. Pondberry would be protected according to measures in the most current recovery plan and site-specific conditions based upon input from the US Fish and Wildlife Service.

Direct effects of all alternatives could include mortality of individuals from ground disturbing activities associated with habitat management. Ground disturbing activities that could potentially harm pondberry include tree harvest during thinning operations and restoration during ecosystem management operations. Direct effects to individuals can be minimized through protection of individuals and following guidelines created for associated species groups and the species' recovery plan guidance.

Generally, the indirect effects of forest management activities will be beneficial to pondberry due to the increase of forest health and habitat quality through ecosystem management.

Cumulative effects to pondberry populations over the long-term in all alternatives are expected to be population growth, and ultimately, recovery of the species. Management of this species and its habitat will be in accordance with the Endangered Species Act and cooperation with the US Fish and Wildlife Service and Mississippi Department of Wildlife, Fisheries and Parks. The most current recovery plan will be incorporated into management of this species on the National Forests in Mississippi.

With protective measures and guidelines implemented, all alternatives will have insignificant direct, indirect, and cumulative effects on the pondberry.

4.6 Terrestrial Species Groups Covered by Ecological System Sustainability Forest Plan Components

The National Forests in Mississippi used species groups as an evaluation and analysis tool to improve planning efficiency and for development of management strategies. Species were grouped according to their habitat needs, limiting factors, threats, and specific habitat elements (snags, den trees, woody debris, etc.). All federally listed threatened and endangered species are included in species groups because although they have individual species requirements for management, their management is connected with ecosystem and species diversity. Many threatened and endangered, regional forester's sensitive, locally rare, and demand species occurred in multiple groups.

Initial groupings of species were at a broad spatial scale and were based on similar habitats associated with ecological systems. Each group was analyzed by species, and determinations made on whether species needs were fully met by forest plan components for the associated ecological systems. The ecological system sustainability components were described in section 3.5.1 of the EIS. These groups and the ecological system(s) with which they are associated are listed in appendix G. Species to group relationships were weighted from "very high" to "low" with higher ratings indicative of indispensable relationships between species and the habitat attributes targeted by a given group.

Road and trail density is an important aspect of these data that is unlikely to change or improve over time. Many roads that cross the Forests' lands are administered under the jurisdiction of local, State, and other Federal entities and are therefore, outside of the control of the National Forests in Mississippi. Roads and trails administered by the Forests are in most cases considered essential to public access. While some roads and trails may be gated and rehabilitated if considered unessential to the public good, the overall road and trail density scores among all alternatives will change little due to the statistical weight of roads outside the Forests' jurisdiction. While road densities are a concern in some instances, in many cases road and trail ecological sustainability evaluation scores are already in the good or very good range which is expected to continue to contribute to ecological sustainability on National Forest System lands.

4.6.1 Cypress Dominated Wetlands Associates

These species are generally associated with swamps that are dominated by cypress and require intact hydrologic function of this system. A list of targeted species associated with this species group can be found in appendix G. Of the listed species, only the cypress-knee sedge is dependent on the presence of cypress trees. Headcutting is threatening hydrologic integrity of two of the better known examples on the Forests (Holly Springs and Homochitto NFs). It is assumed that sustainable populations will continue as long as there is permanently flooded cypress-gum forest with hydrologic integrity. Headcutting or other events leading to drainage and sedimentation from adjacent uplands may prevent management for sustainable populations of these species, and rapid assessment protocols should be designed to measure sustainability of cypress dominated wetland associates. Relative abundance of cypress dominated wetland ecological systems and restoration and maintenance of hydrologic integrity are key characteristics for this species group. Planting of cypress may be necessary to restore some of these sites. Forest plan components include desired conditions for cypress dominated wetlands and guidelines for vegetation and wildlife; soil and water; roads; herbicides; and administration, facilities, and recreation.

Depending on past history of disturbance and other factors, bald cypress may occur with other species such as black gum, water tupelo, green ash, ironwood and red maple. Cypress dominated wetlands may be found throughout the Forests, but due to inconsistencies in past mapping practices there is no current accurate estimate of the amount of acreage in this type. Current condition of this type on the forest is probably relatively young forest growing back from harvest in the early part of this century. Several key locations are at risk due to headcutting of streams threatening to drain the wetland, while other locations have been harvested without successful cypress regeneration and await restoration.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is not presented since composite scores did not change across alternatives or time interval.

Due to small amount of acreage of this rare community and inadequate mapping (they are usually mapped as inclusions inside a larger stand) and that stands containing cypress are to be managed as old growth, effects are the same across all alternatives. No charts are presented because there is no change across alternatives for the species in this group.

Cypress Dominated Wetlands Associates Alternatives and Effects

All overall ecological sustainability evaluation scores were calculated as very good for this system for all alternatives and all time intervals, while units where data was available are rated as good. There are many data needs for this system including location and aerial extent of occurrences of the system across the Forest.

Cypress Dominated Wetlands Associates Environmental Effects

Restoration operations including system creation and restoration, regeneration, harvest of offsite species, and salvage operations in the wake of natural disturbances in the surrounding matrix community may be required in some cases. Where restoration occurs, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used during management of this ecosystem (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties. Note that where this embedded ecosystem is found, it will be protected by the National Forests in Mississippi as a designated old-growth area.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Best management practices and guidelines regarding non-native invasives are expected to mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management and protection should result in sustainable native communities and associated species, especially as management is expected to be as designated old growth. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

4.6.2 Herbaceous Seepage Bogs and Flats Associates

Herbaceous seepage bogs and flats are rare communities and provide unique habitats for many species. A list of targeted species associated with this species group can be found in appendix G. Various species of pitcher-plants are often dominant in these areas. Inventory and mapping of herbaceous seepage bogs are important to help understand and manage these species. It is assumed that sustainable populations of the associated species will continue in conjunction with maintenance of hydrologic regime, regular prescribed burning, and protection from human disturbance (vehicular and foot traffic). Some of these areas have grown up in woody vegetation and may require mechanical clearing. Although guidelines generally prohibit management activities within rare communities, exceptions can be made for restoration of the system. When management activities occur within a rare community, the species associated with it should be considered at the project level.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented in Figure 86.

Herbaceous Seepage Bogs and Flats Associates Alternatives and Effects

As shown in Figure 86, all alternative scores by decade remain with a good overall ecological sustainability evaluation score for this species association. Management focus and intensity does not change across alternatives in the ecosystem related to this species association.

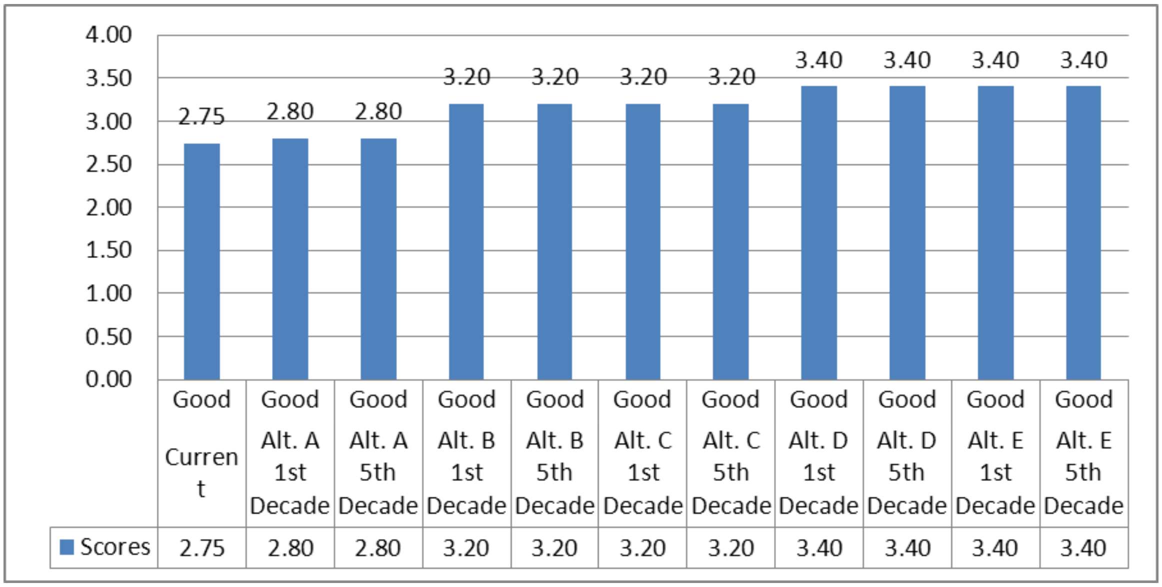


Figure 86. Herbaceous seepage bogs and flats associates current and estimated ecological sustainability evaluation scores forestwide

Herbaceous Seepage Bogs and Flats Associates Environmental Effects

Protection of this ecosystem is a priority in all alternatives. Restoration will be based on management intensity and scale (acres restored through time). Restoration and maintenance activities will include prescribed fire, thinning, and offsite canopy species conversion to native canopy species, native herbaceous understory, restoring hydrologic function, and protection of the system.

Past management practices have favored less fire-tolerant communities normally associated with fire suppression and the introduction of offsite canopy species. Prescribed fire will alter both overstory and understory composition in favor of fire-tolerant and fire-dependent vegetative assemblages at the expense of species not normally associated with pyrogenic uplands. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with this system. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire to longleaf-associated species and communities will far outweigh any losses incurred during implementation.

Forest thinning and harvests of offsite species within this system and within the surrounding matrix communities may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Use of herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts are expected to be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat restoration.

Vehicle and machinery use and other ground disturbing activities during restoration and maintenance activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass and red-imported fire ants. Best management practices and guidelines regarding non-native invasives are expected to mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species. The proposed thinnings would reduce the average basal area of pine stands in the project area, thus reducing the risk of southern pine beetle infestation on National Forest System and private lands.

Wildlife would benefit from thinning, harvest, restoration and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire and change in hydrology of the system. Prescribed burnings would reduce the forest fuel, thus lessening the risk of catastrophic fires. Habitat quality could be reduced in the vicinity restoration activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components and hydrologic function should increase in coverage and quality. Changes in floral and faunal community composition and hydrology can be expected as restoration sites progress through successional stages. These changes should be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple seral stages.

In all alternatives, the long-term effects of ecosystem management and protection are expected to result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern should remain sustainable.

4.6.3 Mature Mesic Deciduous Forest Associates

Mature mesic deciduous forest communities are located on cool north-facing slopes with rich soils and thick layers of fertile leaf litter. They can be considered to be patches within a matrix of more xeric forest types. Each patch is only a small portion of the overall landscape and is generally removed from other mesic deciduous forest by 100 meters or more. A list of targeted species associated with this species group can be found in appendix G. Species dependent upon this forest type generally require closed canopy forest with moist organic soils and thick leaf litter. Abundance of mast-producing trees provides food for many species and downed wood, snags, and other refuge are a key requirement within this group (appendix G). Species should remain sustainable if a mature, closed canopy mesic deciduous forest is maintained on the landscape and appropriate guidelines are followed. It is important that only low intensity fire creep into these areas to maintain the duff and organic layer.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented in Figure 87.

Mature Mesic Deciduous Forest Associates Alternatives and Effects

As shown in Figure 87, all alternative scores by decade remain with a good overall ecological sustainability evaluation score despite little management due to few management needs for systems related to this species association.

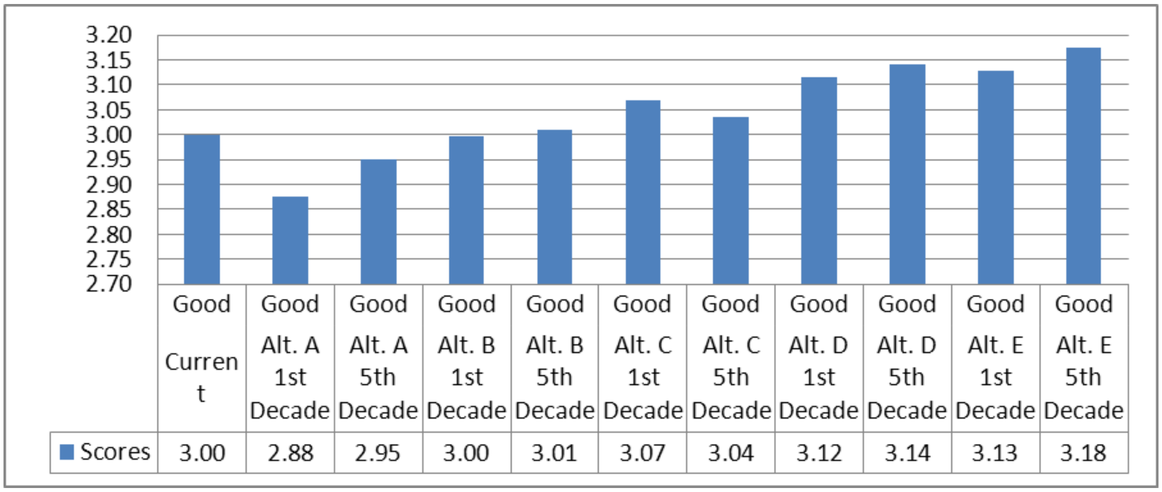


Figure 87. Mature mesic deciduous forest associates current and estimated ecological sustainability evaluation scores forestwide

Mature Mesic Deciduous Forest Associates Environmental Effects

Management activities will include infrequent, low intensity prescribed fire and maintaining this species association at its current abundance across the Forests over time. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Regeneration will primarily occur naturally or as a result of salvage operations in the wake of natural disturbances. In cases where managed regeneration may be required, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used during management of the associated ecosystems (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to these species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

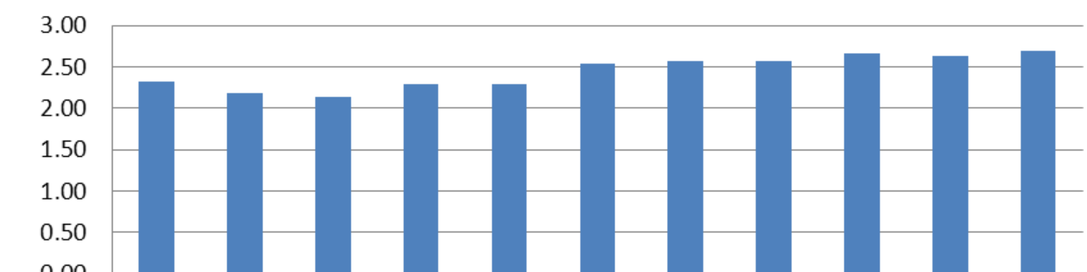
4.6.4 Mature Open Pine-Grass Associates

Mature upland pine forests and woodlands support a diversity of species and provide critical habitat for several rare and endangered species. A list of targeted species associated with this species group can be found in appendix G. Pine-grass associated species are dependent on mature open canopy, fire-maintained forests or woodlands across multiple ecosystem types. Frequent fire is critical to maintaining these systems, and in the absence of fire, chemical or mechanical means may be needed to maintain the herbaceous grass/forb layer. Abundant, diverse ground cover provides food and shelter for a variety of wildlife species. By providing for healthy and abundant upland pine forests, species in this group should continue to thrive on the National Forests in Mississippi.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented in Figure 88.

Mature Upland Open Pine-Grass Associates Alternatives and Effects

Alternatives A and B provide slightly inadequate conditions for this species association, while alternatives C, D, and E should provide sustainable conditions over the next half century (Figure 88).



	Fair Current	Fair Alt. A 1st Decade	Fair Alt. A 5th Decade	Fair Alt. B 1st Decade	Fair Alt. B 5th Decade	Good Alt. C 1st Decade	Good Alt. C 5th Decade	Good Alt. D 1st Decade	Good Alt. D 5th Decade	Good Alt. E 1st Decade	Good Alt. E 5th Decade
Scores	2.32	2.19	2.13	2.29	2.30	2.53	2.56	2.57	2.67	2.63	2.69

Figure 88. Mature open pine-grass associates current and estimated ecological sustainability evaluation scores forestwide

Mature Open Pine-Grass Associates Environmental Effects

Restoration of ecosystems contributes to the health of this species association is a priority in alternatives C, D, and E. The future distribution of the associated ecosystems on the Forests will vary across all alternatives based on management intensity and scale (acres restored through time). Restoration and maintenance activities will include prescribed fire, thinning, and offsite canopy species conversion to native ecosystems.

Past management practices have favored less fire-tolerant communities normally associated with fire suppression and the introduction of offsite canopy species. Prescribed fire will alter both overstory and understory composition in favor of fire-tolerant and fire-dependent vegetative assemblages at the expense of species not normally associated with pyrogenic uplands. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with mature pine-grasslands. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire this species association will far outweigh any losses incurred during implementation.

Forest thinning and harvests of offsite species may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts are expected to be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat restoration.

Vehicle and machinery use and other ground disturbing activities during restoration and maintenance activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass and red-imported fire ants. Best management practices and guidelines regarding non-native invasives are expected to mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species. The proposed thinnings would reduce the average basal area of pine stands in the project area, thus reducing the risk of southern pine beetle infestation on National Forest System and private lands.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, thus lessening the risk of catastrophic fires. Habitat quality could be reduced in the vicinity restoration activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality. Changes in floral and faunal community composition can be expected as restoration sites progress through successional stages. These changes are expected to be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple seral stages.

In some cases, prescribed fire will be the only restoration method required to gradually transition mature open offsite canopies to more fire-tolerant pines. In these cases, a variety of age classes and successional stages should be present providing multiple habitat and micro-habitat opportunities for a diverse assemblage of species.

In alternatives C, D, and E the long-term effects of restoration, management, and maintenance of the ecosystem are expected to be critical to the sustainability of this species association. Over time, associated species of regional as well as local viability concern will become increasingly sustainable. In both decades of alternative A and B, conditions remain slightly inadequate; although associated species' populations may persist for some time, they may be subject to gradual decline.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under alternatives C, D, and E. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species. These positive impacts are less pronounced in alternative A and B.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of alternatives C, D, and E will be minor while the positive impacts will be substantial.

4.6.5 Mature Riparian Forest Associates

These species are dependent upon adequate soil moisture and closed canopy deciduous forest in riparian areas. An abundance of mast producing trees and shelter in the form of downed wood, snags, and tree cavities must be available for species occurring within this system. A list of targeted species associated with this species group can be found in appendix G. It is assumed that sustainable populations will persist if the riparian areas contain a mature, closed canopy forest with little or no unnatural disturbance, and the hydrologic function remains intact.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented in Figure 89.

Mature Riparian Forest Associates Alternatives and Effects

All alternatives continue as good for this species association and are expected to provide sustainable conditions over the next half century (Figure 89).

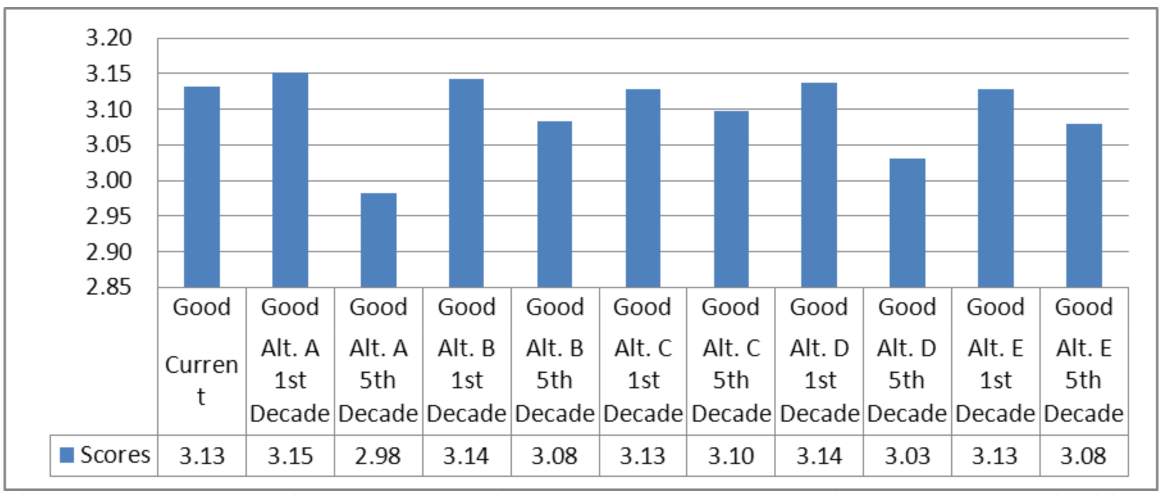


Figure 89. Mature riparian forest associates current and estimated ecological sustainability evaluation scores forestwide

Mature Riparian Forest Associates Environmental Effects

Management activities will include infrequent, low intensity prescribed fire and maintaining this species association at its current abundance across the Forest over time. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Regeneration will be primarily allowed to occur naturally or as a result of salvage operations in the wake of natural disturbances. In cases where managed regeneration may be required, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used during management of the associated ecosystems (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to these species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

4.6.6 Mature Upland Pine-Hardwood Associates

These species are associated with xeric stands of hardwood although pine may be intermingled with the oaks. A list of targeted species associated with this species group can be found in appendix G. These forests occur on sandy, porous, nutrient-poor soils typically found on southern and western slopes or on hilltops dominated by oaks and hickories. The irregular canopy creates openings for sunlight to penetrate to the forest floor, where a variety of saplings develop, opening the way for succession. Oak leaves are low in nutrients, high in acid and slow to decay. Oaks “stump-sprout” following a fire further perpetuating their species. Shrub diversity is highly variable throughout this extensive landscape area, providing a variety of food sources and habitat for animal species. The ground layer under this relatively sunny canopy tends to bloom in mid-summer. Some of the native flowers that occur in this community include orchids, rattlesnake plantain, smooth bedstraw, wild geranium, and false Solomon's seal.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented in Figure 90.

Mature Upland Pine-Hardwood Associates Alternatives and Effects

Alternative A provides slightly inadequate conditions for this species association, while alternatives B, C, D, and E are expected to provide sustainable conditions over the next half century (Figure 90).

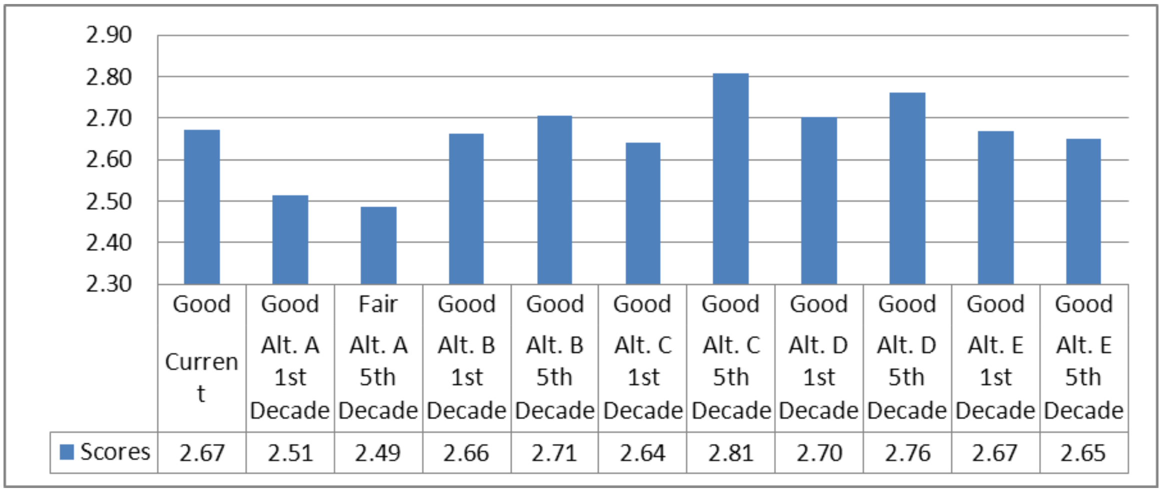


Figure 90. Mature upland pine-hardwood associates current and estimated ecological sustainability evaluation scores forestwide

Mature Upland Pine-Hardwood Associates Environmental Effects

Management activities will include prescribed fire, thinning, and regeneration. Prescribed fire is essential to maintenance of structural and compositional attributes critical to this species association. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Forest thinning and harvest may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burning would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality. Changes in floral and faunal community composition can be expected as regeneration sites progress through successional stages. These changes are expected to be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In alternatives B, C, D, and E, the long-term effects of ecosystem management should be sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable. In alternative A, the associated systems will not achieve sustainability of native communities and this associated species group.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives; except alternative A which includes no management of associated systems. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species in alternatives B, C, D, and E.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of alternatives B, C, D, and E will be minor while the positive impacts will be substantial. Alternative A will have negative impacts on species and communities in the long run due to little management of the associated systems.

4.6.7 Pine Flatwoods Associates

Species in this group inhabit sparse woodlands dominated by longleaf and slash pine with scattered loblolly pine, located predominately on non-riverine hydric soil site types. A list of targeted species associated with this species group can be found in appendix G. Fire is necessary to maintain this habitat as well as intact hydrologic regimes. Past agricultural practices have altered the habitat and efforts should be made to restore it to its original form. Management activities are frequently needed to restore near-coast pine flatwood forests, historical fire regimes, and characteristic grass-forb understories.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented Figure 91.

Pine Flatwoods Associates Alternatives and Effects

As shown in Figure 91, all alternative scores by decade remain sustainable throughout the next 50 years. Alternatives A and B with a good overall ecological sustainability evaluation score, and alternatives C, D, and E achieving very good scores with Alternative E having the highest score.

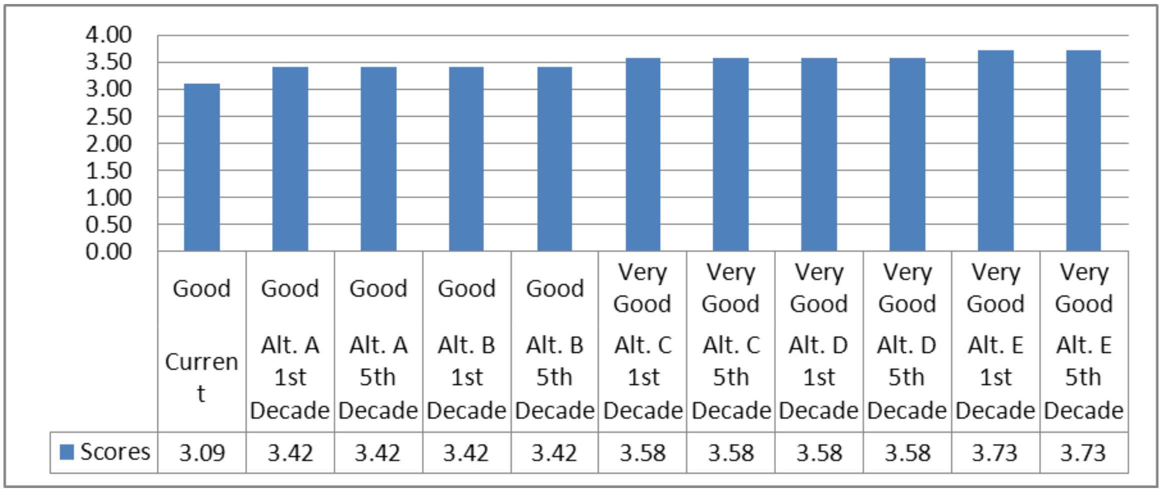


Figure 91. Pine flatwoods associates current and estimated ecological sustainability evaluation scores forestwide

Pine Flatwoods Associates Environmental Effects

Management activities will include prescribed fire, thinning, and regeneration. Prescribed fire is essential to maintenance of structural and compositional attributes critical to this species association. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Forest thinnings and harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality. Changes in floral and faunal community composition can be expected as regeneration sites progress through successional stages. These changes should be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In all alternatives, the long-term effects of ecosystem management should be sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern should remain sustainable. Alternatives C, D and E will hasten the recovery of the ecosystem and have better effects on the species group sooner.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives except alternative A which includes no management of associated systems. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species in all alternatives.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of all alternatives will be minor while the positive impacts will be substantial.

4.6.8 Ponds and Emergent Wetlands Associates

The species associated with this wetland system utilize a wide array of seasonally flooded depression wetlands, freshwater marshes, and ephemeral ponds. A list of targeted species associated with this species group can be found in appendix G. Included here are ponds of various geomorphic origins in a variety of substrates including lime sinks and Grady ponds which may hold areas of shallow open water for significant portions of the year. Many of these have been altered or destroyed as a result of agricultural practices or erosion from disturbance on adjacent uplands. Past management actions in these areas may have resulted in woody plant encroachment and drainage of the wetlands. The few remaining examples are vulnerable to OHV use, ditching and drainage, and invasion by non-native plants and animals. Information on location and size of this community type is not well known or documented.

Since they are of small size and often dry up during the year, they are valuable as breeding sites for amphibians and are invaluable for Mississippi sandhill crane breeding on the De Soto National Forest. These habitats are also important for Mississippi gopher frog breeding and survival. Many of the species in this group thrive in a fishless environment as fish are known predators of larval amphibians. Species in this group generally migrate to ponds and emergent wetlands for breeding and are susceptible to hazards caused by crossing roads. Species in this group are also susceptible to damage caused by trampling and hydrologic modification cause by OHVs or other human disturbance.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for the first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented in Figure 92. However, since these unique wetlands are small and not easily identified during large portions of the year, no meaningful inventory by location or size currently exists. The composite scores are dependent on adherence to guidelines.

Ponds and Emergent Wetlands Associates Alternatives and Effects

The sustainability of this species group is dependent on mapping current and historic occurrences and undertaking management activities as necessary to restore and enhance the ecosystem. These activities may include restoration of hydrologic function, removal of predator fish species, thinning and or removal of the overstory, and prescribed burn to maintain habitat conditions. These activities are easily achieved and sustainability of the species group readily assured.

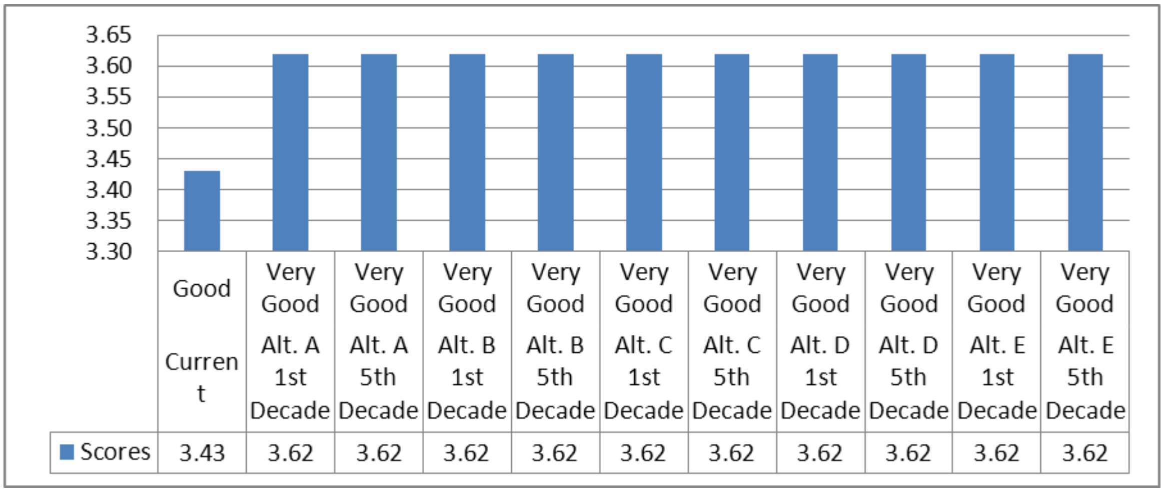


Figure 92. Ponds and emergent wetlands associates current and estimated ecological sustainability evaluation scores forestwide

Ponds and Emergent Wetlands Associates Environmental Effects

Management activities will include prescribed fire at the same frequency and intensity as the surrounding matrix community and maintaining ecosystem abundance across the Forests over time. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems in which this community is embedded. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation. Some direct mortality of competing fish species is expected and desired.

Where timber and restoration operations including pond creation and restoration, thinning, regeneration, and salvage operations in the wake of natural disturbances in the surrounding matrix community may be required, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used during management of this ecosystem (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties. Note that where this embedded ecosystem is found, it will be protected by the National Forests in Mississippi.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management and protection are expected to result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

4.6.9 Prairie Associates

These species are associated with two rare ecological systems (Jackson prairie and black belt) and occupy open grassy areas with highly calcareous, high pH soils. The herbaceous and grass species are dominated by characteristic prairie species. A list of targeted species associated with this species group can be found in appendix G. Known sites are now in woodland or sparsely forested due to past land use practices. Many may show signs of erosion such as gullies. Plant species diversity in these understories has likely been adversely affected by past intensive grazing, and use of the prairie openings as wildlife food plots, roads and log landings. Management activities are frequently needed to restore prairie vegetation, enlarge present openings, and restore damage done by past management actions (remove food plots, log landings, etc.), historical fire regimes. Locations of this rare community should be identified and mapped on the National Forests in Mississippi. Rapid assessment protocols should be developed to determine sustainability of these species, and species in this group should be protected from ground disturbance, human disturbance, and habitat loss.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for the first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented in Figure 93.

Prairie Associates Alternatives and Effects

As shown in Figure 93, all alternative scores for this species group by decade with the lone exception of alternative A remain with a good overall ecological sustainability evaluation score.

Prairie Associates Environmental Effects

The future conditions of this ecosystem will vary little based on overall score of the system when all variables are taken in account. Restoration of this ecosystem to appropriate acres that have been previously converted to other system types or allowed to degrade, though, is a priority in alternatives C, D, and E in the first decade while alternative B does not meet restoration goals until the fifth decade. Restoration and maintenance activities will include prescribed fire and offsite species conversion to native vegetation.

Past management practices have favored less fire-tolerant communities normally associated with fire suppression and the introduction of offsite canopy species. Prescribed fire will alter both overstory and understory composition in favor of fire-tolerant and fire-dependent vegetative assemblages at the expense of species not normally associated with pyrogenic uplands. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with this system. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire to prairie associated species and communities, will far outweigh any losses incurred during implementation.

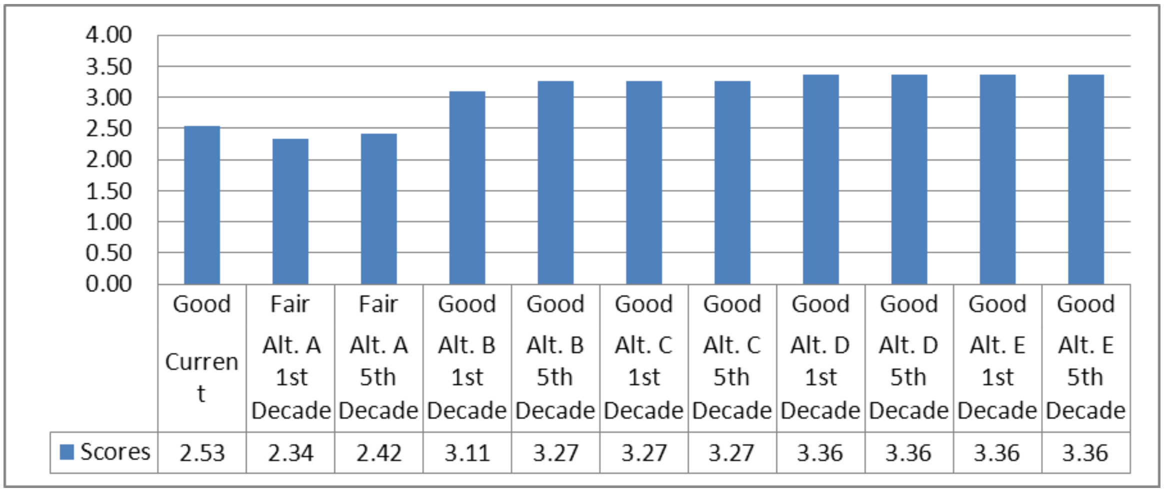


Figure 93. Prairie associates current and estimated ecological sustainability evaluation scores forestwide

Forest harvests of offsite species may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat restoration.

Vehicle and machinery use and other ground disturbing activities during restoration and maintenance activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from restoration activities and prescribed fire through increased soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Habitat quality could be reduced in the vicinity of restoration activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality. Changes in floral and faunal community composition can be expected as restoration sites progress through time. These changes should be gradual and are considered natural in response to the variety of habitat characteristics.

In all alternatives, the long-term effects of restoration, management, and maintenance of the ecosystem are critical to the sustainability of this system and associated species. Over time, associated species of regional as well as local viability concern will become increasingly sustainable.

4.6.10 Rock Outcrop Associates

Rock outcrops are rare, localized features of the landscape which mainly occur along steep hill slopes, ravines, or river channels where soils have eroded away. They are usually embedded in a larger ecological system and rely heavily on surrounding habitats for landscape scale functions and processes. There are an estimated 500 acres of this habitat in the entire state of Mississippi. Distribution on the National Forests in Mississippi is unknown; however, rock outcrops may occur on all National Forests except the De Soto Chickasawhay and Delta Units. Although of minor aerial extent, the rock outcrops provide unique quality habitat for several species of animals and plants including Webster's salamander and hairy lipfern.

The primary species associated with rock outcrops on the National Forests in Mississippi is Webster's salamander. A list of targeted species associated with this species group can be found in appendix G. Webster's salamander is found in association with this system and is dependent upon it for thermal refuge. Webster's salamanders are not considered fully covered by ecological diversity plan components as they have needs in addition to those covered by their associated ecological systems. Many other herpetofaunal and plant species also depend upon this rare habitat as rock outcrops provide thermal refuge and foraging opportunities for associated species. General management strategy for this species group includes completion of inventory and mapping of the ecological system as part of project planning, training on recognition and ecological function of rare ecosystems, and development of rapid assessment criteria. Management activities are frequently needed to restore hardwood overstories and healthy hydrologic regimes such as springs and seeps that often co-occur with rock outcrops. The inclusion of rock outcrops in designated old-growth or botanical areas should be a priority of the National Forests in Mississippi.

Rock Outcrop Associates Alternatives and Effects

Retention of rock outcrop ecosystems is a priority across all alternatives. These small, localized ecosystems are not currently mapped; and identifying and mapping outcrops is a high priority. Management activities would mainly consist of avoiding any damage to outcrops and actions to restore shade to outcrops where necessary over time.

Rock Outcrop Associates Environmental Effects

Management activities will include low intensity prescribed fire over a relatively long interval at the same frequency as the surrounding matrix community and maintaining ecosystem abundance across the Forests over time. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems in which this community is embedded. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Where timber operations including thinning, regeneration, and salvage operations in the wake of natural disturbances in the surrounding matrix community may be required, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used during management of this ecosystem (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties. Note that where this embedded ecosystem is found, it will be protected by the National Forests in Mississippi.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities in surrounding matrix communities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives are expected to mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

4.6.11 Seeps, Springs, and Seepage Swamps Associates

Species occurring in this group require forested wetlands in acidic, seepage-influenced habitats. These habitats are usually in deciduous forests or herbaceous communities and are generally found at the base of slopes where seepage flow is concentrated and resulting moisture conditions are saturated or inundated. A list of targeted species associated with this species group can be found in appendix G. The vegetation is characterized by black gum, tupelo gum, and red maple. Due to excessive wetness, historically these sites have not been as highly disturbed as adjacent upland areas and are protected from fire except during extreme droughty periods. Currently, they are susceptible to damage from hydrologic changes, canopy cover reduction, and human disturbance. Local lowering of water tables has caused many seeps and springs to dry during part of the year. Maintenance of saturated to inundated soil conditions are essential to maintenance of the unique forb, grass, and sedge community dependent upon these sites. Without wet conditions, the site would soon be dominated by more xeric species from surrounding habitats. Management activities are frequently needed to maintain canopy closure as appropriate over these communities and to ensure maintenance of the water table. Current information on location and size of this community type is not well documented.

Seeps, Springs, and Seepage Swamps Associates Alternatives and Effects

Retention of the ecosystem is a priority across all alternatives. These small, localized ecosystems are not currently mapped and identifying and mapping occurrences is a high priority. Management activities would mainly consist of avoiding any damage to this ecosystem and actions to restore shade to this ecosystem where necessary over time. Sustainability is estimated as good across all alternatives (Figure 94).

Seeps, Springs, and Seepage Swamps Associates Environmental Effects

Management activities will include prescribed fire at the same frequency and intensity as the surrounding matrix community and maintaining ecosystem abundance across the Forests over time. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems in which this community is embedded although fire frequency in this system is expected to only occur during periods of drought. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

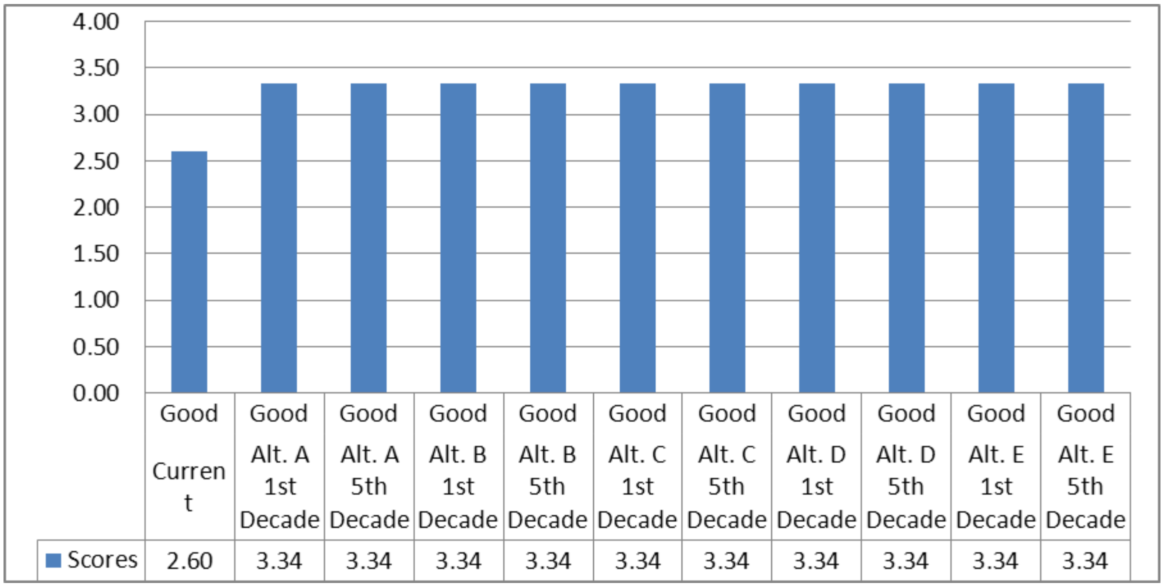


Figure 94. Seeps, springs and seepage swamps associates current and estimated ecological sustainability evaluation scores forestwide

Where timber and restoration operations of surrounding matrix communities are warranted, this ecosystem and its hydrology should be protected using guidelines and best management practices. Where thinning, regeneration, and salvage operations in the wake of natural disturbances in the surrounding matrix community may be required, harvests may expose some species and communities, especially those in transition zones, to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance although this system will be protected from machinery disturbance due to soil moisture and protection measures aimed at maintaining hydrologic integrity. Herbicides may also be used during management of this ecosystem (including invasive species control to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices and guidelines. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties. Note that where this embedded ecosystem is found, it will be protected by the National Forests in Mississippi.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives are expected to mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management and protection should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

4.6.12 Wet Pine Savanna Associates

These species occupy rare wetland systems of open savannas dominated by grasses, sedges, orchids, and carnivorous plants. A list of targeted species associated with this species group can be found in appendix G. Occurrences on the National Forests in Mississippi typically have too much canopy closure, causing negative impacts on the hydrologic regime.

Carnivorous plants are diagnostic, especially pitcher plants. Pitcher plants range from dominant or co-dominant to sparse, and several species may be present. Where ephemeral ponds and emergent wetlands are interspersed, this is habitat for the endangered Mississippi sandhill crane. Frequent fires, including growing-season burns, are essential for stimulating rich understories of grasses and forbs. Inventory, mapping, and developing rapid assessment protocols are priorities for species sustainability.

Many wet pine savanna sites have been converted to forest or support only depauperate communities due to a long history of exploitation, system drainage and fire suppression. Management activities are frequently needed to restore healthy hydrologic function, historical fire regimes, and characteristic grass-forb understories.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for the first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented in Figure 95. Since the species group occurs on only one unit, only one figure is presented.

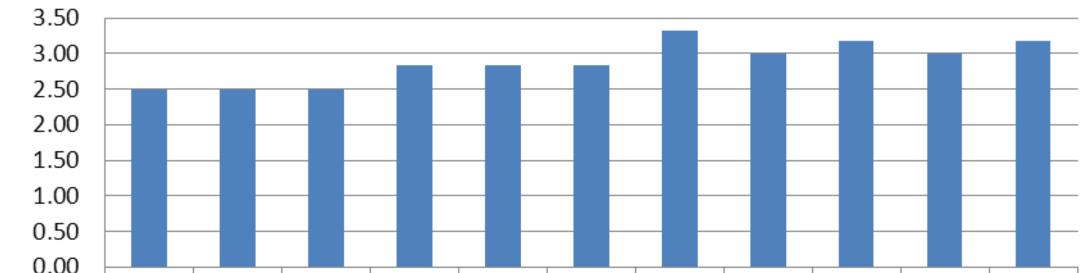
Wet Pine Savanna Associates Alternatives and Effects

As shown in Figure 95, all alternative scores by decade remain with a good overall ecological sustainability evaluation score for this species association, with the exception of alternative A which is fair. Management focus and intensity does not change across alternatives in the ecosystem related to this species association.

Wet Pine Savanna Associates Environmental Effects

Protection of this ecosystem is a priority in all alternatives. Restoration will be based on management intensity and scale (acres restored through time). Restoration and maintenance activities will include prescribed fire, thinning, and converting offsite canopy species to native canopy species, native herbaceous understory, restoring hydrologic function, and protecting the system.

Past management practices have favored less fire-tolerant communities normally associated with fire suppression and the introduction of offsite canopy species. Prescribed fire will alter both overstory and understory composition in favor of fire-tolerant and fire-dependent vegetative assemblages at the expense of species not normally associated with fire-adapted uplands. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with this system. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire to longleaf-associated species and communities will far outweigh any losses incurred during implementation.



	Fair Current	Fair Alt. A 1st Decade	Fair Alt. A 5th Decade	Good Alt. B 1st Decade	Good Alt. B 5th Decade	Good Alt. C 1st Decade	Good Alt. C 5th Decade	Good Alt. D 1st Decade	Good Alt. D 5th Decade	Good Alt. E 1st Decade	Good Alt. E 5th Decade
Scores	2.50	2.50	2.50	2.83	2.83	2.83	3.33	3.00	3.17	3.00	3.17

Figure 95. Wet pine savanna associates current and estimated ecological sustainability evaluation scores forestwide

Forest thinning and harvests of offsite species within this system and within the surrounding matrix communities may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat restoration.

Vehicle and machinery use and other ground disturbing activities during restoration and maintenance activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species. The proposed thinnings would reduce the average basal area of pine stands in the project area, thus reducing the risk of southern pine beetle infestation on National Forest System and private lands.

Wildlife would benefit from thinning, harvest, restoration and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire and change in hydrology of the system. Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity restoration activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components and hydrologic function should increase in coverage and quality. Changes in floral and faunal community composition and hydrology can be expected as restoration sites progress through successional stages. These changes should be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple seral stages.

In all alternatives, the long-term effects of ecosystem management and protection should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

4.6.13 Xeric Sandhill Associates

Xeric sandhills are a unique habitat type in Mississippi and are a vital component of many species ecological needs. For planning purposes, they have been defined as gopher tortoise priority soils and are the driest of the upland sites occurring on the Chickasawhay and De Soto National Forests. All management decisions made within these areas should focus on sustainability of the federally threatened gopher tortoise. A list of all targeted species associated with this species group can be found in appendix G. The tortoise serves as a keystone species for many species on this list. Its burrows provide habitat otherwise unavailable for many of these species.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores for the species associated with this ecosystem to derive composite current scores and estimated scores by alternative for the first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide and ecosystem by alternative summary of these scores is presented in Figure 96.

Xeric Sandhill Associates Alternatives and Effects

As shown in Figure 96, alternatives A, B, C, and D contribute to the restoration and maintenance of this system with overall ecological sustainability evaluation scores of good. Alternative E is even more successful, but will still require decades to achieve all restoration goals. All alternatives show acceptable rates of ecological sustainability by the fifth decade.

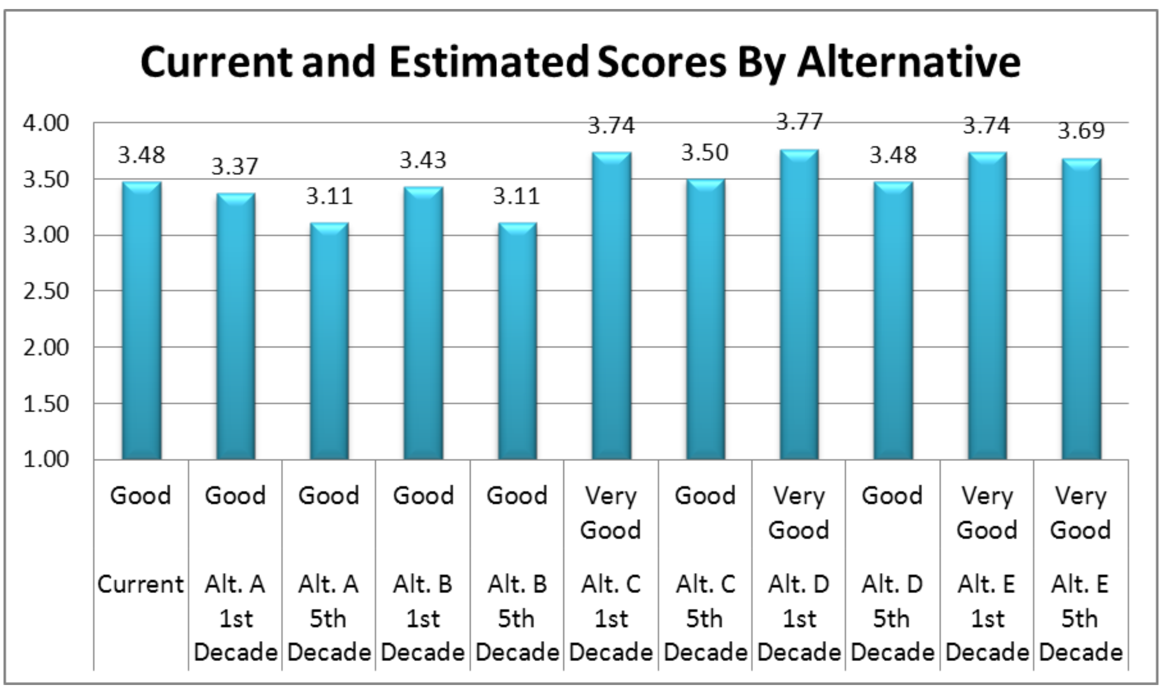


Figure 96. Xeric sandhills associates forestwide xeric sandhills ecological sustainability evaluation scores

Figure 97 and Figure 98 show fire regime variables by alternative. Herbaceous-dominated understories, including grasses and forbs, are important attributes of healthy xeric sandhill ecosystems best achieved by the application of frequent growing season fire, ideally once every one to three years (desired interval). These data show that fire frequency, seasonality and intensity are; in most cases; well within the good to very good range and increase respectively from alternatives C thru E.

Xeric Sandhill Associates Environmental Effects

Management activities will include prescribed fire, thinning, and regeneration. Prescribed fire is essential to maintenance of structural and compositional attributes critical to this species association. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

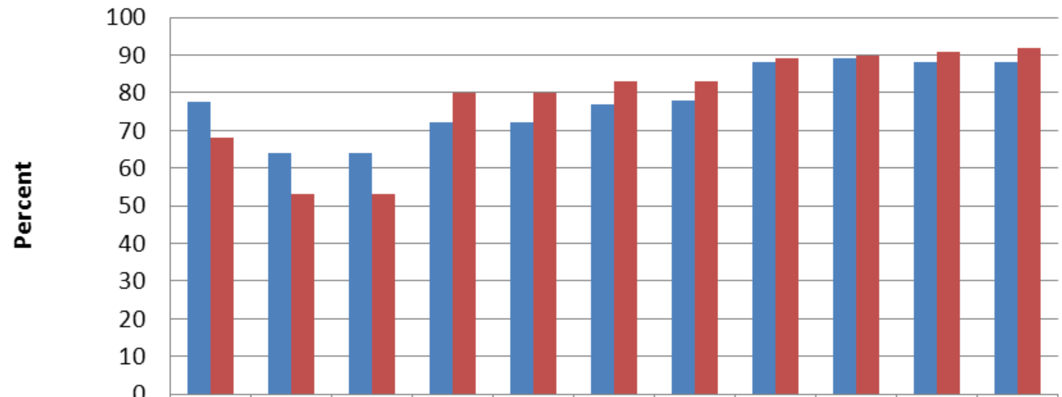
Forest thinnings and harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

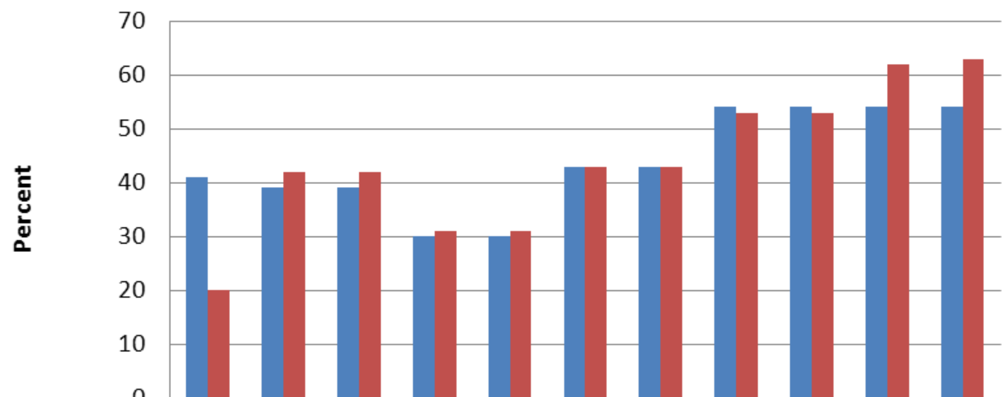
Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality. Changes in floral and faunal community composition can be expected as regeneration sites progress through successional stages. These changes are expected to be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In all alternatives, the long-term effects of ecosystem management should be sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.



	Current	Alt A 1st Decade	Alt A 5th Decade	Alt B 1st Decade	Alt B 5th Decade	Alt C 1st Decade	Alt C 5th Decade	Alt D 1st Decade	Alt D 5th Decade	Alt E 1st Decade	Alt E 5th Decade
Chickasawhay	77.68	64	64	72	72	77	78	88	89	88	88
DeSoto	67.91	53	53	80	80	83	83	89	90	91	92

Figure 97. Percent of xeric sandhills burned at desired interval by alternative and unit



	Curren t	Alt A 1st Decade	Alt A 5th Decade	Alt B 1st Decade	Alt B 5th Decade	Alt C 1st Decade	Alt C 5th Decade	Alt D 1st Decade	Alt D 5th Decade	Alt E 1st Decade	Alt E 5th Decade
Chickasawhay	41	39	39	30	30	43	43	54	54	54	54
DeSoto	20	42	42	31	31	43	43	53	53	62	63

Figure 98. Percent of xeric sandhills burned in the growing season by alternative and unit

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species in alternatives B, C, D, and E.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of all alternatives will be minor while the positive impacts will be substantial.

4.7 Terrestrial Species Groups Requiring Additional Forest Plan Components

This section provides details on groups of species that required further forest plan components in addition to those already provided by ecological diversity. Management strategies and appropriate forest plan components are described for each group. Species groups contain threatened and endangered, regional forester’s sensitive species, and locally rare species arranged together for analysis purposes. These groups represent small spatial scales and groups of species associated with localized conditions and features that cross ecosystem boundaries. A list of targeted species groups needing additional forest plan components can be found in Table 62. Targeted species within each group are in a table as each group is discussed.

Table 62. Species groups requiring additional forest plan component

Species Group	Species Group
Bat Roost Structure Group	Species Sensitive to Hydrologic Modification of Wetlands
Den Tree Associates	Species Sensitive to Recreational Traffic (Terrestrial and Non-riverine Aquatic)
Downed Wood Associates	Species Needing Occurrence Protection
Forest Interior Birds	Stump and Stump-hole Associates
Species Sensitive to Fire Injury	Calciphiles
Snag Associates	Species Sensitive to Canopy Cover Modifications
Species Dependent on Fire to Maintain Habitat	Species Sensitive to Soil Disturbance

4.7.1 Bat Roost Structure Group

Bat species generally live in mature riparian areas on the National Forests in Mississippi. They utilize bridges, cisterns, culverts, old abandoned houses, leaf litter, snags, and branches, bark, and cavities of live trees as roosts. They are insectivores and require some proximity to water. A list of targeted species associated with this species group can be found in appendix G.

Bat Roost Structure Group Alternatives and Effects

Bat Roost Structure Group Environmental Effects

Management activities effecting members of this species group will be dependent on the ecosystem in which they occur. Depending on the ecosystem, prescribed fire will vary in intensity and frequency, depending on the restoration goals of the ecosystem. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired as community structures normally found in association with native ecosystems are achieved. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

In cases where managed regeneration may be required, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used during management of the associated ecosystems (including invasive species control to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices and management guidelines. The benefits to this species group by managing and restoring the habitat will far outweigh those few casualties.

Figure 99. Bat Roost structure group current and estimated ecological sustainability evaluation scores forestwide

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality.

In all alternatives, the long-term effects of proposed ecosystem management should result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

4.7.2 Den Tree Associates

Den trees include cavities in both dead and live trees that are found in a variety of hardwood and softwood tree species. The species in this group require cavities or den trees for reproduction, shelter, and hibernation. A list of targeted species associated with this species group can be found in appendix G. Large diameter hollow trees provide important denning habitat for the federally threatened black bear in Mississippi. Den trees are also important for sustaining the red-cockaded woodpecker and provide refuge for many other species including bats, small mammals, and amphibians and reptiles. It is necessary to recruit and retain these trees in areas where those species occur (appendix G). Several bat species that are regional forester's sensitive species or locally rare species are included under the "bat roost structure group" description.

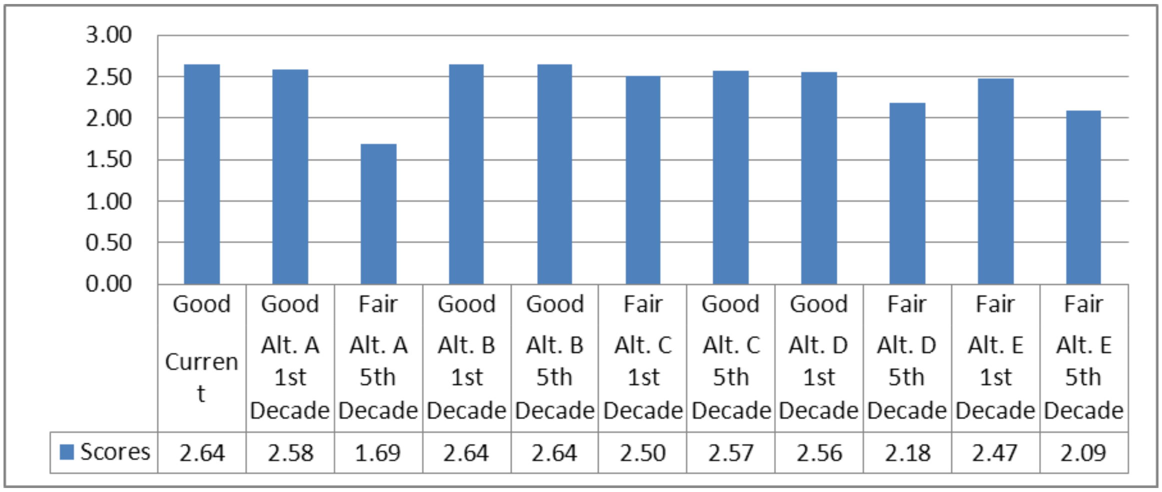


Figure 100. Den tree associates current and estimated ecological sustainability evaluation scores forestwide

Den Tree Associates Alternatives and Effects

Den Tree Associates Environmental Effects

Management activities effecting members of this species group will be dependent on the ecosystem in which they occur. Depending on the ecosystem, prescribed fire will vary in intensity and frequency, depending on the restoration goals of the ecosystem. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired as community structures normally found in association with native ecosystems are achieved. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

In cases where managed regeneration may be required, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some microhabitat loss due to soil compaction and disturbance. Herbicides may also be used during management of the associated ecosystems (including invasive species control) to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices and management guidelines. The benefits to this species group by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

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In all alternatives, the long-term effects of ecosystem management are expected to result in sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

4.7.3 Downed Wood Associates

Species in this association require downed and decaying wood for some vital part of their life history. A list of targeted species associated with this species group can be found in appendix G. Downed wood provides shelter for many species and their prey items. Mississippi gopher frog, Webster's salamander, ornate chorus frog, mud salamander, and pine woods snake are all tied to downed wood for some portion of their life cycle. The Trachyxiphium moss grows on permanently wet downed wood and cannot survive without it. Past forestry practices in Mississippi included removing stumps during vegetative management treatments.

Downed Wood Associates Alternatives and Effects

No charts analyzing effects of different alternatives are presented because there is no change across alternatives for the species in this group. The abundance of habitat elements in the forest plan will provide sustainable amounts of habitat for the species in this group.

Downed Wood Associates Environmental Effects

Management activities, depending on the ecosystem in which the species group occurs, may include prescribed fire, thinning, and regeneration. Prescribed fire is essential to maintenance of structural and compositional attributes critical to this species association. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Forest thinnings and harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, thus lessening the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality. Changes in floral and faunal community composition can be expected as regeneration sites progress through successional stages. These changes are expected to be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In all alternatives the long-term effects of ecosystem management are expected to sustain native communities and associated species since downed wood retention is a priority. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of all alternatives will be minor while the positive impacts will be substantial.

4.7.4 Forest Interior Birds

Forest-interior birds require intact mature forests with no permanent fragmentation by agricultural or urban development. A list of targeted species associated with this species group can be found in appendix G. Some fragmentation may be present as a result of timber harvesting, however this may only cause a temporary reduction in habitat for forest-interior species. In most large landscapes, the needs of early successional species can be met quickly through various sources of disturbance, including timber harvesting. Much more time, however, is required to develop suitable habitat for species that require mature forest (appendix G). Effective conservation strategies must focus on maintaining adequate amounts of mature forest at any point in time.

Forest Interior Birds Alternatives and Effects

Forest Interior Birds Environmental Effects

Management activities will include prescribed fire, thinning, and regeneration as the needs of the ecosystem dictate. Prescribed fire is essential to maintenance of structural and compositional attributes critical to this species association within the context of the surrounding ecosystem. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

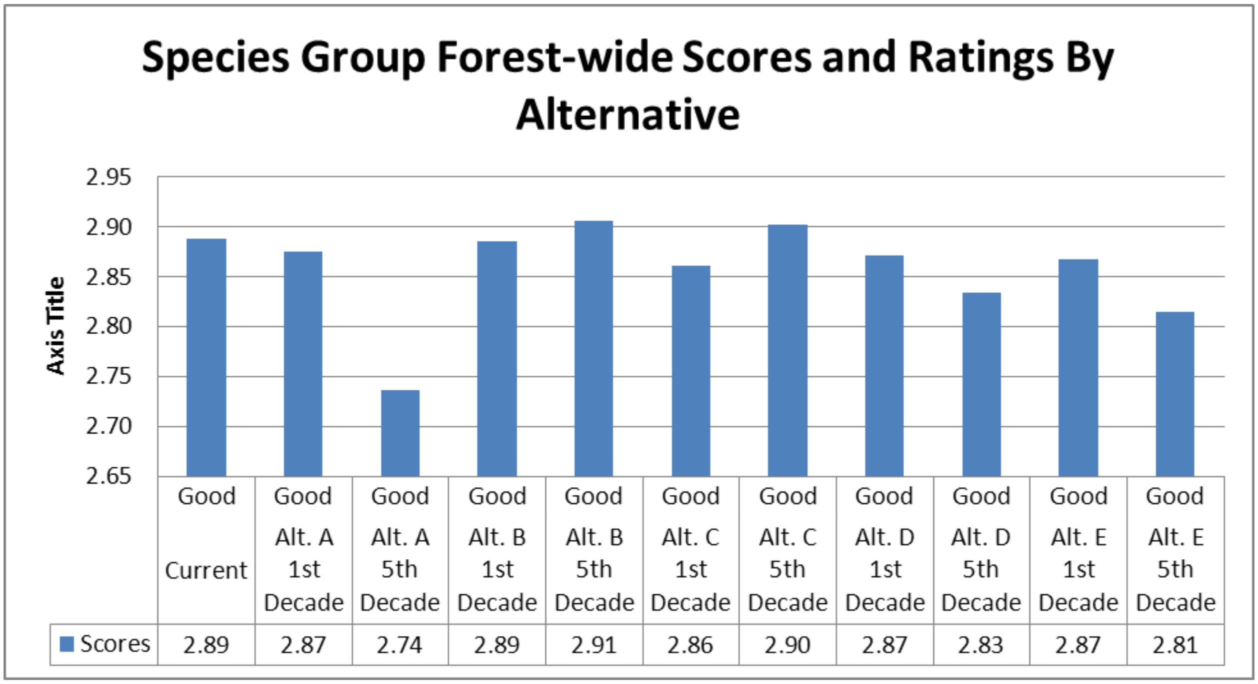

Figure 101. Forest interior birds group current and estimated ecological sustainability evaluation scores forestwide

Forest thinnings and harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, thus lessening the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality. Changes in floral and faunal community composition can be expected as regeneration sites progress through successional stages. These changes should be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In all alternatives, the long-term effects of ecosystem management are expected to sustain native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of all alternatives will be minor while the positive impacts will be substantial.

4.7.5 Species Sensitive to Fire Injury

Individuals of these species are sensitive to fire injury. A list of targeted species associated with this species group can be found in appendix G. Gopher frogs can be injured by effects of direct fire and fire can harm red-cockaded woodpecker cavity trees and fledglings. Atlantic white cedar has no fire tolerance and should be protected from fire. Oglethorpe oak, butternut, and big shellbark hickory have thin bark which makes them susceptible to negative effects from fire. Argos skippers are both dependent upon fire to maintain their habitat and sensitive to injury of individuals and populations caused by fire. The rest of the species in this group occur in areas where only low intensity fires should occur, however, fires can occur in these areas resulting in death of individuals.

Species Sensitive to Fire Injury Alternatives and Effects

No charts analyzing effects of different alternatives are presented because there is no change across alternatives for the species in this group. The abundance of habitat elements in the forest plan will provide sustainable amounts of habitat for the species in this group.

Species Sensitive to Fire Injury Environmental Effects

Management activities will include prescribed fire, thinning, and regeneration as required for the surrounding ecosystem. Prescribed fire is essential to maintenance of structural and compositional attributes critical to maintenance of the overall landscape. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The overall benefits of prescribed fire will outweigh any losses incurred during implementation as long as the applicable guidelines are followed.

Forest thinnings and harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

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In all alternatives, the long-term effects of ecosystem management are expected to sustain native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species in all alternatives.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts minor while the positive impacts will be substantial.

4.7.6 Snag Associates

If retention and recruitment guidelines and other guidelines pertinent to creation of downed wood and snags are followed, and there is a forestwide level of 30 percent mature and 10 percent old-growth forest that is within good or very good rating criteria, then we assume that we are providing adequate downed wood and snags to sustain dependent species. Ecological system sustainability plan components include desired conditions for all associated ecological systems and specific guidelines. A list of targeted species associated with this species group can be found in appendix G.

Snag Associates Alternatives and Effects

No charts analyzing effects of different alternatives are presented because there is no change across alternatives for the species in this group. The abundance of habitat elements in the forest plan will provide sustainable amounts of habitat for the species in this group.

Snag Associates Environmental Effects

Management activities will include prescribed fire, thinning, and regeneration. Prescribed fire is essential to maintenance of structural and compositional attributes critical to this species association. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

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In all alternatives, the long-term effects of ecosystem management are expected to sustain native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species.

4.7.7 Species Dependent on Fire to Maintain Habitat

Many species of the southeastern forest depend on fire to maintain the health and well-being of their habitat. Prescribed burning is an important management tool in a healthy fire-adapted ecosystem by recycling nutrients back to the soil and increasing plant diversity and growth patterns. The season, frequency, frequency, and intensity of fire are critical variables that should be used based on the existing and desired vegetative communities and featured species. A list of targeted species associated with this species group can be found in appendix G.

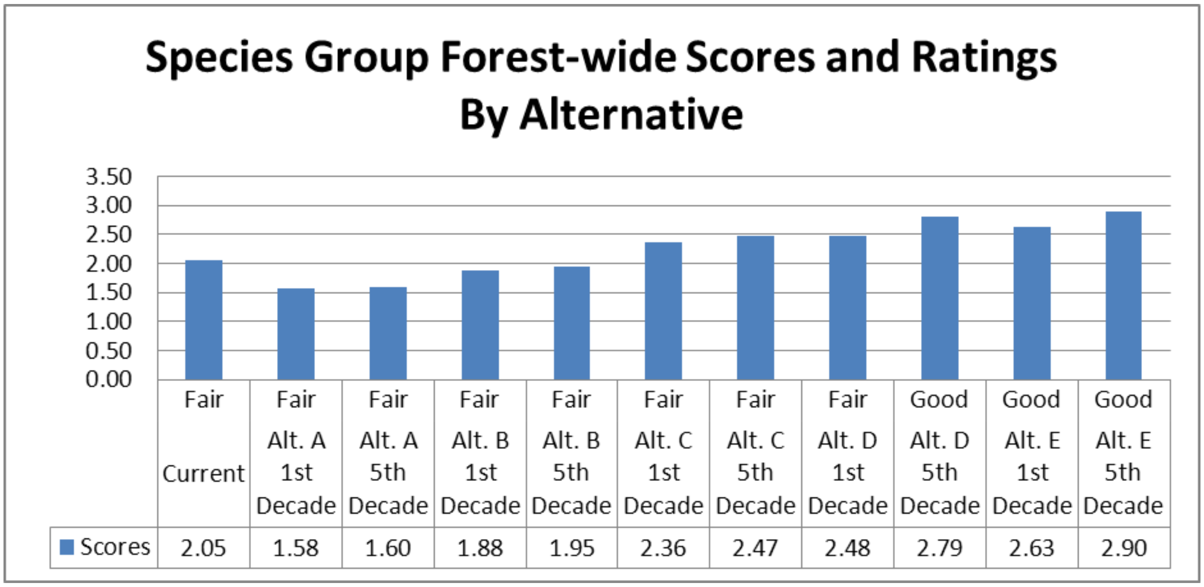

Figure 102. Species dependent on fire to maintain habitat current and estimated ecological sustainability evaluation scores forestwide

Species Dependent on Fire to Maintain Habitat Alternatives and Effects

Species Dependent on Fire to Maintain Habitat Environmental Effects

Management activities will include prescribed fire, thinning, and regeneration. Prescribed fire is essential to maintenance of structural and compositional attributes critical to this species association. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Forest thinnings and harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing or restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

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In alternatives B, C, D, and E, the long-term effects of ecosystem management should be sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable. In alternative A, the associated systems will not achieve sustainable native communities and associated species.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives except alternative A which includes no management of associated systems. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species in alternatives B, C, D, and E.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of alternatives B, C, D, and E will be minor while the positive impacts will be substantial. Alternative A will have negative impacts on species and communities in the long run due to little management of the associated systems.

4.7.8 Species Sensitive to Hydrologic Modification of Wetlands

Species in this group are associated with wetlands, including, but not limited to seeps, springs, bogs, swamps, wet flatwoods and ephemeral ponds and are dependent on hydrological integrity in these habitats. A list of targeted species associated with this species group can be found in appendix G.

Species Sensitive to Hydrologic Modification of Wetlands Alternatives and Effects

Species Sensitive to Hydrologic Modification of Wetlands Environmental Effects

Management activities will include prescribed fire, thinning, and regeneration. Prescribed fire is essential to maintenance of structural and compositional attributes critical to ecosystems. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Forest thinnings and harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties.

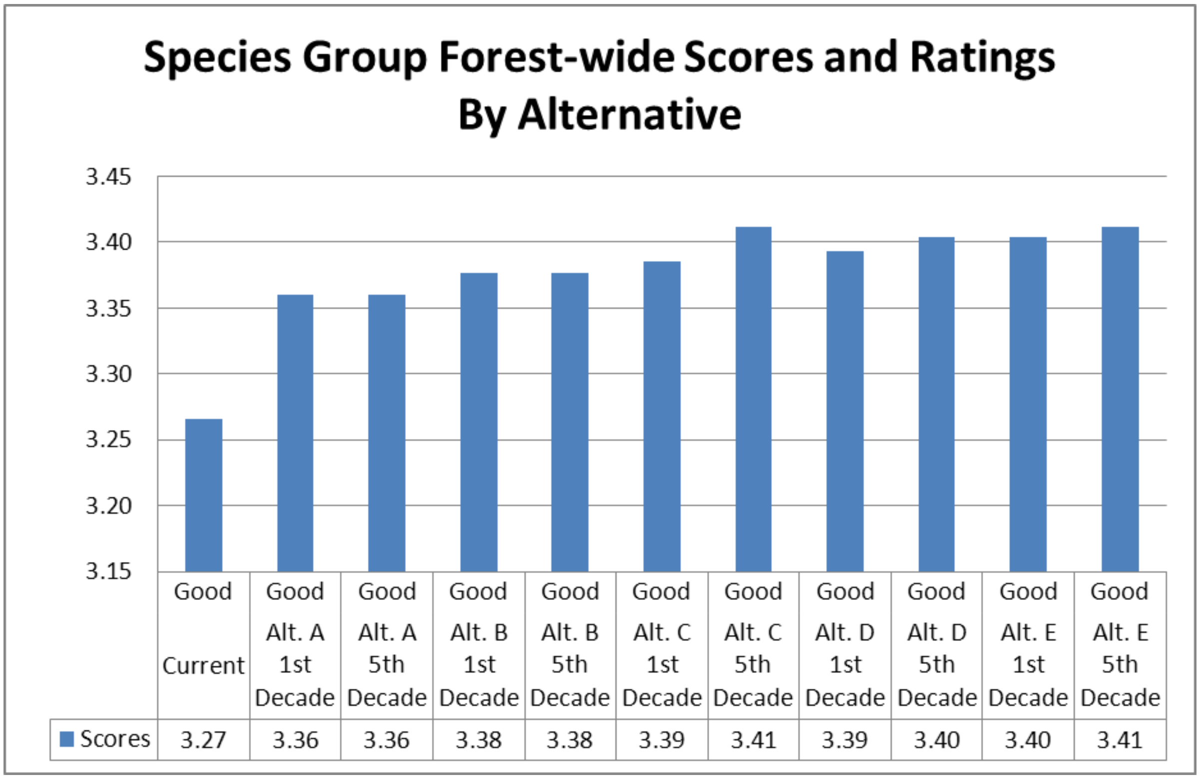

Figure 103. Species sensitive to hydrologic modification of wetlands current and estimated ecological sustainability evaluation scores forestwide

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality. Changes in floral and faunal community composition can be expected as regeneration sites progress through successional stages. These changes should be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In alternatives B, C, D, and E, the long-term effects of ecosystem management should be sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable. In alternative A, the associated systems will not achieve sustainable native communities and associated species.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives except alternative A which includes no management of associated systems. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species in alternatives B, C, D, and E.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of alternatives B, C, D, and E will be minor while the positive impacts will be substantial. Alternative A will have negative impacts on species and communities in the long run due to little management of the associated systems.

4.7.9 Species Sensitive to Recreational Traffic (Terrestrial and Non-riverine Aquatic)

Species in this group are sensitive to excessive human disturbance such as trampling, harassment, vehicular mortality, and direct mortality. Reptile species are especially sensitive to being harmed, harassed, and killed by humans. This interaction with humans can have long-term negative effects on population sizes and sustainability. The black bear is sensitive to high road densities. Mississippi gopher frog, gopher tortoise, and snake and plant species on this list are especially sensitive to harm due to off-road vehicles, heavy equipment, horses, and human traffic. Some species are collected commercially and used for a variety of purposes including but not limited to food, medicine, decoration, gardening, landscaping, and the pet trade. A list of targeted species associated with this species group can be found in appendix G.

There are no measurable performance measures for this species group. However, direct effects of mortality for this species group could be limited by the implementation of guidelines which protect species from direct take, and intentional killing or harassment; and limit access to sensitive populations of these species. Providing habitat for these species is not enough to ensure long-term sustainability of populations. The following actions could reduce impacts to these species by adopting them as Forest policy:

- design roads to avoid highly populated areas of these species;
- design roads to include safe passage for these species;
- provide educational materials to the public to increase knowledge and awareness of species needs;
- work collaboratively with state agencies to limit take of fish species in this group on FS lands;
- limit recreational access to sensitive habitats associated with species on this list; and
- require regulations on collecting permits to limit collections to approved scientific purposes only.

These actions include but are not limited to direct impacts from ORVs, horses, mountain bikes, and other conveyances as well as direct impacts caused by the activities of persons utilizing said conveyances.

Species Sensitive to Recreational Traffic (Terrestrial and Non-riverine Aquatic) Alternatives and Effects

No charts analyzing effects of different alternatives are presented because there is no change across alternatives for the species in this group. The abundance of habitat elements in the forest plan will provide sustainable amounts of habitat for the species in this group.

Species Sensitive to Recreational Traffic (Terrestrial and Non-riverine Aquatic) Environmental Effects

Management activities will include prescribed fire, thinning, and regeneration. Prescribed fire is essential to maintenance of structural and compositional attributes critical to this species association. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Forest thinnings and harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality. Changes in floral and faunal community composition can be expected as regeneration sites progress through successional stages. These changes should be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In alternatives B, C, D, and E, the long-term effects of ecosystem management should be sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable. In alternative A, the associated systems will not achieve sustainable native communities and associated species.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives except alternative A which includes no management of associated systems. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species in alternatives B, C, D, and E.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of alternatives B, C, D, and E will be minor while the positive impacts will be substantial. Alternative A will have negative impacts on species and communities in the long run due to little management of the associated systems.

4.7.10 Species Needing Occurrence Protection

Species in this group are rare on the National Forests in Mississippi although habitat is widespread. Habitat assessments cannot accurately predict the presence of these species. Most of these species occur in less than five populations on the Forests and are sensitive to management actions. Those species which have more than five known occurrences represent populations which are critical to the survival of the species and have limited occurrence outside of the National Forests in Mississippi. Threatened and endangered species are not included in this group because they require species-specific protection and have specific guidance already described. A list of targeted species associated with this species group can be found in appendix G.

Species Needing Occurrence Protection Alternatives and Effects

No charts analyzing effects of different alternatives are presented because there is no change across alternatives for the species in this group. The abundance of habitat elements in the forest plan will provide sustainable amounts of habitat for the species in this group.

Species Needing Occurrence Protection Environmental Effects

Management activities will include prescribed fire, thinning, and regeneration. Prescribed fire is essential to maintenance of structural and compositional attributes critical to this species association. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Forest thinnings and harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives are expected to mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burning would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality. Changes in floral and faunal community composition can be expected as regeneration sites progress through successional stages. These changes should be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In alternatives B, C, D, and E, the long-term effects of ecosystem management should be sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable. In alternative A, the associated systems will not achieve sustainable native communities and associated species. Use of the “life-boat” system will insure the survival of even the rarest species in sustainable numbers.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives except alternative A which includes no management of associated systems. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species in alternatives B, C, D, and E.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of Alternatives B, C, D, and E will be minor while the positive impacts will be substantial. Alternative A will have negative impacts on species and communities in the long run due to little management of the associated systems.

4.7.11 Stump and Stump-hole Associates

Stumps and stump holes provide a network of underground chambers that support many species throughout their life cycle. Past forestry practices in Mississippi included removing stumps during vegetative management treatments. A list of targeted species associated with this species group can be found in appendix G.

Stump and Stump-hole Associates Alternatives and Effects

No charts analyzing effects of different alternatives are presented because there is no change across alternatives for the species in this group. The abundance of habitat elements in the forest plan will provide sustainable amounts of habitat for the species in this group.

Stump and Stump-hole Associates Environmental Effects

Management activities will include prescribed fire, thinning, and regeneration. Prescribed fire is essential to maintenance of structural and compositional attributes critical to this species association. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Forest thinnings and harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality. Changes in floral and faunal community composition can be expected as regeneration sites progress through successional stages. These changes should be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In alternatives B, C, D, and E, the long-term effects of ecosystem management should be sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable. In alternative A, the associated systems will not achieve sustainable native communities and associated species.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives except alternative A which includes no management of associated systems. At any given point in time, a mosaic of structural and compositional conditions is spread across the forest landscape providing habitat for the full range of native species in alternatives B, C, D, and E.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of alternatives B, C, D, and E will be minor while the positive impacts will be substantial. Alternative A will have negative impacts on species and communities in the long run due to little management of the associated systems.

4.7.12 Calciphiles

Calciphiles are “calcium loving” vascular plant species that are dependent upon high levels of calcium in the soil to thrive. A list of targeted species associated with this species group can be found in appendix G. They generally occur in the black belt, Jackson prairie and loess hills regions of Mississippi (Holly Springs, Tombigbee, and Bienville National Forests). These areas are relatively small portions of the respective forests and offer excellent opportunities for biological reserves. Relative abundance of black belt and Jackson prairie are indicator performance measures for calciphiles (appendix G). The management strategy for these species is to protect the soil on which they occur from degradation, as the assumption is that protecting the soil sustains the species.

Figure 104. Calciphiles associates current and estimated ecological sustainability evaluation scores forestwide

Calciphiles Alternatives and Effects

As shown in Figure 104, all alternatives attain good overall ecological sustainability evaluation scores with few management needs for systems related to this species association. Alternative A remains fair through the first 50 years. Species in this group are tied to particular soil chemistry. Prescribed fire will be applied as necessary. The effects of soil on species can be modified by prescribed fire in both positive and negative manners, depending upon particular species need. Maintaining soil profiles by preventing soil erosion is critical.

Calciphiles Environmental Effects

Management activities may include prescribed fire as needed to sustain the matrix community in which the species group occurs and maintaining this species association at its current abundance across the Forest over time. Accordingly, some direct mortality of less fire-tolerant species is expected to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Regeneration will be primarily allowed to occur naturally or as a result of salvage operations in the wake of natural disturbances. In cases where managed regeneration may be required, harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Use of herbicides during management of the associated ecosystems (including invasive species control) may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to these species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire may also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components are expected to increase in coverage and quality.

In all alternatives, the long-term effects of ecosystem management should result in sustainable native communities and associated species. The amount of available habitat is determined by the location and extent of suitable soils. Habitat quality can be increased by management activities, but not the amount of habitat. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

4.7.13 Species Sensitive to Canopy Cover Modifications

Species sensitive to canopy cover reduction generally occur in areas with closed canopy desired conditions, especially hardwood dominated ecological systems; however, some of these areas may be targeted for vegetative management treatments. A list of targeted species associated with this species group can be found in appendix G. When conducting projects where species sensitive to canopy cover reduction are known or suspected to occur, consideration should be given to maintaining closed canopy conditions to provide for sustainable species populations. Project level surveys may be necessary to determine species presence; however suitable habitat for the species may serve as a surrogate for surveys.

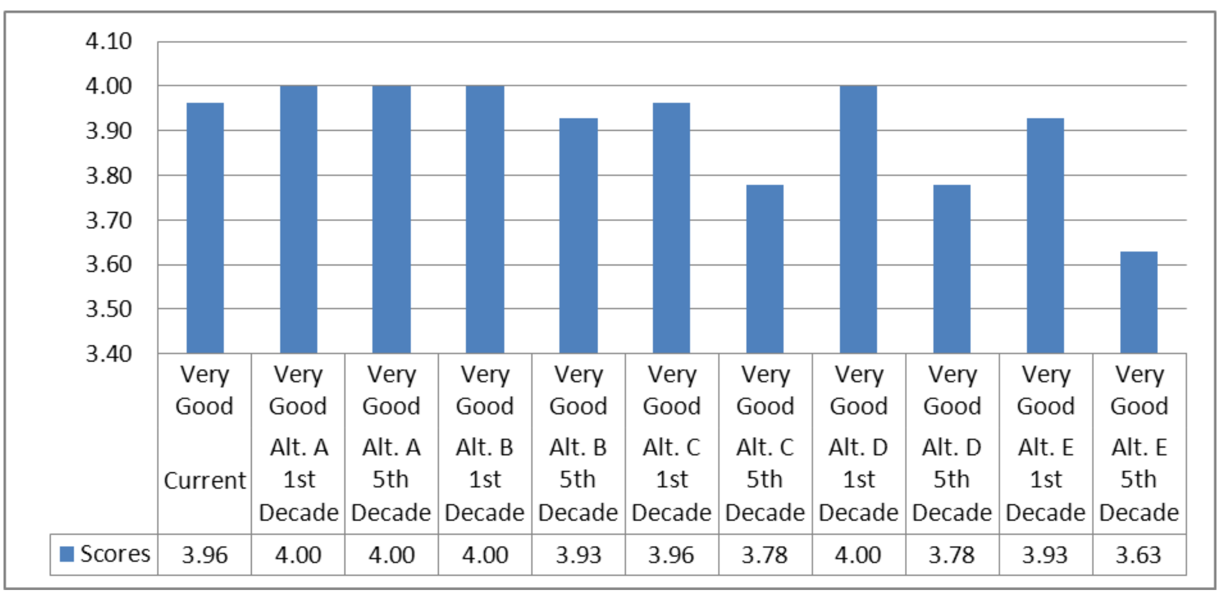

Figure 105. Species sensitive to canopy cover modifications current and estimated ecological sustainability evaluation scores forestwide

Species Sensitive to Canopy Cover Modifications Alternatives and Effects

Species Sensitive to Canopy Cover Modifications Environmental Effects

Management activities may include prescribed fire, thinning, and regeneration depending on the characteristics of the matrix community. Prescribed fire is essential to maintenance of structural and compositional attributes critical to this species association. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Forest thinnings and harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality. Changes in floral and faunal community composition can be expected as regeneration sites progress through successional stages. These changes should be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In all alternatives, the long-term effects of ecosystem management should sustain native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of alternatives B, C, D, and E will be minor while the positive impacts will be substantial.

Alternative A will have negative impacts on species and communities in the long run due to little management of the associated systems.

4.7.14 Species Sensitive to Soil Disturbance

These are species considered to be especially impacted by excavation or blading of roads and trails, compaction of soil, soil erosion, soil sedimentation and others. A list of targeted species associated with this species group can be found in appendix G. If a project has ground disturbing activities planned, than these species should be reviewed for occurrence and mitigation. Implementation monitoring and use of guidelines are the management tools used in ensuring sustainability of these species. Guidelines specific to this group can be found in vegetation and wildlife, and soil and water guideline sections in chapter 4 of the revised Forest Plan.

Species Sensitive to Soil Disturbance Alternatives and Effects

No charts analyzing effects of different alternatives are presented because there is no change across alternatives for the species in this group. The abundance of habitat elements in the forest plan will provide sustainable amounts of habitat for the species in this group.

Species Sensitive to Soil Disturbance Environmental Effects

Management activities will include prescribed fire, thinning, and regeneration. Prescribed fire is essential to maintenance of structural and compositional attributes critical to this species association. Accordingly, some direct mortality of less fire-tolerant species is both expected and desired to achieve community structures normally found in association with native ecosystems. Where rare species sensitive to fire injury are known to occur and are not protected by localized fire exclusion, some losses can be expected. The benefits of prescribed fire will outweigh any losses incurred during implementation.

Forest thinnings and harvests may expose species and communities to direct mortality related to vehicle and machinery use, which may also result in some micro-habitat loss due to soil compaction and disturbance. Herbicides may also be used to establish acceptable understory composition and structure. Negative direct impacts should be temporary and, to the extent possible, will be mitigated by best management practices. The benefits to those species by managing and restoring the habitat will far outweigh those few casualties.

In all cases, short-term negative effects to individual plants and animals are expected to be minimal and discountable compared to the long-term positive effects of habitat sustainability.

Vehicle and machinery use and other ground disturbing activities during management activities may inadvertently introduce invasives. Prescribed fire and thinning also create overstory and understory conditions favorable for some invasive species, particularly cogongrass, kudzu, and red-imported fire ants. Best management practices and guidelines regarding non-native invasives mitigate these effects to an extent but some invasive species colonization can still be expected. Where colonization does occur, invasive species control measures should minimize negative impacts. However, control measures may require the application of pesticides possibly resulting in unintended loss of native species.

Wildlife would benefit from thinning treatments and prescribed fire through increased hard and soft mast production and proliferation of wildlife browse from increased light levels and herbaceous expansion in response to fire. Prescribed burnings would reduce the forest fuel, lowering the risk of catastrophic fires. Habitat quality could be reduced in the vicinity of management activity due to loss of important structural components (canopy levels within the Forest and down woody material) and fragmentation of habitat which could cause indirect effects in the short term. In the long term, however, essential structural components should increase in coverage and quality. Changes in floral and faunal community composition can be expected as regeneration sites progress through successional stages. These changes should be gradual and are considered natural in response to the variety of habitat characteristics and components provided by multiple native ecosystem stages.

In all alternatives, the long-term effects of ecosystem management should be sustainable native communities and associated species. Over time, associated species of regional as well as local viability concern are expected to remain sustainable.

The cumulative effect of vegetation management practices in combination with timber harvest and other management is that a variety of vegetation types and structures result under all alternatives.

Considering the total amount of disturbance that has, is, and will be occurring within the forest, and which ultimately affects the status and distribution of species and communities, negative cumulative impacts of alternatives B, C, D, and E will be minor while the positive impacts will be substantial. Alternative A will have negative impacts on species and communities in the long run due to little management of the associated systems.

4.8 Aquatic Species Associations

Species occurring in these groups require healthy watersheds and good water quality for survival. Implementation of streamside management zones and consideration of effects to water quality at the project level and management of riparian and floodplain forests should be sufficient to sustain these species.

4.8.1 Aquatic Coarse Woody Debris Associates

These species (appendix G) are dependent on quantities of coarse woody debris located in the stream or riparian area. Coarse woody debris plays a vital role in the life history for many of these species or their prey. Coarse woody debris is measured as a byproduct of a mature riparian area enclosing the stream. A sustainable amount of debris will enter the stream if the surrounding riparian area contains a mature, closed canopy forest with little or no unnatural disturbance. Trees and other woody debris should not be removed from streams unless it is for safety or transportation needs. If removed for transportation requirements, only those trees in the area adjacent to the road or causing direct impacts to roads, trails, or bridges should be removed.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for the first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented below (Figure 106).

Road and trail density is an important aspect of these data that is unlikely to change or improve over time. Many roads that cross National Forest System lands are administered under the jurisdiction of local, state, and other federal entities and are therefore, outside of the control of the National Forests in Mississippi. Roads and trails administered by the Forests are in most cases considered essential to public access. While some National Forest System roads and trails may be gated and rehabilitated if considered unessential to the public good, the overall road and trail density scores among all alternatives will change little due to the statistical weight of roads outside the Forests' jurisdictions. While road densities are a concern in some instances, in many cases road and trail scores are already in the good or very good range which is expected to continue to contribute to ecological sustainability on National Forest System lands.

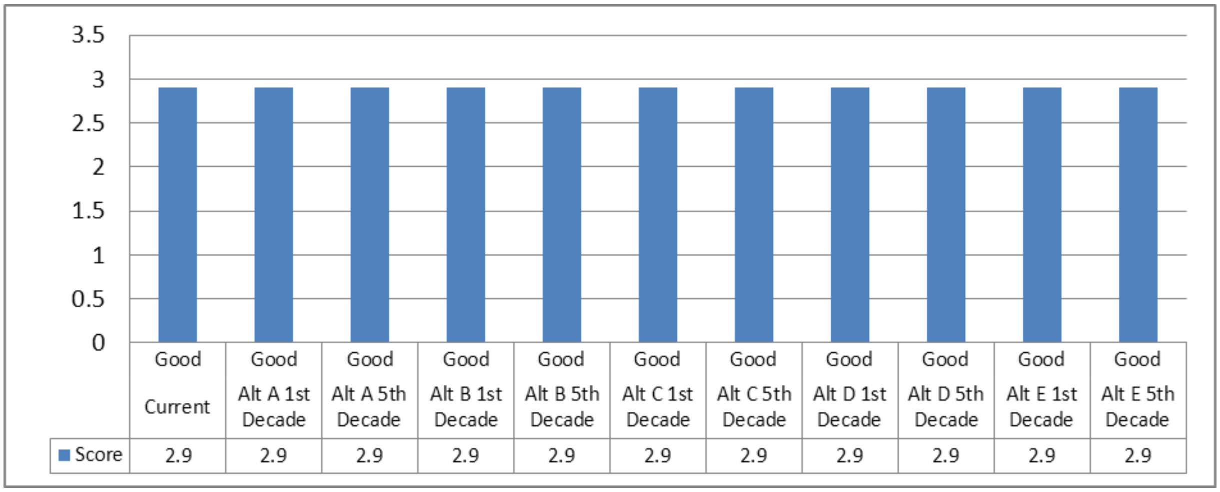

Figure 106. Species association current (watershed-wide) and predictive status based on National Forest System land management and activities

The resulting scores of the analysis described above, which are measured watershed-wide regardless of ownership profiles, result in a good rating for current status and all alternatives. While neighboring landowners may contribute varying and unpredictable levels of risk to watershed health, the National Forests in Mississippi will continue to maintain a positive contribution to aquatic sustainability. As a result, watershed health should remain relatively stable, at least to the extent that Forests can control based on ownership profiles. In many watersheds, depending on ownership and land-use profiles, the National Forests in Mississippi may be a primary contributor to coarse woody debris associates due to riparian forest management practices and guidelines.

Aquatic Coarse Woody Debris Associates Environmental Effects

Retention and protection of riparian forests should have no negative effects. Positive effects will include maintenance of hydrologic and hydrothermal regimes along with increases in the abundance of coarse woody debris.

4.8.2 Open Water Associates

These species (appendix G) require areas of open water. On National Forest System land, the largest bodies of water are often developed for various outdoor recreational activities. Open water surrounded by National Forest System land may be a rare commodity and the Forests provide opportunities for some species that are losing habitat elsewhere. Species needs should be incorporated into management of open areas with water, especially large lakes, ponds and rivers.

Abundance is the vital key factor for this species group. As the limiting factor for these species is the presence of extensive open bodies of water, Forest Service management should focus on maintaining quality and extent of existing habitat (appendix G). If new opportunities become available to create habitat, these species should be considered in all planning processes. Desired conditions and objectives for lakes and permanent ponds, both floodplain ecological systems, and rivers and streams will help to sustain these species.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for the first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented below (Figure 107).

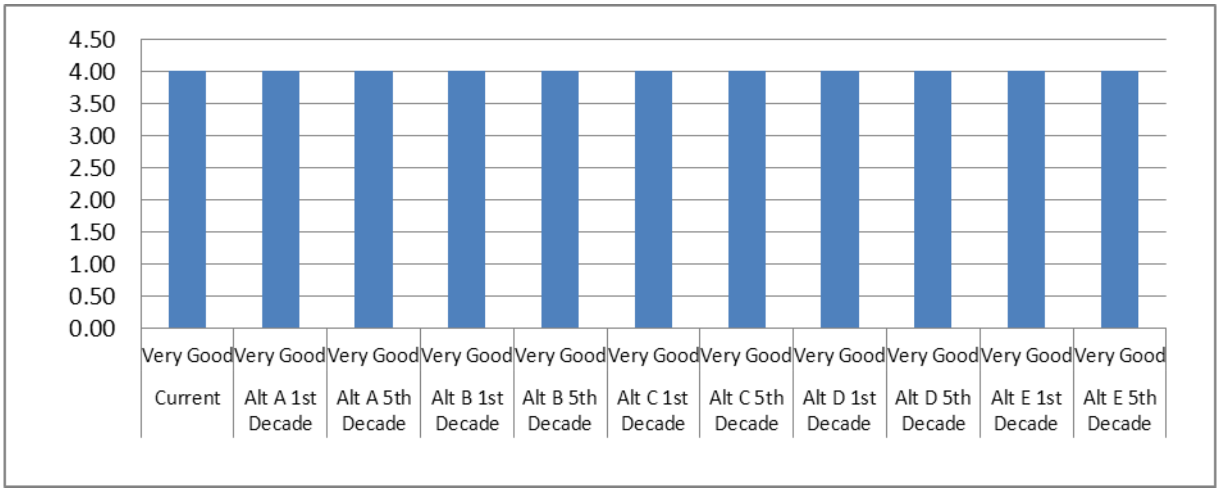

Figure 107. Species association current (watershed-wide) and predictive status based on National Forest System land management and activities

The resulting scores of the analysis described above, which are measured watershed-wide regardless of ownership profiles, result in a very good rating for current status and all alternatives. While neighboring landowners may contribute varying and unpredictable levels of risk to watershed health, the National Forests in Mississippi will continue to maintain a positive contribution to aquatic sustainability. As a result, watershed health is expected to remain relatively stable, at least to the extent that the Forests can control based on ownership profiles.

Open Water Associates Environmental Effects

The creation and retention of manmade impoundments can disrupt sediment, hydrologic, and thermal regimes as well as migration patterns of some riverine aquatic species. Positive effects include the creation of nesting, foraging, breeding, and roosting habitat for some bird and bat species.

Recreational traffic exposes the public to the outdoors and ideally raises conservation awareness. On the other hand, high levels of recreational traffic can negatively impact native species via excessive take, direct persecution, and disturbance of sensitive populations. Excessive recreational traffic may also contribute to litter and pollution.

The balance between negative impacts and positive impacts will vary from case to case.

4.8.3 Aquatic Species Sensitive to Modification of In-stream Flow

Species in this group are sensitive to in-stream flow modifications which include channelization, dredging, dams, road crossings, and culverts. In many cases, hydrologic modification impedes or completely prevents natural migration and dispersal strategies. In other cases, hydrologic alteration may change water temperature regimes and water chemistry variables such as dissolved oxygen levels. Other more subtle impacts of hydrologic alteration include unnatural fluctuations in hydro period that may impede reproduction or other phases in the life history of associated species.

Algorithms were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for the first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the

Forest. A forestwide species group by alternative summary of these scores is presented below (Figure 108).

An important and common impact vector for aquatic species is road and trail density. Sections 4.8.3 - 4.8.9 all share this common relationship. That is, road and trail density is an important aspect that is unlikely to change or improve over time. Many roads that cross the National Forests in Mississippi are administered under the jurisdiction of local, State, and other Federal entities and are therefore, outside of the control of the Forests. National Forest System roads and trails are in most cases considered essential to public access. While some roads and trails may be gated and rehabilitated if considered unessential to the public good, the overall road and trail density scores among all alternatives will change little due to the statistical weight of roads outside the Forests' jurisdiction. While road densities are a concern in some instances, in many cases road and trail scores are already in the good or very good range which is expected to continue to contribute to ecological sustainability on National Forest System lands.

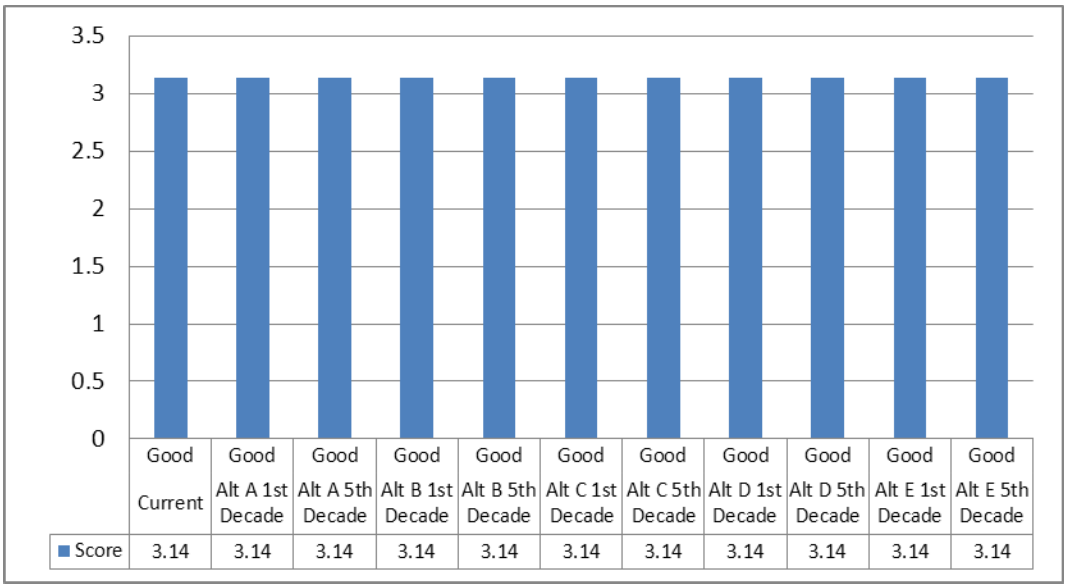

Figure 108. Aquatic species sensitive to modification of in-stream flow. Species association current (watershed-wide) and predictive status based on National Forest System land management and activities

The resulting scores of the analysis described above, which are measured watershed-wide regardless of ownership profiles, result in a good rating for current status and all alternatives. While neighboring landowners may contribute varying and unpredictable levels of risk to watershed health, the Forests will continue to maintain a positive contribution to aquatic sustainability. As a result, watershed health should remain relatively stable, at least to the extent that the Forests can control it based on ownership profiles. Dam densities, channelization, ditching, dredging, and stream crossings, a large majority of which are on neighboring privately owned lands, play a major role in elevating risk levels to hydrological integrity.

Aquatic Species Sensitive to Modification of In-stream Flow Environmental Effects

Most hydrologic alterations on the Forests watersheds occur on privately owned adjacent lands and are outside of Forest Service control. Other than man-made impoundments and stream crossings, National Forest System lands should not contribute negative impacts to hydrologic regimes. In some cases, the Forests may actually restore hydrologic regimes, particularly through stream enhancement and restoration projects. Stream crossings may increase sediment loads and modify hydraulic processes as well as serve as an impediment to species migration and dispersal. The creation and retention of manmade impoundments can also disrupt flow regimes as well as migration patterns and dispersal of some riverine aquatic species.

4.8.4 Aquatic Species Sensitive to Non-native Invasive Species

Non-native invasive species (appendix G) negatively impact native communities in a number of ways. In some cases, invasives compete with native species for resources and space. Some invasive species may also prey directly upon native species. Still others may temporarily or even permanently alter habitats and community structures. The species in this association are susceptible to competition, predation, displacement, and habitat alteration.

Algorithms were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for the first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forest. A forestwide species group by alternative summary of these scores is presented below (Figure 109).

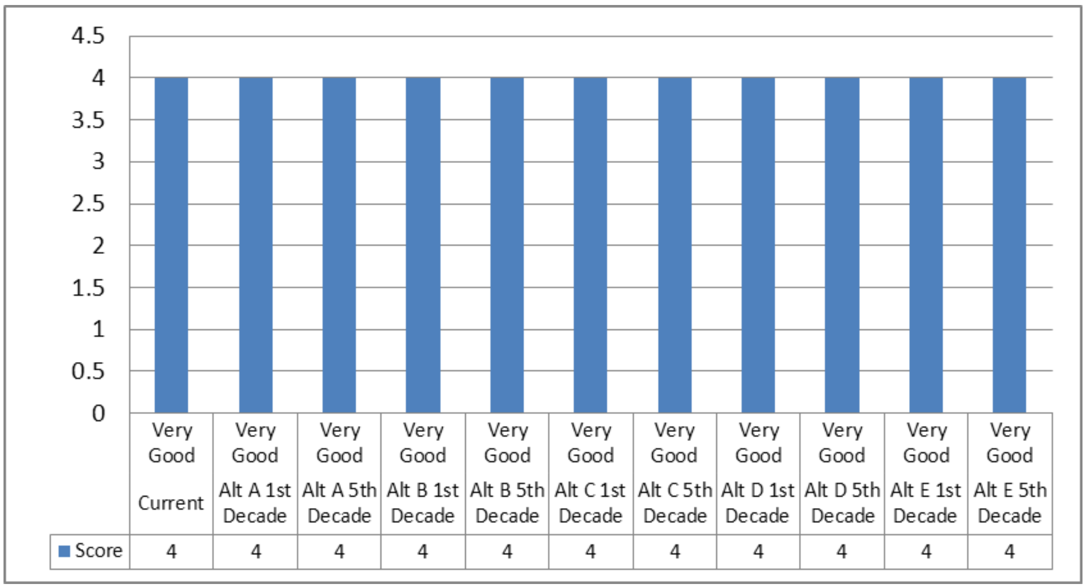

Figure 109. Aquatic species sensitive to non-native invasive species; species association current (watershed-wide) and predictive status based on National Forest System land management and activities

The resulting scores of the analysis described above, which are measured watershed-wide regardless of ownership profiles, result in a very good rating for current status and all alternatives. While neighboring landowners may contribute varying and unpredictable levels of risk to watershed health, the National Forests in Mississippi will continue to maintain a positive contribution to aquatic sustainability. As a result, watershed health should remain relatively stable, at least to the extent that the Forests can control it based on ownership profiles. These scores are measured exclusively by the National Forests in Mississippi compliance with guidelines addressing invasive species.

Aquatic Species Sensitive to Non-native Invasive Species Environmental Effects

Invasive species control measures may result in direct mortality to small numbers of native species. Proper application of control measures and guidelines are intended to minimize direct loses. Indirect and cumulative effects, however, includes the enhancement to the abundance and diversity of native species and communities.

4.8.5 Aquatic Species Sensitive to Non-Point Source Pollution

Urban and agricultural land uses generate a wide variety of toxins that often find their way into aquatic systems. While no one source may contribute large levels, when aggregated at the watershed scale, these toxins may alter water chemistry to a detrimental extent. Species in this association (appendix G) are highly susceptible to alterations in water chemistry resulting from high levels of urban and agricultural land uses in a given watershed. Runoff from non-forested land uses can accumulate to levels toxic to species in this association.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for the first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented below (Figure 110).

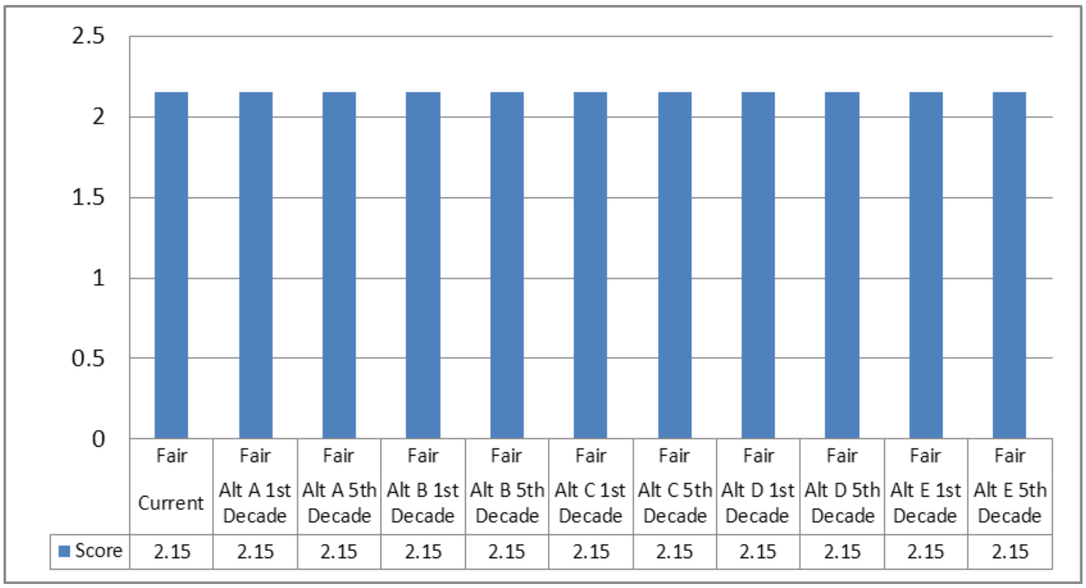

Figure 110. Aquatic species sensitive to non-point source pollution; species association current (watershed-wide) and predictive status based on National Forest System land management and activities

The resulting scores of the analysis described above, which are measured watershed-wide regardless of ownership profiles, result in a fair rating for current status and all alternatives. While neighboring landowners may contribute varying and unpredictable levels of risk to watershed health, the Forests will continue to maintain a positive contribution to aquatic sustainability. As a result, watershed health should remain relatively stable, at least to the extent that the Forests can control it based on ownership profiles. These scores were calculated based on the spatial extent of each watershed in non-forested land uses, particularly urban and agricultural areas. National Forest System lands do not contribute to non-point source risk levels.

Aquatic Species Sensitive to Non-Point Source Pollution Environmental Effects

The National Forests in Mississippi do not contribute to or manage for non-point source pollution therefore no effects are anticipated.

4.8.6 Aquatic Species Sensitive to Stream Sediment

Suspended sediments may adversely impact respiration and other biological functions necessary to the survival of some species in this association. As heavier sediments settle to stream bottoms, important foraging and spawning habitat may also degrade. Excessive deposits of sediment may disrupt photosynthesis in some plant species or even completely bury occurrences.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group (appendix G) to derive composite current scores and estimated scores by alternative for the first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented below (Figure 111).

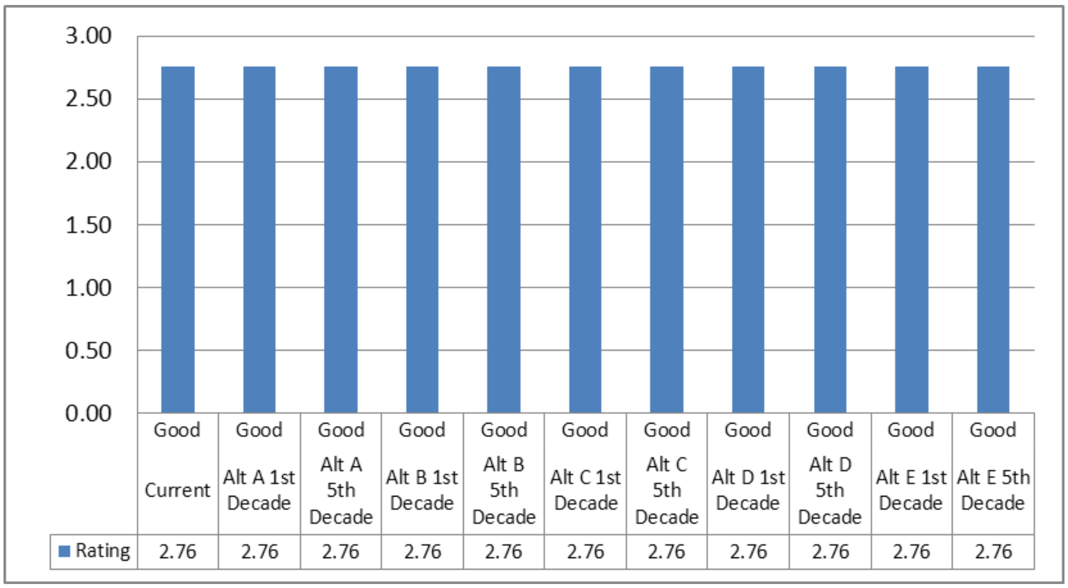

Figure 111. Aquatic species sensitive to stream sediment; species association current (watershed-wide) and predictive status based on National Forest System land management and activities

The resulting scores of the analysis described above, which are measured watershed-wide regardless of ownership profiles, result in a good rating for current status and all alternatives. While neighboring landowners may contribute varying and unpredictable levels of risk to watershed health, the Forests will continue to maintain a positive contribution to aquatic sustainability. As a result, watershed health should remain relatively stable, at least to the extent that the Forests can control it based on ownership profiles. While some forest management activities on National Forest System lands may contribute occasional and temporary relatively low levels of elevated sediment risk, these activities are usually minor when compared to neighboring landowners and, in the long term, often contribute more to ecosystem health than to risk levels.

Aquatic Species Sensitive to Stream Sediment Environmental Effects

Forest management activities, such as thinning, regeneration, and prescribed fire, may contribute temporary low levels of sediment risk. These short term risks are more than offset by the positive ecological benefits of these activities.

Maintenance of National Forest System roads contribute varying levels of elevated sediment depending on slope, elevation, aspect, soil type, and road management regimes. Since many National Forest System roads are important for public and intra-agency access, these effects are unlikely to abate significantly. In other cases, National Forest System roads may fall under shared jurisdiction with other agencies and entities. Here again, these impacts are unlikely to abate significantly.

In most watersheds, the Forests' sediment contributions are minor when compared to neighboring land-uses. In all cases, best management practices and guidelines are intended to minimize sediment risk levels to the extent possible.

4.8.7 Aquatic Species Sensitive to Stream Toxins

Unlike non-point source pollution, this association is especially susceptible to point source pollution. While permitted point sources may not adversely impact this group when compliant; spills, discharges, and other accidents may precipitate spikes in stream toxin levels sufficient to extirpate entire occurrences. Extreme alterations in water chemistry from any source can be highly detrimental to these species.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group (appendix G) to derive composite current scores and estimated scores by alternative for the first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented below (Figure 112).

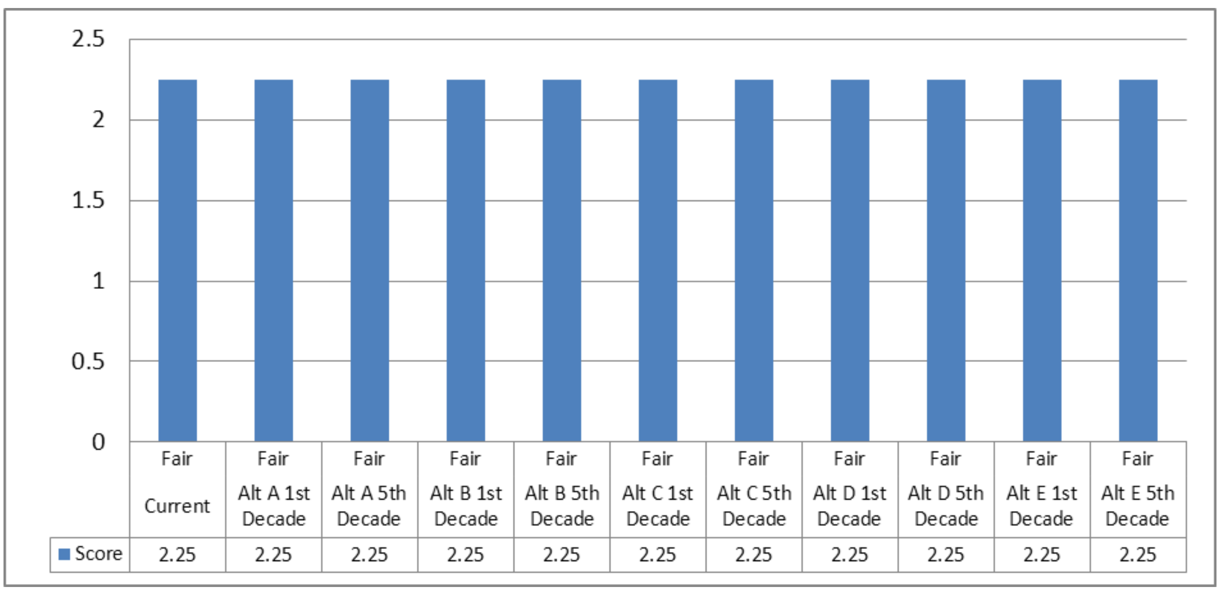

Figure 112. Aquatic species sensitive to stream toxins; species association current (watershed-wide) and predictive status based on National Forest System land management and activities

The resulting scores of the analysis described above, which are measured watershed-wide regardless of ownership profiles, result in a fair rating for current status and all alternatives. While neighboring landowners may contribute varying and unpredictable levels of risk to watershed health, the Forests will continue to maintain a positive contribution to aquatic sustainability. As a result, watershed health is expected to remain relatively stable, at least to the extent that the Forests can control it based on ownership profiles. These scores reflect risk levels primarily derived from point source permit densities and vehicle emissions and residues. Point source densities are entirely out of the Forests' control and vehicle traffic is often a result of local, State, and other Federal jurisdictions.

Aquatic Species Sensitive to Stream Toxins Environmental Effects

Some forest management practices may require the application of herbicides and pesticides which may impact aquatic systems via direct mortality and indirectly via temporarily altered water chemistry. Guidelines and best management practices should minimize risks to native species and communities. In most cases, the long-term benefits will outweigh any short term negative effects. Otherwise, the National Forests in Mississippi do not contribute to nor manage for stream toxins, therefore no effects are anticipated.

4.8.8 Aquatic Species Sensitive to Water Temperature Regime

These species (appendix G) are highly dependent on specific water temperature regimes for all or part of their life history. Thermal alteration most often occurs when riparian areas are deforested exposing water surface to increased levels of direct sunlight. Other sources of thermal alteration, such as accidental industrial discharge, are much rarer and usually temporary.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for the first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented below (Figure 113).

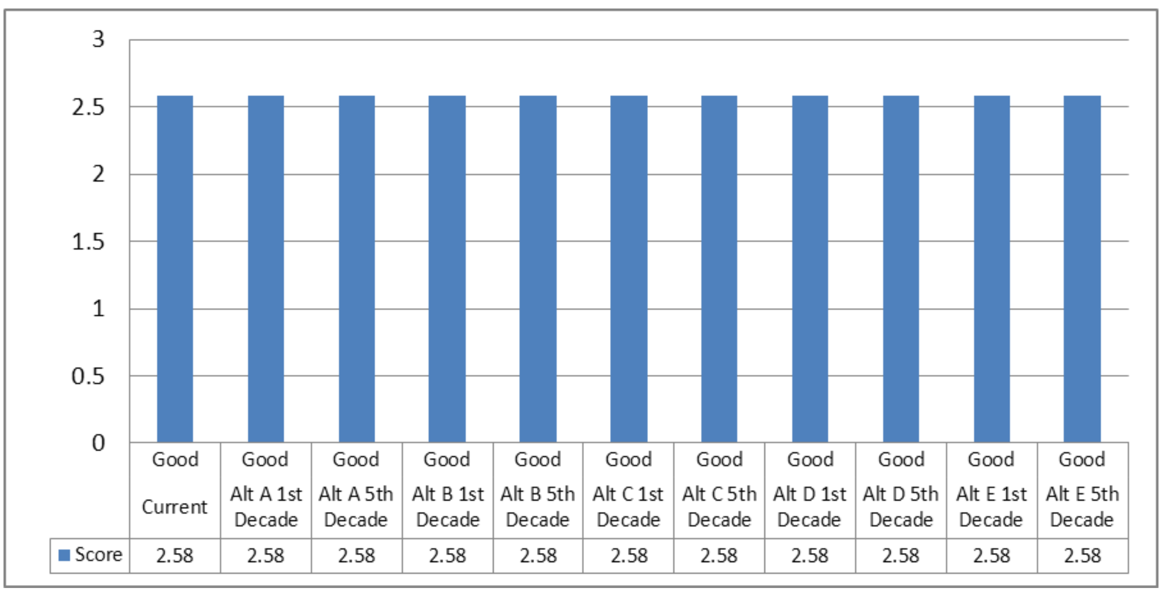

Figure 113. Aquatic species sensitive to water temperature regime; species association current (watershed-wide) and predictive status based on National Forest System land management and activities

The resulting scores of the analysis described above, which are measured watershed-wide regardless of ownership profiles, result in a good rating for current status and all alternatives. While neighboring landowners may contribute varying and unpredictable levels of risk to watershed health, the Forests will continue to maintain a positive contribution to aquatic sustainability. As a result, watershed health is expected to remain relatively stable, at least to the extent that the Forests can control it based on ownership profiles. Riparian forest cover is the primary ecological variable contributing to healthy aquatic thermal regimes. In many watersheds, the National Forests in Mississippi are a primary contributor to thermal integrity when compared to neighboring landowners. In all cases, the Forests make a positive contribution to aquatic thermal regimes due to protection of riparian areas.

Aquatic Species Sensitive to Water Temperature Regime Environmental Effects

Retention and protection of riparian forest communities has a strong positive impact on hydrothermal regimes. No negative impacts are expected.

4.8.9 Species Sensitive to Recreational Traffic

Species in this group (appendix G) are sensitive to excessive human disturbance such as trampling, harassment, vehicular mortality, excessive collection, breeding or nest disturbance, and direct mortality. Many species are collected commercially and used for a variety of purposes including food, medicine, decoration, gardening, landscaping, the pet trade, bait, and trophy fishing. Reptile species are especially sensitive to being harmed, harassed, and killed by humans. This interaction with humans can have long-term negative effects on population sizes and sustainability.

Algorithms in the ecological sustainability evaluation tool were developed taking into account all weights, rankings, and scores associated with this species group to derive composite current scores and estimated scores by alternative for the first and fifth decade intervals. These composite scores were calculated at both the unit level and aggregately across the Forests. A forestwide species group by alternative summary of these scores is presented below (Figure 114).

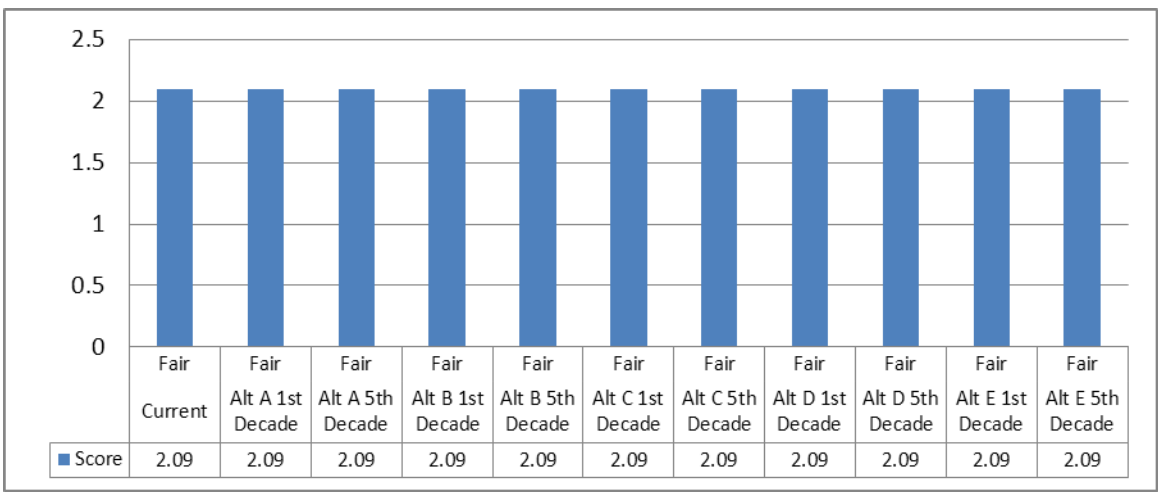

Figure 114. Species sensitive to recreational traffic; species association current (watershed-wide) and predictive status based on National Forest System land management and activities

The resulting scores of the analysis described above, which are measured watershed-wide regardless of ownership profiles, result in a fair rating for current status and all alternatives. While neighboring landowners may contribute varying and unpredictable levels of risk to watershed health, the Forests will continue to maintain a positive contribution to aquatic sustainability. As a result, watershed health is expected to remain relatively stable, at least to the extent that the Forests can control it based on ownership profiles. Recreational access is an important function of the National Forest System appreciated by the public, and ideally, contributes more to conservation awareness than is lost to recreational casualties.

Species Sensitive to Recreational Traffic Environmental Effects

Recreational traffic exposes the public to the outdoors and ideally raises conservation awareness. On the other hand, high levels of recreational traffic can negatively impact native species via excessive take, direct persecution, and disturbance of sensitive populations. Excessive recreational traffic may also contribute to litter and pollution.

The balance between negative impacts and positive impacts will vary from case to case.

4.9 Management Indicator Species

4.9.1 Environmental Effects

Future trends in management indicator species are discussed in various sections of this document. These are identified in Table 63. Within specific major forest ecosystems and species groups there is discussion of expected response to each alternative. The mix of habitat components, by alternative, will influence the degree to which increases or decreases are expected for management indicator species.

In summary, six species have been selected as management indicator species for the revised forest plan. They will be used to assess effects of alternatives and to help monitor effects of implementing the selected alternative.

Table 63. Location of discussion of management indicator species management and effects

Species Common Name	Location of Management Indicator Species and Discussion of Management and Effects
Red-cockaded Woodpecker	Associated with all pine dominated ecological systems occurring on the Bienville, Chickasawhay, De Soto, and Homochitto Ranger Districts. It is also discussed in the threatened and endangered portion of the EIS and is associated with mature open pine-grass associates, den tree associates, xeric sandhill associates, terrestrial and non-riverine aquatic species sensitive to recreational traffic, and species dependent on fire to maintain habitat species groups
Pileated Woodpecker	Associated with den tree associates, forest associates mature mesic deciduous, mature riparian forest associates, and mature upland pine-hardwood associates species groups
Wood Thrush	Associated with forest interior birds
Longleaf Pine	Associated with upland longleaf pine and woodland ecosystem
Sothern Pine Beetle	Associated with all pine dominated ecological ecosystems on the forest and forest health
Largemouth Bass	Associated with recreational fisheries

4.10 Forest Health and Protection

Our overall strategy for achieving healthy forests is to use a combination of vegetation management practices and prescribed burning to restore and maintain resilient native ecosystems. The emphasis in this forest plan on thinning; converting loblolly and slash pine stands that are not on appropriate sites to longleaf and shortleaf pine forests; and restoring rare communities and old growth; is expected to not only improve native species diversity but also improve resilience of ecological communities to non-native invasive species, disease and insect outbreaks, extreme weather disturbances associated with climate change, and other stressors. In addition to resilience, a variety of age classes, including old growth, is needed for ecological sustainability. The three most important forest health issues for the National Forests in Mississippi are non-native invasive species, southern pine beetle and the need to improve old-growth composition. These three issues are covered in more detail in the following sections. There are numerous other forest health issues, but these are normally addressed by vegetation management practices in the proposed action such as thinning, prescribed burning and regeneration. Alternatives C, D and E will positively influence overall forest health. Alternative A would allow overall forestwide forest health to deteriorate.

4.10.1 Non-native Invasive Species

The Forests' objective is to protect native populations of plants and animals through the timely treatment of non-native invasive infestations and to prevent or reduce the spread of infestations to high quality natural habitats. In selecting treatment methods, minimizing effects to native species and natural communities is a priority.

One of the goals of National Forests in Mississippi Forest Plan is to maintain and enhance the diversity of plant and animal communities of Mississippi. The integrity of natural communities on the Forests will be compromised if non-native invasive species infestations are allowed to continue to spread and invade previously unaffected areas. In addition, management of non-native invasive species infestations sites will help slow the spread of non-native invasive species in Mississippi by minimizing the degree to which the Forests are a source of infestations for surrounding lands, both public and private.

To fulfill the goals of Executive Order 13112, non-native invasive species treatments are intended to be adaptive in nature and allow the use of integrated methods for the future treatment of infestations. The Forests recognize that prevention is critical in non-native invasive species management. Prevention includes educational efforts as well as forest plan standards and guidelines that reduce the probability of non-native invasive species being spread by Forest management activities.

The following guidelines were developed specifically for species in this group or address specific needs for this group and are incorporated into chapter 4 of the revised Forest Plan:

1. All ground disturbing activities should be designed and implemented using practices for prevention of spread of non-native invasive species.
2. Contracts and permits should include provisions to prevent the introduction and spread of non-native invasive species on National Forest System lands and resources.
3. National Forests in Mississippi facilities, including administrative sites, campgrounds, offices, etc., should be maintained to be free of non-native invasive species.
4. Gravel and other soil or fill products used on National Forest System lands should come from pits that are free of non-native invasive species.
5. Noxious weed-seed-free materials should be used for erosion control, mulch, and other purposes.
6. Native or non-invasive non-native species should be used when seeding temporary openings (temporary roads, skid trails, and log landings), wildlife food plots, or for use in erosion control.
7. Treatment of non-native invasive species should be considered in all project planning. Authorized uses of timber sale receipts should include needs for non-native invasive species monitoring and treatment, as appropriate.

8. Personnel involved in non-native invasive plant treatments should be able to identify federally listed species, species of concern, and species of interest to minimize or eliminate the risk of damage to these non-target plant populations.
9. Non-native invasive species should be controlled where they are causing negative effects to rare ecological systems. (See Table 9 for a list of ecological systems in the Forests). Non-native invasive plants should not be introduced in or near these communities, except where their influence is expected to be beneficial to the community's composition, structure, or function.
10. Opportunity for introduction of non-native invasive species during road construction and associated timber harvest should be minimized including washing equipment after use and before moving to the next site.

Non-native Invasive Plants

A list of the high priority invasive plant species across the Forests has been developed and listed below (Table 64). The exact infested acreage within the Forests is unknown and changes annually. Most of the 21 species identified in Table 64 are prevalent across the region and are continuing to spread, actively impacting biodiversity. These species were assigned a relative priority for treatment based on their known impacts on rare species and communities, their ability to rapidly spread, and their ability to persist in the forest. These species have been identified as the highest priority species on the Forests at the present time but the list will be updated as needed, based on new information regarding species' spread, invasion by new species, and infestation characteristics.

Non-native Invasive Plants Environmental Effects

While not all non-native species are known to disrupt native ecosystems, of particular concern are those that are successful at invading and rapidly spreading through natural habitats. Invasive plants create a host of harmful environmental effects to native ecosystems including: displacing native plants; degrading or eliminating habitat and forage for wildlife; extirpating rare species; impacting recreation; affecting fire frequency; altering soil properties; and decreasing native biodiversity. Invasive plants spread across landscapes, unimpeded by ownership boundaries. Infested areas represent potential seed sources for continuation of the invasion on neighboring lands. Alternative A places limited emphasis on control of invasive species due to reduced resource capabilities. Although this alternative would result in the least amount of ground disturbance which could reduce the potential for non-native invasive plant infestations, the decrease in resource capabilities would result in less aggressive treatment of infestations. Alternatives B, C, D, and E all have similar language regarding pre-treatment of areas that will be disturbed. Therefore, the potential for non-native invasive plant infestations from ground disturbing activities could be offset by aggressive treatments.

Left unmanaged, non-native invasive species infestations will continue to spread. Even without active management invasive plant infestations will occur across the Forests. Insect and disease outbreaks, wildfires, and storm events (including wind thrown trees, flooding, landslides, and ice damage) encourage non-native invasive plant establishment. More areas of the Forests will be affected and the areas that are affected now will grow in size. Native species diversity and the integrity of natural communities will decline. Some threatened, endangered, sensitive or locally rare species may be extirpated from the Forests. Wildlife species will lose food sources and habitat structure will be modified. Forest plan alternatives that limit accessibility and management will reduce somewhat the likelihood of non-native invasive plant infestations, but they will also reduce the ability to actively restore and maintain habitat using fire and timber management. Private land, state and federal roads, and streams adjacent to the Forests are all potential sources for non-native invasive plants that can affect the Forests. It can be expected during the life of the forest plan that development will occur near the Forests that will facilitate the spread of non-native invasive plants onto the Forests.

Table 64. Invasive species

Scientific Name	Common Name	Priority[a]
Triadica sebifera	Chinese tallow	1
Albizia julibrissin	Mimosa	1
Melia azedarach	Chinaberrytree	1
Paulownia tomentosa	Princesstree	1
Ligustrum sinense	Chinese Privet	2/3
Ligustrum vulgare	European Privet	2/3
Ligustrum lucidum	Glossy Privet	2/3
Ligustrum japonicum	Japanese Privet	2/3
Nandina domestica	Sacred bamboo	1
Lonicera japonica	Japanese Honeysuckle	4
Pueraria Montana	Kudzu	1
Wisteria sinensis	Nonnative Wisteria	1
Wisteria floribunda	Nonnative Wisteria	1
Lolium arundinaceum	Tall Fescue	3
Microstegium vimineum	Nepalese Browntop	1
Imperata cylindrica	Cogongrass	1
Miscanthus sinensis	Chinese Silvergrass	1
Rottboellia cochinchinensis	Itchgrass	1
Lespedeza cuneata	Chinese Lespedeza	3
Lygodium japonicum	Japanese Climbing Fern	3
Lespedeza bicolor	Shrubby Lespedeza	2

a - Priority:

1=high, eradicate wherever found
2=medium, control source populations and eradicate outliers
3=low, prevent invasion of last areas not invaded; eradicate high priority areas

Non-native Insects and Disease

Insects and diseases of most concern for the purposes of this analysis include emerald ash borer, sudden oak death, redbay ambrosia beetle which is associated with laurel wilt disease, Asian longhorned beetle, sirex noctilio, and red-imported fire ant.

Emerald Ash Borer

The emerald ash borer (*Agrilus planipennis*) is an insect pest of recent concern for the National Forests in Mississippi. Since there are no known occurrences of emerald ash borer, control measures should focus on regulation (quarantines), detection, and education. Federal and State entities are continuing to monitor detection throughout the Country for new cases of emerald ash borer. When new infestations are discovered, extensive eradication and quarantines should be enacted.

Emerald Ash Borer Environmental Effects

As there are few management actions or treatments identified that can prevent emerald ash borer susceptibility or risk, it is difficult to display differences in impacts amongst the alternatives. At this time the most effective activities in combating emerald ash borer on the National Forests in Mississippi involve continued detection, cooperating with enforcement of quarantines (administered by the Animal and Plant Health Inspection Service), and perhaps restrictions on the importation of firewood. We expect all these activities would continue under all alternatives.

In the event that an infestation is discovered on the Forests, removing the infested trees is about the only tactic that would prevent further spread. It is expected that all alternatives would utilize this approach. Perhaps the only difference between alternatives that can be expected is that if a silvicultural management tool is developed, alternative A may be less likely to implement measures.

Similar to the discussion above, there is a concern about the potential impact of this insect in our ecosystems. Fortunately, this species has not yet been found on the Forests. We cannot identify any cumulative actions or activities that would combine with the National Forests in Mississippi activities to alter the impacts of the emerald ash borer.

Sudden Oak Death Phytophthora ramorum

Since there is no known cure for oaks infected with *P. ramorum*, control measures should focus on regulation (quarantines), detection, and education. Federal and State entities are continuing to monitor nurseries throughout the country for new cases of sudden oak death. When new infestations are discovered, extensive eradication and quarantines should be enacted.

Sudden Oak Death Environmental Effects

As there are few management actions or treatments identified that can prevent sudden oak death susceptibility or risk, it is difficult to display differences in impacts amongst the alternatives. At this time the most effective activities in combating sudden oak death on the National Forests in Mississippi involve continued detection, cooperating with enforcement of quarantines (administered by the Animal and Plant Health Inspection Service), and perhaps restrictions on the importation of firewood and exotic ornamentals. We expect all these activities would continue under all alternatives.

In the event that an infestation is discovered on the Forests, removing the infested trees is about the only tactic that would prevent further spread. It is expected that all alternatives would utilize this approach. Perhaps the only difference between alternatives that can be expected is that if a silvicultural management tool is developed, alternative A may be less likely to implement measures.

Similar to the discussion above, there is a concern about the potential impact of this fungus in our ecosystems. Fortunately, this species has not yet been found on the Forests. We cannot identify any cumulative actions or activities that would combine with the National Forests in Mississippi activities to alter the impacts of *P. ramorum*.

Redbay Ambrosia Beetle

An integrated management strategy is needed to limit the spread and impact of laurel wilt. This strategy may take various forms depending on the area of interest. As yet, there are no proven silvicultural or arboricultural treatments for mitigating the impact of laurel wilt. The most reasonable management response where laurel wilt is established may be to simply let the disease run its course. “Recovery” from laurel wilt in redbay and other forest species could be considered in terms of the following general courses of action:

- Slow the long distance, human-assisted spread of the disease.
- Improve our understanding of the biology, host associations, and impacts of the disease and its vector.
- Protect individual, high-value landscape trees with pesticides when feasible.
- Develop other tools for management of the disease and its vector, possibly to include sanitation, other silvicultural methods, trap-out or attract-and-kill techniques, use of resistant genotypes, and biological control.
- Assess the need for, and possibly pursue, a germplasm conservation program for threatened hosts.
- Continue to monitor the geographic spread of the disease, assess its impacts on host species as its spreads to new ecosystems, and educate the public about the issue.

Redbay Ambrosia Beetle Environmental Effects

As there are few management actions or treatments identified that can prevent redbay ambrosia beetle and associated laurel wilt susceptibility or risk, it is difficult to display differences in impacts amongst the alternatives. At this time the most effective activities in combating redbay ambrosia beetle and laurel wilt on the National Forests in Mississippi involve continued detection, cooperating with other agencies, and perhaps restrictions on the importation of firewood and mulch. We expect all these activities would continue under all alternatives. Perhaps the only difference between alternatives that can be expected is that if a silvicultural management tool is developed, alternative A may be less likely to implement measures.

Similar to the discussion above, there is a concern about the potential impact of this disease in our ecosystems. Unfortunately, very little is known regarding the potential impacts redbay ambrosia beetle or possible treatments to manage this disease at this time. We cannot identify any cumulative actions or activities that would combine with the National Forests in Mississippi activities to alter the impacts of redbay ambrosia beetle and associated laurel wilt.

Asian Longhorned Beetle

Since there are no known occurrences of Asian longhorned beetle, control measures should focus on regulation (quarantines), detection, eradication, and education. Federal and State entities are continuing to monitor detection throughout the Country for new cases of Asian longhorned beetle. When new infestations are discovered, extensive eradication and quarantines should be enacted. Currently, the only effective means to eliminate Asian longhorned beetle is to remove infested trees and destroy them by chipping or burning. Early detection of infestations and rapid treatment response are crucial to successful eradication of the beetle.

Asian Longhorned Beetle Environmental Effects

At this time the most effective activities in combating Asian longhorned beetle on the National Forests in Mississippi involve continued detection, cooperating with enforcement of quarantines (administered by the Animal and Plant Health Inspection Service), and perhaps restrictions on the importation of firewood. We expect all these activities would continue under all alternatives.

In the event that an infestation is discovered on the Forests, removing the infested trees is about the only tactic that would prevent further spread. It is expected that all alternatives would utilize this approach. Perhaps the only difference between alternatives that can be expected is that if a silvicultural management tool is developed, alternative A may be less likely to implement measures.

Similar to the discussion above, there is a concern about the potential impact of this insect in our ecosystems. Fortunately, this species has not yet been found on the Forests. We cannot identify any cumulative actions or activities that would combine with the National Forests in Mississippi activities to alter the impacts of the Asian longhorned beetle.

Sirex Woodwasp (Sirex noctilio)

Since there are no known occurrences of sirex woodwasp, control measures should focus on regulation (quarantines), detection, eradication, and education. Federal and State entities are continuing to monitor detection throughout the country for new cases. When new infestations are discovered, extensive eradication and quarantines should be enacted. Sirex woodwasp has been successfully managed using biological control agents. The key agent is a parasitic nematode, *Deladenus siricidicola*, which infects sirex woodwasp larvae, and ultimately sterilizes the adult females. These infected females emerge and lay infertile eggs that are filled with nematodes, which sustain and spread the nematode population. In addition to the nematode, hymenopteran parasitoids have also been introduced into sirex woodwasp populations in the Southern Hemisphere, and most of them are native to North America. Early detection of infestations and rapid treatment response are crucial to successful eradication of this insect.

Sirex Woodwasp Environmental Effects

At this time the most effective activities in combating sirex woodwasp on the National Forests in Mississippi involve continued detection, cooperating with enforcement of quarantines (administered by the Animal and Plant Health Inspection Service), and perhaps restrictions on wood packing materials. We expect all these activities would continue under all alternatives.

In the event that an infestation is discovered on the Forest, control by use of biological agents and silvicultural practices would be implemented. It is expected that all alternatives would utilize this approach. Perhaps the only difference between alternatives that can be expected is that if a silvicultural management tool is developed, alternative A may be less likely to implement measures.

Similar to the discussion above, there is a concern about the potential impact of this insect in our ecosystems. Fortunately, this species has not yet been found on the Forests. We cannot identify any cumulative actions or activities that would combine with the National Forests in Mississippi activities to alter the impacts of the sirex woodwasp.

Red-Imported Fire Ant (Solenopsis invicta)

An integrated management strategy is needed to limit the spread and impact of red-imported fire ant. This strategy may take various forms depending on the area of interest. As yet, there are no proven treatments for mitigating the impact of red-imported fire ant at a landscape level. The National Forests in Mississippi will cooperate with Federal, State, and private entities as a means to control this species across the landscape is developed.

Red-Imported Fire Ant Environmental Effects

At this time the most effective activities in combating red-imported fire ant on the National Forests in Mississippi involve continued cooperation with Federal, State, and private entities to find a cost efficient control method to be applied across the landscape. We expect all activities would continue under all alternatives.

In the event that a landscape-wide control method is feasible, control by use of biological agents and silvicultural practices would be implemented. It is expected that all alternatives would utilize this approach. Perhaps the only difference between alternatives that can be expected is that if a silvicultural management tool is developed, alternative A may be less likely to implement measures.

Similar to the discussion above, there is a concern about the potential impact of this insect in our ecosystems. We cannot identify any cumulative actions or activities that would combine with the National Forests in Mississippi activities to alter the impacts of red-imported fire ant.

Non-native Fauna

Feral Hogs

Wild pigs are highly mobile and freely move across land ownership boundaries. Attempts to reduce wild pig impacts to National Forest System land and water must be considered within the context of what occurs on adjacent private, tribal, or other governmental land. Coordination of control efforts across boundaries is imperative. Reducing or eliminating impacts of wild non-native pigs can be both challenging and expensive. It is difficult to remove all members of a population. Even if all pigs were to be removed, the potential for wild pigs repopulating the area remains. Hunting and trapping of these animals remains the most viable method of control. The National Forests in Mississippi will cooperate with Federal, State, and private entities as a means to control this species across the landscape is developed.

Feral Hogs Environmental Effects

At this time the most effective activities in combating wild hogs on the National Forests in Mississippi involve continued cooperation with Federal, State, and private entities to find a cost efficient control method to be applied across the landscape. We expect all activities would continue under all alternatives.

In the event that a landscape-wide control method is feasible, control would be implemented. It is expected that all alternatives would utilize this approach. Perhaps the only difference between alternatives that can be expected is that if a management tool is developed, alternative A may be less likely to implement measures.

Similar to the discussion above, there is a concern about the potential impact of feral hogs in our ecosystems. We cannot identify any cumulative actions or activities that would combine with the National Forests in Mississippi activities to alter the impacts of feral hogs.

4.10.2 Southern Pine Beetle

Southern pine beetle (*Dendroctonus frontalis*) infestations have occurred cyclically throughout recorded history in the South. Factors that determine southern pine beetle hazard include the proportion of the stand in susceptibility host trees (primarily the southern yellow pine species) and the radial growth of those trees over the past five years. Trees with a relatively high radial growth are less susceptible to southern pine beetle-related mortality. While we do not have individual tree radial growth data to estimate susceptibility, we can use the culmination of mean annual increment as a proxy for radial growth. Trees within stands that have passed beyond culmination of mean annual increment are growing relatively slower and radial growth should be slower. Previous modeling using the forest vegetation simulator indicates that culmination of mean annual increment for the yellow pine working group ranges from 35 to 50 years old depending upon site productivity. For the purpose of this analysis we will consider stands equal to or older than 60 years old to be of a higher susceptibility to southern pine beetle.

Currently, approximately 75 percent of the National Forests in Mississippi are in pine dominated ecological systems. Of these systems, over 70 percent are considered to be in medium or high southern pine beetle hazard categories. Natural enemies, such as diseases, parasites, predators and weather, help maintain beetle populations and bring cyclic outbreaks under control. When southern pine beetle outbreaks occur, direct suppression would need to be implemented using integrated pest management strategies. Integrated pest management may be achieved through rapid salvage and utilization of infested trees, piling and burning of infested materials, chemical control in high value resources, and cut-and-leave.

Good forest management is the most effective method of preventing losses from the southern pine beetle. Proactive prevention treatments, such as thinning, are known to effectively reduce a southern pine beetle hazard and are best implemented in periods between southern pine beetle outbreaks. Thinning is the preferred practice for reducing a forest stand's susceptibility to southern pine beetles. Thinning stands to a threshold of about 80 square feet per acre of basal area decreases the frequency and severity of southern pine beetle infestations, reduces intraspecific competition and provides trees with enhanced ability to ward off southern pine beetle attacks via increased resin flow. Reducing stand density through thinning also disrupts southern pine beetle pheromone communication by increasing the amount of air flow within the stand (Ayers et al. 2009). Planting pine species that are less susceptible to southern pine beetle such as longleaf pine is also a management focus. Treatments associated with southern pine beetle prevention have multiple benefits, including improving fire condition class, enhancing wildlife habitat, and increasing recreational opportunities.

Prescribed burning is a forest management tool commonly used in southern pine forests to reduce understory competition. It can be used to treat large areas at a relatively low cost relative to mechanical treatments. Limited literature exists on the relationships between prescribed burning and bark beetles in the eastern United States, including southern pine beetles. Prescribed fire to reduce competition may influence the stand's microenvironment and help disrupt the pheromone plume in the stand (Kneble and Wentworth 2007). Additional studies are needed to understand the complex interactions between prescribed fire and bark beetle activity.

Southern Pine Beetle Environmental Effects

Managers can control both the proportion of susceptible species and the radial growth of trees through vegetation manipulation activities. Thinning and regeneration harvests can alter both species composition and radial growth of the trees within a stand (Table 65).

Table 65. Acres in pine dominated ecological systems regenerated and thinned and at risk from southern pine beetle effects at the end of the next decade by alternative

Activity in Susceptible Types	Alternative (acres)				
	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Acres Regenerated by Harvest	847	12,072	17,693	32,850	23,957
Acres Thinned by Harvest	77,598	90,887	132,239	109,142	172,317
Total Acres Mature (60+) Pine	516,616	488,790	468,510	449,511	461,210

Between 460,000 and 516,000 acres of the ecological systems of concern would be in a southern pine beetle susceptible condition under the various alternatives analyzed given the objectives for prescribed fire and timber harvesting under each alternative. Alternatives C, D, and E would reduce southern pine beetle risk the most as it is projected that these alternatives will utilize thinning and regeneration the most due to the alternatives' focus on ecological restoration and maintenance objectives which also decreases total susceptible acres. Alternative B includes less regeneration and thinning activities than alternatives C, D and E; leaving higher total acres vulnerable to southern pine beetle. Alternative A does the least of all the alternatives to improve southern pine beetle susceptibility. Regeneration is not a high priority and thinning is much lower than all other alternatives which will cause a higher number of vulnerable acres which are more susceptible to southern pine beetle outbreaks.

When considering actions on private and other agency lands within or directly adjacent to the National Forests in Mississippi, cumulative impacts regarding southern pine beetle hazard is somewhat mixed. Management actions on privately held lands vary quite a bit depending upon the objectives and beliefs of individual landowners. The role of fire in lowering susceptibility to southern pine beetle on private lands is expected to be negligible since the majority of private landowners do not use fire frequently enough to impact southern pine beetle. Certainly those forested acres held by private industry are likely to be intensively managed and southern pine beetle outbreaks aggressively fought using timber harvest. However, many acres of privately held lands would remain unmanaged and likely increase the probability of southern pine beetle outbreaks no matter what alternative is chosen by the Forests. Alternatives C, D, and E would help decrease southern pine beetle outbreaks on National Forest System land thus decreasing southern pine beetle spread from the Forests to adjacent lands while alternatives A and B would likely compound the problem over time.

4.10.3 Old Growth

The National Forests in Mississippi have developed old-growth management guides based on guidance provided by the regional forester (Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region, Report of the Region 8 Old-Growth Team, June 1997). The National Forests in Mississippi guidelines are found in a document titled National Forests in Mississippi Guidance for Conserving and Restoring Old-Growth Forest Communities, November 2011. Forest plan alternatives C, D and E all include the same desired old-growth conditions, strategy and guidance for old-growth that was the result of compliance with regional guidance and the ecological sustainability evaluation. Alternatives A and B differ in that the Forests would primarily be dependent on natural events and chance for old-growth development. Alternative B would retain existing wilderness, special area designations and late serial management which contribute to old growth.

Under alternatives C, D or E, each ecological system will contribute to a network of well-distributed old-growth. The guidance establishes a forestwide strategy to create this network that cuts across all ecological systems to maintain, or where necessary identify for restoration, ten percent of all forested lands to an old-growth condition. Alternatives C, D or E should increase each unit’s identified old-growth management acres from the preliminary percentages to at least ten percent.

Under alternatives C, D or E, the old-growth network will consist of both small and medium sized areas. In addition to the ten percent goal stated above, each district would evaluate current medium sized possible old-growth and the ecological need for medium sized old-growth areas and designate a minimum of one percent of the unit’s forested acres to manage as medium sized old-growth.

Alternatives A and B would not have the ten percent old-growth goal or a goal to designate medium sized old-growth areas.

Areas selected to manage for old-growth will be suitable for timber harvest but not suitable for timber production. Generally, harvests planned for these designations should be designed to protect and promote old-growth values.

Old Growth Environmental Effects

The most obvious effect of old-growth management will be beneficial effects to old-growth dependent flora and fauna. There will also be an increase in aesthetic appeal of the forest due to the increased visual variety and developed unique landscapes. There would be an increase in mature age classes in all alternatives. The trend by alternative would generally be based on the level of regeneration achieved by alternative. At higher regeneration levels less mature forest would be retained. Alternative A would therefore produce the most mature forest. However, alternatives C, D and E would provide greater resources for identification, inventory and monitoring. The use of these resources could provide better distribution of stands identified to manage for old-growth character across systems and administrative units on the Forests. Alternative B would maintain current status and trends. See the following section (4.10.4) on forest age class distribution differences by alternative for more details on the alternatives' management actions on forest age.

When considering actions on private and other agency lands within or directly adjacent to the National Forests in Mississippi, cumulative impacts regarding old-growth management is somewhat mixed. Management actions on privately held lands vary quite a bit depending upon the objectives and beliefs of individual landowners. Some other public lands are managed for amenity values while others (such as sixteenth section lands) are managed to generate revenue. The role of old growth on private lands is expected to be negligible since the majority of private landowners do not benefit monetarily from old-growth conditions. Alternative A would increase the percentage of old growth on National Forest System lands more than the other alternatives due to reduced harvest while alternatives B through E would likely have smaller increases in old growth due to greater regeneration activity. However, a major part of the old-growth management strategy is inventory, identification, protection and monitoring. The alternatives with higher outcome objectives for timber harvest and vegetation management practices will have programs with greater funding and resources available to accomplish these identification, inventory and monitoring activities.

Old-growth management in alternatives C, D and E does forgo some timber productivity. However, timber production is limited by budget constraints to levels well below growth and biological potential. By designating old growth, the areas not receiving harvest treatments are better focused on areas with ecologically valuable old-growth character. Alternatives A and B do not provide this structured old growth benefit and depend more on chance and lack of management activity for this ecological benefit.

4.10.4 Age Class Changes for Each Alternative

One of the results of the restoration and regeneration harvests implemented under each alternative would be changes in the age class distribution across the Forests. Without disturbance, either man caused or natural, more acres in each vegetation type get older. The regeneration management actions taken in each alternative shifts acres back to zero. Balanced age classes are desirable because both young and old vegetation provide benefits. Also, it would be highly disruptive for large portions of the forest to decline or die at the same time. This could happen based on higher disease and insect risks with older trees. From a timber resource perspective, balanced age classes help assure an even flow of commodities from the Forests.

Table 66 below displays age class information from each alternative modeled. The table displays acres within three age groups at the end of the first and fifth decades. The three groups used are 0-10 years, 11-59 years and 60 years and above. These groupings are used because acres in 0-10, and 60 plus age classes were important components of the ecological evaluations done on each alternative developed for forest plan revision. Also, the acres that each alternative creates each decade and the acres reaching mature condition provide the information needed to evaluate the flow of forest products over time as well as provide information to evaluate forest health.

Table 66, acres by age classes, is based on likely regeneration for all alternatives at the end of the first and fifth decades.

Table 66. Acres by age class and alternative

Age Class	End of Decade 1			End of Decade 5		
Alternative	**0-10**	**11-59**	**60 +**	**0-10**	**11-59**	**60 +**
Custodial Alternative (A)	847	427,776	724,728	6,019	56,310	1,090,064
No-action Alternative (B)	16,173	425,290	711,679	25,194	126,041	1,001,628
Proposed Action (C)	25,230	424,821	701,699	35,925	167,823	944,561
Accelerated Restoration (D)	43,701	417,784	690,781	34,224	213,391	902,998
Enhanced Forest Health (E)	37,770	420,487	697,506	57,194	205,295	889,063

Across all vegetation types the overall forest age shifts to older age classes for all alternatives.

The effects of changing age classes on systems and species was included in the evaluation of alternatives discussed in sections 4.4 through 4.7 above.

Within individual vegetation types, there are only two alternatives where 60 plus age class acreage was less Forest wide after the fifth decade than it was after the first decade. These occurred in the model outcomes for shortleaf pine-oak forest and woodland in the alternatives C and E. This also occurred for dry upland hardwood forest in alternative E. For alternative C, at the project development and decision level of planning for implementation, a focus on increasing and enhancing shortleaf pine-oak forest and woodland and dry upland hardwood forest would likely result in a different outcome than these model results. In alternative E these reductions in older age classes was an attempt to model healthier forest conditions. Project level implementation of this emphasis would likely have similar results.

Details on age class by vegetation types for each alternative are shown in appendix B.

The regeneration harvest acres for the overall forest would result in 0 to 10 year age class acres of approximately one percent for alternative A, two percent for alternative B, three percent for alternatives C and D, and five percent for alternative E. This results in effective rotation ages of 1000 years, 500 years, 333 years, 333 years and 200 years respectively. These ultimate stand ages are not reasonable for many Mississippi forest types.

In alternative A most stands would die naturally several times within a 1000 year time frame. The alternative’s regeneration would be focused on restoration to benefit threatened and endangered species on the Bienville, Chickasawhay, DeSoto, and Homochitto Districts. So, loblolly pine and slash pine on those units would be harvested at a rate of 1 to 6 percent rate or 166 to 1000 year rate. Many stands of loblolly and slash on these units will face natural mortality before managed harvest for restoration could occur. On the Holly Springs, Tombigbee and Delta Districts only natural mortality and time will affect the age class distribution.

In alternative B most stands would die naturally several times within a 500 year time frame. Shorter effective rotations would occur for pine stands where there is harvest. This would still not prevent many stands from breaking up naturally before managed harvest could occur. For example, loblolly and slash pine stands on the DeSoto District would be harvested at a rate of 5 percent per decade or effectively every 200 years. This is longer than intact stands of these pines survive. For the Homochitto District loblolly would be harvested at a rate of 9 percent per decade or effectively a 100 year rotation length. This is slightly better but many stands would have to reach ages approaching 200 prior to harvest because many stands are already over 70 years old.

Alternatives C, D and E deal with liquidating off site pines at a quicker rate than alternatives A and B. However for alternative E (which has the highest regeneration rate) the overall pine harvest rate is 7 percent and effective rotation length is 143 years. This would require some stands to be over 200 years old prior to harvest. Alternatives C and D would have a pine harvest rate of about 4 percent or an effective rotation of 250 years. Again it should not be expected that pine stands will remain intact without significant mortality at this harvest rate.

Based on this analysis, forest health issues related to forest age will increase in all alternatives. However, management actions in each alternative will reduce forest health risks. The positive effect will increase from alternative A to alternative E in that order.

4.11 Fire Management

A concern for forest health and its relationship to the risks of catastrophic fire has resulted in a number of government-wide initiatives, including the National Fire Plan, the Healthy Forest Initiative, and Healthy Forest Restoration Act. These initiatives recognize the natural role of fire in ecosystems and the problems that decades of fire exclusion in these ecosystems have created as it relates to hazardous fuel build-ups and the risk of catastrophic fire. Based on fire ecology research, ecosystems have been classified according to fire regime condition classes (condition classes). Assessments of fire regime condition class can help managers determine where fuels mitigation activities and ecosystem management work is most needed.

4.11.1 Wildland and Prescribed Fire

Fire management on the National Forests in Mississippi encompasses a wide variety of activities including wildfire prevention efforts, wildfire suppression, hazardous fuel reduction (prescribed fire and mechanical treatments), ecosystem management including restoration, maintenance and enhancement of fire-adapted ecological communities, firefighter training, community assistance in dealing with wildfires, and dispatching of firefighting resources to both fire and non-fire (or “allrisk”) incidents.

Prescribed Fire

The rationale for prescribed fire varies and can include ecological restoration, fuels management, silvicultural or wildlife habitat improvement, control of non-native invasive species, or other objectives. A prescribed fire often meets multiple objectives. Prescribed fires are also conducted to help meet specific wildlife habitat objectives, to facilitate silvicultural operations, and to aid in the control of non-native, invasive species. All prescribed fires require the completion and approval of a prescribed fire plan. These plans clearly state the objective(s) of the fire, document compliance with 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). Screening is done to identify potential smoke sensitive targets up to 100 miles from planned fires. An emission model, fire behavior model, and smoke dispersion model are run prior to fire ignition to ensure compliance with State and Federal standards and to predict fire intensity in response to specific burn objectives. A complexity analysis is done for fires where special integration or 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.

Prescribed Fire Environmental Effects

While suppression strategies and resources needed to combat wildland fires will not vary by alternative, the level of prescribed fire for hazardous fuel mitigation and ecosystem management will vary (Table 67).

Alternatives C, D, and E, because of the projected level of prescribed fires (220,000; 240,000 and 251,000 acres annually respectively), will provide the highest level of hazardous fuels reduction and ecological restoration and maintenance in fire-adapted ecosystems with an emphasis on growing season burning. A variety of other vegetation management tools (mechanical, herbicide, etc.) will likely also be used to restore rare ecological communities that are fire-dependent (e.g. bogs and prairies). As needed, fire will be used to help control non-native, invasive vegetation whenever and wherever it is practical to do so. Alternative B, at an average annual prescribed fire program of 190,000 acres, will likewise contribute to fuels management and ecological restoration, but will likely relegate some restoration of rare ecological communities and control of non-native invasive plant species to occurrences embedded in larger landscape burns as has been done in the past with less emphasis on growing season burning. The level of prescribed fire in alternative A, (121,000 acres), will be restricted to four districts. Priorities will be established based on the need for burning for threatened and endangered species habitat areas and minimal fuels management. This level of prescribed burning will likely decrease viability trends for a number of flora and fauna, and hamper any effort to maintain condition class at or near desirable levels.

As more acres are restored to condition class 1 in ecological communities adapted to low-intensity periodic fire, a grass and forb dominated understory would prevail over a larger part of the landscape. In this condition, surface fuels are the primary component contributing to fire behavior. There would not be as much of a woody live and dead fuels component to contribute to either flaming or smoldering fire behavior. In prescribed fires and wildfires, the grassy component would burn more easily, faster, and produce fewer smoke emissions (both in concentration and duration) as compared to current fuel conditions. Fire intensity would be less 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. Although the role of fire in fire-adapted ecosystems has been studied in recent years, it is not possible to know the exact role that fire has played over time. Also, the role of fire may appear different depending on which years or time periods are compared. Given these uncertainties, the cumulative effect of prescribed fire will likely not restore the role of fire to the level it would have been in all fire-adapted ecosystems. Of the alternatives being considered, alternatives C, D, and E place the most emphasis on ecological restoration and maintenance, while alternative B places the least emphasis on ecosystem management. Alternative A is inadequate by comparison for both ecosystem and fuels management as its focus is primarily threatened and endangered habitat maintenance.

The effects of prescribed fires are usually short-lived and cumulative impacts are generally ascribed to impacts to soil and potential for smoke accumulation. Prescribed fire can have short-term negative effects on air quality. These effects may be mitigated by burning at certain times of the year, at certain fuel moisture thresholds, and under meteorological conditions that promote smoke dispersion. This information is provided in the burn plan prepared for each prescribed fire. A smoke management plan is required for each burn plan. The impacts of prescribed fire on soils and air are expected to stay within established limits for all alternatives.

Table 67. Annual prescribed burning programs by district by alternative

	Alternative A		Alternative B		Alternative C		Alternative D		Alternative E	
	Burn Acres	Growing Season	Burn Acres	Growing Season	Burn Acres	Growing Season	Burn Acres	Growing Season	Burn Acres	Growing Season
Bienville	25,000	9,200	30,000	7,500	33,000	14,000	35,000	20,000	40,000	21,000
De Soto	55,000	22,000	81,000	24,000	84,000	35,000	91,000	46,000	93,000	56,000
Homochitto	19,000	5,500	26,000	7,800	36,000	13,000	40,000	24,000	44,000	25,000
Chickasawhay	22,000	8,500	31,000	9,000	33,000	14,000	38,000	20,000	38,000	20,000
Holly Springs	0	0	13,000	2,000	23,000	9,000	24,000	12,000	24,000	12,000
Tombigbee	0	0	9,000	1,000	11,000	4,500	12,000	6,000	12,000	6,000
Total	121,000	45,200	190,000	51,300	220,000	89,500	240,000	128,000	251,000	140,000

Wildland Fire Suppression

Each year, Mississippi 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 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, 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. When summer and fall droughts occur, wildfires can be very destructive, though infrequent.

A full range of wildland fire suppression strategies may be utilized. Direct attack is most often the costliest, and is used whenever safety is a concern or to minimize acreage burned and resource values lost. With indirect attack the fire often becomes larger because it is allowed to spread out to pre-existing barriers in exchange for reduced suppression costs. The option of simply monitoring the fire, both its behavior and effects, may be the most cost efficient strategy in those areas where the effects of the fire are desirable and the risk to safety or resource values is manageable. Firefighter and public safety is always the primary consideration for all suppression actions. Strategies and tactics for the fire should secondarily be commensurate with resource values at risk.

Wildland Fire Suppression Environmental Effects

While the firefighting resources would remain stable regardless of alternative, the effects of wildfire (wildfire intensity, duration, and resistance to control) would change over time based on alternative. Alternatives C, D, and E would lead to conditions with lower fuel loading occurring on a significant portion of the forested landscape. All wildland-urban interface areas would be maintained as condition class 1. Snags would likely be less of a problem in treated stands and firefighter safety would be better addressed. Fire suppression costs would likely go down in alternatives C, D, and E over time as fuels are reduced. Alternative B would be intermediate in response to fuels mitigation and firefighter and public safety by comparison. Alternative A would provide the least responsiveness to these concerns (fuels mitigation, suppression costs, and firefighter and public safety).

Wildland Urban Interface/Intermix

As the populations increase and private lands within the Forests’ boundaries become populated with single structures, small farms, poultry operations, and other developments, the wildland-urban interface is becoming more of an issue. Many rural residents typically like to live in wooded surroundings and desire to maintain a natural vegetative setting around structures, which blends property into the adjacent forested environment. While 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 wildland-urban interface 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 wildland-urban interface on the Forests.

Wildland Urban Interface/Intermix Environmental Effects

All the alternatives focus attention on fuels mitigation projects in the wildland-urban interface and near communities at risk. All the alternatives call for enough prescribed fire to accomplish the task of lowering condition class in the immediate vicinity of these areas. Alternatives calling for 200,000 acres or more of prescribed fire (alternatives C, D, and E) provide the best potential benefit of treating even larger landscapes intersecting the wildland-urban interface and treating fuels surrounding communities at risk.

Over time, fuels reduction by prescribed fire will reduce the fire hazard in the wildland-urban interface leading to less damage to private properties than fires with heavy fuel loads. Also, fuel reduction will, over time, benefit fire control by reducing resistance to control. Overall, risk to communities should be significantly reduced as a result of fuel reduction in the wildland-urban interface.

4.12 Outdoor Recreation

4.12.1 Outdoor Recreation Opportunities

This section examines changes across alternatives for recreation opportunities and management impacts associated with or influencing outdoor recreation opportunities, wilderness and wild and scenic rivers and scenery.

General Effects

General themes were developed for alternatives that emphasize different resource management objectives for improving the ecological sustainability of the national forest. Alternative B – is the "Current Management" alternative and will provide the baseline for evaluating other alternatives.

In the future, additional opportunities for outdoor recreation (including the flexibility to offer to a broader range of people and more people) will most likely not come from building more facilities. Rather services and benefits provided by strong partnerships will provide the greatest gains in future recreation opportunities. Opportunities will be found by tapping into unused capacity of existing facilities and trails.

Improvements will be seen to preserve quality natural and cultural settings and to provide safe, and enjoyable areas and trails that appeal to a broad range of the state's population demographics– age, race and ethnically.

The management actions related to recreation are discussed below and the following assumptions are applicable to all alternatives.

- Other special area designations may provide destinations of interest; these designation themselves will not increase forest wide use but should create a better program for dispersed area use and perhaps attract a new visitor audience.
- The partnerships will improve and increase recreation opportunities forest wide.
- There are no new large land purchases anticipated.
- There are no new sizeable designations of wilderness or wild and scenic river acres.
- As population increases, recreational use will increase on national forests.
- Many roads that cross National Forest System lands are under the jurisdiction of local, state or other federal agencies and are outside control of the National Forests in Mississippi. Therefore, in many places, closing National Forest System routes will not increase remoteness to create semi-primitive nonmotorized opportunities due to these other routes. Overall road and trail density scores among alternatives will change little due to the statistical weight of roads outside the Forests' jurisdiction. However, local spots with between 1000 to 2500 acres may develop with low road densities.

Description of Recreation across Alternatives:

Alternative A – Custodial Management

- Eliminates many recreation opportunities because activities and access are reduced greatly. Public Access is curtailed as most roads are closed or are not managed for recreation access. Hiking is the only trail use; some trailheads are available for remaining. Trail miles are reduced to about half of current levels.

- Visitor information is focuses only on regulations and prohibitions.
- Acceptable activities include hiking, hunting, fishing, nature observation, watching wildlife, relaxing and other passive activities where the user does not want and the activity does not require facilities or supervision. This alternative will over time close all facilities. It will decommission and remove them, restoring native habitat to all recreation facilities (day use and overnight) except boat ramps on large lakes and the wild and scenic river.
- Trails and scenery are not actively maintained. Repair of, and removing hazards, along trails or waterways will not occur as frequently or may be too large of scale for custodial care. Partners are few and limited. Special use permits could be issued for outfitters or recreational and volunteer groups for hiking trail care, natural observation and exploration due to limited funding and staffing levels.
- The dispersed recreation opportunities under alternative A will be more primitive and would require visitors to have more outdoor skills. Although there may be more remote settings as old-growth forest acres increase, the forest will be more difficult to access as remaining trails and roads are not regularly available and understory vegetation will be very thick in some places due to reduced burning. A basic assumption is that visitation would be cut in half due to more difficult assess.

Alternative B – No-action

- The recreation emphasis is to provide a variety of high-quality recreation opportunities. The assumptions are that established financial resource will continue to be limited and diminishing. Therefore there will be a challenge managing growing and changing recreation demands.

Alternatives (C) Restoration; (D) Accelerated Restoration; and (E) Forest Health

- A new backcountry designation on the Tombigbee National Forest and acquisition next to Black Creek Wilderness provides approximately 4600 acres of more remote outdoor experiences. Mountain bike trails would be allowed as a way for people to tour the undeveloped area but outdoor skills are emphasized. Management options that could be explored are primitive hunting and other use experiences.
- Special area designations may require additional trail segments for public access and site protection which may in some locations provide distinctive destinations for forest visitors, improving visitor experience and discovery of unique natural and cultural heritage. The total amount of trails will remain approximately the same or have a slight increase.
- Developed recreation sites would stay approximately the same number and size. Low occupancy periods will be targeted for higher visitation.
- All developed site use would quickly increase moderately due to better marketing and visitor information.
- Focus on expanding opportunities for wildlife observation and environmental learning through partner programs. Site management and other activity oversight may also be transferred to skilled businesses and dedicated communities through concessions or permits.
- Maintain most current developed activities unless they are no longer of substantial interest to the public, conflict with natural linkages, or amount of use overwhelms capacity of the program or the integrity of the land.
- Emphasis on aquatic habitats will improve anglers catch. Maintenance or enhancement of habitats for some game species may increase hunting opportunities.

Changes in use by Alternative

Across the five alternatives, current and future recreation demand and supply is evaluated using projections from the Southern Forest Futures Project and from the 2010 Resource Planning Act Assessment.

The change in overall sites visitation across the alternatives are shown below. The greatest change factor is population growth, not direct management decisions. However, it is estimated that initial changes spurred by new partnerships and improving communication will cause a moderate increase in visits.

Table 68. Estimated change in national forest site visits by alternative (1000s)

Alt. A	Alt. B	Alt C,D,E
2015		
-30%	0%	+10%
2030		
1,723.63	3,526.88	3,879.57
+59%	121%	133%
2060		
2,046.80	4,196.98	4,616.68
70%	144%	158%
2,046.80	4,196.98	4,616.68

Alternative A will have the least amount and variety of outdoor opportunities yet visitor use is still forecasted to increase more than the average anticipated population growth of 44 percent.

Changes in Recreation Opportunity Spectrum (ROS) by Alternative

There is forest-wide difference in alternatives on opportunities for recreation as indicated by recreation opportunity spectrum class, and developed sites and trail miles for alternative A, custodial management, but only slight forest wide differences for C, D and E alternatives.

During the forest plan revision analysis for potential wilderness designation (appendix C), a forest wide GIS analysis identified 16 areas over 1,000 acres with a road density of less than 1/2 miles per 1000 acres. That study revealed 1 area which was proposed for a new recreation opportunity spectrum class on the Forests – remote roaded natural

From that study, the following areas would be managed for remote roaded natural under alternatives C, D and E:

Table 69. Areas for recreation opportunity spectrum class, remote roaded natural

	acres
Tombigbee NF Hawk’s Nest	4431
Desoto NF Bordering Black Creek Wilderness	252

Under alternative A, more primitive recreational experiences would be possible as the area would require more outdoor skills from visitors, as there would be no visitor services or facilities, excepting where access would have to be provided. There will be significantly less visits, activity choices and access for recreation, under the custodial alternative, as the management is minimal. Settings become more primitive; however access may be difficult due to storm debris clogging trails, as maintenance is limited to visitor safety needs. Most access through the forest is by foot only. All other trail uses are prohibited as consistent maintenance is required. Few interior National Forest System roads will remain open. No facilities are available for outdoor recreation use. Moderate high maintenance activities are eliminated. Historic structures may be rented, leased, or put under long term special use permit but accumulated use will not be significant on a forest basis.

Alternative A would create the greatest change in recreation opportunity spectrum settings, increasing the more remote and rustic settings. 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. However, since annual and periodic maintenance of hiking trails and boat ramps will be limited, facilities may not be available throughout the year. Scenic conditions will vary across the forest as storm clean up and prescribed burning activities are reduced. In some places old-growth patches are larger (greater than 2500 areas) resulting in a more of a primeval forest setting. However, the thick vegetation on national forest lands, especially with reduced burning, may make the forest impenetrable in some places.

More remote settings may be associated with road closures in some areas, both seasonal and permanent. Obviously road closure decreases 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. Changes in travel routes and motorized game retrieval would still be decided for each site specific area through the travel management process. Road closure often reduces wildlife poaching and litter. No permanent, highly developed hunt camps would be built. Fewer roads would be needed under Alternative A, and the greatest need for open roads would be in Alternatives C, D and E with management activity increases.

The remote roaded natural setting for Hawks Nest under Alternatives C, D and E could provide a more primitive hunting opportunity; it sits within the Choctaw Wildlife Management Area.

In the long term, the old growth will give rise to places that will have remote roaded natural settings. Old Growth strategy does not change by alternative, but lower activity in Alternative A would allow old growth to develop by default.

Developed Recreation Capacity

Examining the change in infrastructure dedicated to recreational pursuits, Table 70 shows the high decrease in trails in alternative A, however under the remaining 3 alternatives there are no activities that would directly increase or decrease trail systems over the long term. Table 70 displays allocation of capacity in terms of 'people at one time' by alternative to existing developed site capacity. Alternatives C,D and E, have little change from the baseline alternative B in the amount and capacity, or development level of developed recreation sites on the forest, but do emphasize changes to upgrade the accessibility of existing sites, which are considered high priority improvements.

Table 70. Estimated change in capacity of developed recreation areas by alternative

Type of Development	Alt A	Alt B	Alt C, D, E
Overnight Camping Areas	Eliminate	4360	Same
Picnic Areas	Eliminate	160	Same
Boating Ramps	Same	300	Same
Shooting Ranges	Eliminate	45	Same
Trail Miles	Approximately 210	435	Same
Horse Camps	Eliminate	381	Same
Total	-----	5,681	------

People at one time will decrease substantially in alternative A, because only trails and boat ramps will remain. Visitors that like the rustic woods may enjoy this. With roads closed, those who like to travel by foot and explore will be more satisfied but at minimum the current developed sites and non-hiking trail use will be displaced.

General Effects by Alternative of other Program Actions

Other forest activities and actions will effect developed recreation and dispersed recreation activities in alternatives A, C, D, and E and effects will depend on the proximity and magnitude of the activity.These activities include construction of roads, vegetation management (including thinning, conversion, regeneration, insect and disease control, prescribed burning and pesticide use), reconstruction and maintenance of roads and trails and mineral exploration.

Some activities have short term effects such as prescribed burning or pesticide use that decrease the satisfaction of the visitors in the area for a short time. Other activities such as road construction, regeneration, and energy well development 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.

Also across the alternatives from A to E the average years between harvest activities within stands decreases and the burn cycle is more frequents. Annual timber activity is 63 percent of current average under alternative A, and 51 percent over current in alternative C, 68 percent increase in alternative D and 98 percent in alternative E.

Based on management actions there will be the potential for the most disruption and possible displacement of recreation activities in alternative E, and the least in alternative A. Mitigation will be done to protect recreation infrastructure and settings. Note that deer and turkey habitat increase as openings increase across the alternatives, promising to increase favorite hunting opportunities.

Under alternative A, there will be less hunting and fishing as discussed in the wildlife and aquatic sections. Under the last three alternatives, the Mississippi Department of Wildlife, Fisheries, and Parks and the National Forests in Mississippi will continue their cooperative relationship in the management of Wildlife Management Areas providing a wide choice of habitats for game species. The habitats created by restoration activities will increase naturally certain populations that are hunter’s favorites.

The most dramatic management actions brought forward are the forest harvest associated with the conversion of loblolly and slash to native long leaf and shortleaf ecosystems. Regeneration harvests, the follow up frequent thinning and the associated prescribed burning will create short-term impacts for recreationists with in the vicinity of such harvest and burning operations. Forest-wide the effects of the actual harvesting and burning operations (dust, noise, and presence of machinery) will be temporary and short term. In the longer term, the improvement of naturalness by removing off-site species and increase in native forest conditions, particularly open forest types with grassland components will improve visibility and scenery.

Other actions encouraging specific wildlife populations like Mississippi sandhill crane may increase chances for observation of unique wildlife for dedicated watchers in specific locals, but not necessarily provide a forest wide increase in opportunities.

4.13 Scenery

The scenic resource is affected by management activities altering the appearance of what is seen in the landscape. Short-term scenic effects are usually considered in terms of degree of visual contrast with existing or adjacent conditions that result from management activity. The scenic landscape can be changed over the long term or cumulatively by the alteration of the visual character. Management activities which result in visual alterations inconsistent with the assigned scenic integrity objectives, even with mitigation, affect scenery. Management activities that have the greatest potential of affecting scenery are road construction, vegetation management, insect and disease control, special use utility rights-of-ways, and mineral extraction.

Other management activities that also can affect the scenic resource at a lesser degree are threatened and endangered species habitat management, prescribed burning, fire suppression, land exchange, old-growth forest management, recreation, and administrative site facility construction, and wildlife management.

Except for alternative A, where the resources will not be expended beyond the minimal legal requirements, the scenic integrity objective acreages of the alternatives do not vary directly across the Current Management (alternative B) and alternatives (C, D and E). What varies across the alternatives is amount of impact, most directly due to the restoration and ecological sustainability activities, total volume of timber cutting, the percentage of restoration harvests, and the location of vegetation management activities. The primary theme of forest plan revision is restoration of native forest ecosystems; vegetation management, and the application of prescribed fireare the principal management tools utilized to achieve this objective. Vegetation management has the greatest potential to alter the landscape and impact the scenic resource. These activities increase across all alternatives, from Alternative A, which is less than current management, up to alternative E which is two times more activeOf the management applications, even-aged management may be the most impacting. Among the even-aged regenerations methods clear cutting 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 the landscape character would impact scenery the least.

Group selection harvests are normally less evident because they do not cause large openings in the canopy. Uneven-aged regeneration methods can affect scenery, causing contrasts in form, line, color, and texture from slash production. All impacts as a result of timber harvest are short-term because of rapid vegetation growth.

Site preparation activities affect scenery by exposing soil and killing other vegetation. These effects are generally short-term. Site preparation usually improves the appearance of the harvest area by removing the non-merchantable trees and most of the broken stems. Stand improvement work can affect scenery by browning the vegetation, reducing visual variety through elimination of target species.

Specific species habitat work also requires vegetation management and fire. Forestwide prescribed burning and midstory manipulation in red-cockaded woodpecker cluster sites are common wildlife management practices. Midstory removal and prescribed burning reduce overstory diversity, often resulting in the loss of valued scenic resources such as flowering dogwoods. Midstory removal and prescribed burning in time produces stands with open understories allowing views into the landscape. This work is common across all alternatives.

All alternatives propose prescribed burning. The frequency and time of year vary with the ecological community. Drifting smoke and blackened vegetation and charred tree trunks would be the main negative visual effect. Visual contrast from fire line construction would also be evident. The contrast levels and duration vary with fire intensity. Blackened vegetation usually last a short time but hot fire charring of trees may be evident for many years. Repetitive burning reduces overall visual diversity. It often results in loss of valued mid- and understory species such as flowering dogwood, but tends to promote herbaceous flowering species. Prescribed fire repeated over time produces stands with open understories allowing views farther into the landscape. Public comments indicate that open long leaf pine forests are pleasing landscape to most visitors.

Alternative E has the most acres in the prescribed burning program and therefore the greatest potential for altered scenery. Implementation guides will reduce the impacts

Road construction can cause a permanent change in the scenery. Due to the high density of roads, no new road construction is expected. Road maintenance, especially rights-of-way maintenance, affects scenery. Mowing frequency and timing alters the appearance of the landscape. Road construction introduces unnatural visual elements into the landscape and causes form, line, color, and texture contrasts. The travel management program determines how much of the landscape is seen by having roads open or closed to public access. Road construction and management does do not vary across the alternatives.

There will be no change in landscape character themes across the alternatives. Most acres are naturally appearing forest, with its structure depending on the specific ecosystem involved. Insect infections and diseases can cause strong, unattractive contrasts in the landscape. Management efforts to control insect infestations and diseases can minimize or reduce effects. Control efforts that include removal of infected trees and buffer areas often appear as clearcutting to forest visitors. These impacts can occur in areas of high scenic value. This impact will not different across alternatives.

Utility rights-of-way have a high potential of affecting the scenic resource for a long duration. Cleared rights-of-way, utility structures contrast and may be incongruent with existing landscape. Cleared rights-of-way create a contrast in form, line, color, and texture when compared to a natural appearing landscape. There are no differences among the alternatives with respect to right-of-way management.

Mineral management and development activities can involve landform alteration, as well as form, line, color, and texture contrasts, causing scenic impacts. Oil and gas wells have a scenery impact, therefore criteria for approval of their placement includes mitigation measures to reduce visual impacts. Recreation facilities are also deviations to the natural landscape. Forest Service recreation facilities are designed to blend into the landscape without major visual disruption. In the custodial alternative, most all facilities would be removed and therefore increase naturalness.

4.14 Recreational Fisheries Management

The National Forests in Mississippi strategy for restoring, maintaining, and enhancing lakes and permanent ponds emphasizes maintaining water quality and lake and permanent pond enhancement. Fisheries management is practiced on the Forests to provide fishing opportunities to the public. Management practices include liming and fertilization, fish habitat improvement, aquatic weed control, angler access improvement, fish population management, and nuisance animal control.

Largemouth bass is the principal predator in most Forest lakes. As the principal predator, largemouth bass presence or absence strongly influences the population structure of other fish species in a lake. For this reason, largemouth bass was selected as the management indicator species to represent the effectiveness of Forest Service recreational fisheries management activities.

4.14.1 Recreational Fisheries Management Environmental Effects

Alternative A – Custodial Management

Limited resources and budgets would favor reduced/ minimal recreational fisheries management. As a result, this action would have following direct and indirect effects:

- Poor water quality
- Poor productivity
- Poor and deteriorated spawning habitat
- Poor and deteriorated fish cover
- Poor angler access
- Increased aquatic weed problems
- Increased nuisance animal problems
- Unbalanced and unhealthy fish populations

The cumulative effect of reduced/minimal fisheries management would be overall reduced recreational fishing opportunities for the public. Angler catch rates would be reduced thus resulting in lower angler satisfaction.

Alternatives (B) No-action; (C) Restoration; (D) Accelerated Restoration; and (E) Forest Health

Fisheries management would be conducted to improve recreational fishing opportunities for the public. The proposed recreational fisheries management activities on the National Forests in Mississippi would have the following direct and indirect effects:

- Improved water quality (buffered pH and increased total alkalinity)
- Increased productivity from fertilization
- Improved spawning habitat
- Improved fish cover
- Improved and increased angler access
- Reduced aquatic weed problems
- Reduced nuisance animal problems
- Balanced and healthy fish populations

The cumulative effect of these activities would be improved recreational fishing opportunities for the public. Angler catch rates would increase resulting in improved angler satisfaction. Suitable habitat for aquatic threatened and endangered species does not occur in the Forests' lakes or immediately downstream, and it should not be affected by proposed management actions. The proposed management activities do not contribute to other unconnected actions within the vicinity that would create unacceptable levels of cumulatively negative impacts.

Liming

Liming is the addition of agricultural lime, primarily calcium carbonate (CaCO3), or hydrated lime, calcium hydroxide (CaOH) to neutralize acidic waters and buffer them from rapid fluctuations in pH. Generally, lakes in the southeastern part of the United States are limed in conjunction with a fertilization program.

Based on individual situations such as manpower, budgets, size of lake, flushing rate, etc. one type of lime may be more efficient to use than the other.

Liming Environmental Effects

The direct effect of liming of lakes and ponds is increased total alkalinity of the water. The threshold of whether lime is needed is 20 parts per million (ppm), or 20 milligrams per liter (mg/l) of total alkalinity.

Less than 20 parts per million indicates a need for lime in conjunction with a fertilization program (Boyd 1990).

Agricultural lime is made of particles of differing size taking several months to dissolve and increase the total alkalinity to the desired level. Approximately 3 to 5 tons per acre every 3 to 5 years is needed to raise and maintain total alkalinity at the desired level. Liming rates above this will not do any harm; rather, the lime will just last longer. Only the surface of the lime will react with the water and go into solution. Higher rates will give a thicker coat of lime causing the initial lime application to last longer. As fresh water enters the lake from water runoff over the un-limed watershed, the concentration of lime will continue to react with the water. This allows a slow release of lime over a number of years. Generally, a 5 ton per acre rate of lime will last approximately 10 exchanges of water volume. Coating the bottom of a lake or pond with agricultural lime protects or buffers the nutrients in the water from being absorbed by ions in the bottom mud and allows them to be more readily available for phytoplankton. Phosphorus is a key element that mud absorbs from the water and is the most critical for good fish growth.

Another direct effect of lime is neutralizing acidic water. The ability of agricultural lime to neutralize acidic water is based on the relative neutralizing value. Relative neutralizing value is an expression of agricultural lime effectiveness based on the combined effect of the calcium carbonate equivalent and fineness of grind. The following guideline should be used for the selection of agricultural lime:

> The minimum relative neutralizing value of agricultural lime used for liming lakes shall be 63 percent. This minimum value is per Mississippi state regulations (Regulations Under the Mississippi Agricultural Liming Materials Act of 1993).

When hydrated lime is used, approximately 50 – 75 pounds per acre is generally needed to raise total alkalinity to the desired level. Unlike agricultural lime, hydrated lime dissolves quickly increasing total alkalinity in a short period of time. Because hydrated lime is suspended in the water column, the benefits are usually lost after one exchange of water volume. Therefore, additional applications may be needed during periods of high rainfall.

The potential negative effect of hydrated lime is that if used improperly the water pH can rise to levels toxic to fish (Boyd 1990). However, when used with the following guidelines, it should cause no negative effect to the environment:

> Hydrated lime will be applied a using water pump system where it is slowly washed into the lake as slurry from a raft or boat. It should be applied in the open water area of the lake away from the littoral zone (shallow water). Hydrated lime is of a caustic nature and should only be used at the specific recommendation and guidance of a Fisheries Biologist.

The first indirect effect from increase in total alkalinity is increased availability of phosphorus, which, in turn, leads to increased phytoplankton productivity, which, in turn leads to increased fish production and growth. The second indirect effect from increase in total alkalinity is increased availability of carbon dioxide, which, in turn, is used for photosynthesis by phytoplankton. The last indirect effect from increase in alkalinity is increased buffering capacity (resist rapid fluctuations in pH) of the water.

There are no anticipated cumulative effects on the environment from the use of agricultural lime or from hydrated lime within the lake it was applied or downstream. The retention time of both types of lime is based on the flushing rate or amount of water flow through the lake. Hydrated lime has been used under the strict guidance of fisheries biologists on the National Forests in Mississippi for over 20 years with no negative effects on fish populations or the environment.

Fertilization

Several types of fertilizer are be used, and all can be effective if the lake total alkalinity is at the desired level. Fertilizers used are in liquid, granular, and powdered forms. Liquid fertilizers dissolve most readily, followed by powders, then granular types. The key ingredient in each of these types of fertilizer is phosphorus. Phosphorus is the element most needed for phytoplankton growth. Typical formulations for each type are:

- Liquid – 10-34-0 and 11-37-0[5]
- Powdered – 12-49-6 and 10-52-4
- Granular – 0-46-0 and 0-20-0

Based on individual situations such as manpower, budgets, size of lake, flushing rate, etc. one type of fertilizer may be more efficient to use than the other.

Fertilization Environmental Effects

A direct effect of the addition of fertilizer to lakes is the stimulation of growth of microscopic plants, called phytoplankton. Phytoplankton makes the water turn green, or bloom.

One indirect effect from increased phytoplankton productivity is increased fish production and growth. Phytoplankton forms the base of the food chain, and small animals eat these small plants, which serve as food for bream (bluegill and redear), which in turn are eaten by bass. Proper fertilization significantly increases the total weight of fish produced in a lake, often by as much as three to four times. Phytoplankton blooms also shade the bottom which tends and discourage submersed aquatic weed growth.

The potential negative effect of fertilizer is that if used improperly a dense phytoplankton bloom can form. During periods of cloudy weather or after a heavy rain the phytoplankton bloom can die causing an oxygen depletion which can lead to a fish kill. However, with the following protective measures and guidelines implemented, fertilization should have no negative effects:

> Liquid fertilizer should be applied at a rate of 0.5 - 1 gallon per surface acre per application. Powdered fertilizer should be applied at a rate of 2 – 8 pounds per surface acre per application. Granulated fertilizer should be applied at a rate of 4 - 12 pounds per surface acre per application. Secchi disc visibilities should be maintained between 18 inches and 24 inches on non-swimming lakes, and between 24 and 30 inches on lakes with swimming.

There are no anticipated cumulative effects on the environment from the use of fertilizer within the lake it was applied or downstream. There are concerns of agricultural fertilizers on the eutrophication (nutrient loading) of stream communities and the Gulf of Mexico. However, when compared to inputs of nutrients from large-scale agriculture, lake fertilization contributions are minimal. Lake fertilization has been practiced under the strict guidance of fisheries biologists on the National Forests in Mississippi for over 20 years with no negative effects on fish populations or the environment.

[5] The three-number sequence for fertilizer formulation reflects the percentages of nitrogen, phosphorous, and potassium respectively.

Spawning Habitat Improvement

Lakes with poor spawning habitat can be enhanced by the placement of gravel. The mechanical action of fish fanning the beds, however, makes the gravel spread out laterally over time, causing it to become thin and ineffective. Therefore, gravel spawning beds should be constructed or boxed in. Spawning beds can vary in size, averaging 20 feet by 20 feet and approximately 12 inches deep. The actual size of each bed will depend on the amount of level ground available at each spawning bed site.

Spawning Habitat Improvement Environmental Effects

A direct effect of creating gravel spawning beds is that the gravel improves water circulation allowing more oxygen to get to the bottom of the egg mass, resulting in higher hatch results from each egg mass. In addition, Bain and Helfrich (1983) found that survival of bluegill larvae was directly correlated with the proportion of coarse substrate in the nest. Substrate with larger particles provided interstitial space that allowed bluegill larvae to escape predation.

Gravel spawning bed construction sometimes requires the use of mechanical equipment to level sloped areas and to deliver gravel to the site. This construction may involve some soil disturbance. Any soil erosion resulting from this activity would be temporary and would be minimized by the installation of erosion control measures such as temporary vegetation around the shoreline until the lake is flooded.

There are no anticipated cumulative effects on the environment from spawning habitat improvement within the lake or downstream.

Fish Attractors

One of the best ways to enhance the fishing experience is to provide cover or structures at strategic locations. Fish such as largemouth bass, bluegill, and redear sunfish are attracted to cover or shelter of all types (Managing Mississippi Ponds and Small Lakes 2011).

A variety of structures can serve as fish attractors such as submerged trees, rootwads, ledges and channels, rock piles, and artificial structures.

Fish Attractors Environmental Effects

The direct effect of fish attractors in lakes is that they provide adequate refuge cover for fish. Largemouth bass are ambush predators and prefer to hide in cover and ambush their prey.

Submerged trees and rootwads provide interstices for smaller fish to hide in and attachment sites for aquatic invertebrates. A major advantage to using submerged trees is low cost. These structures are readily available around most of the Forests’ lakes. Species of trees used is important. Cedar and oak tend to last longer than pine. All submerged trees, however, will deteriorate with age, so fish use will decrease over time. The rate of deterioration is dependent upon the trees exposure to air. Those exposed periodically from fluctuating water levels will deteriorate more rapidly than those that are not.

Ledges and channels provide irregular features in lake bottoms that are attractive to fish. Ledges and channels are not to be confused with the availability of deep water. While it is true that ledges and channels will, by their very definition, provide deeper water, it is the fact that this deeper water is immediately adjacent to significantly shallower water that makes ledges and channels such an important addition to fisheries habitat. Fish will tend to congregate around this structure at various depths at different times of the year. While it is expected that ledges and channels may slowly deteriorate with age due to sediment deposition, these structures are anticipated to last at least 20 years.

Rockpiles provide irregular features in lake bottoms that are attractive to fish. They also provide interstices for aquatic invertebrates and smaller fish to hide in. Rockpiles are usually made of rip-rap, large boulders, or broken concrete/brick. These structures deteriorate very little if any, and should last indefinitely.

Artificial structures provide interstices for smaller fish to hide in and provide attachment sites for aquatic invertebrates. A major advantage to using artificial structures is durability. These structures deteriorate very little if any, and should last indefinitely. Artificial structures vary in configuration and size and are constructed from some of the following materials: PVC pipe, rubber tires, plastic streamers, wooden pallets, and wooden stakes. Another advantage is that lures tend not to snag on them as much as submerged trees and brush. Disadvantages are that commercially produced structures can be expensive and prone to vandalism during exposure in lakes with fluctuating water levels.

The indirect effect of fish attractors is improved fishing opportunities. Fish are attracted to the structures by the presence of cover and food, and they are concentrated so that anglers can better harvest them. Additionally, ledges and channels at the right location can attract or lead fish toward adjacent shorelines, which will be convenient for bank anglers, potentially making for some great fishing opportunities. Boxrucker (1983), Cofer (1991) and Glenn (1983) reported increased angler catch rates of largemouth bass, crappie, bluegill, and channel catfish around fish attractors.

Fish attractor placement or construction sometimes require use of heavy equipment when lakes have been drained. During this process, some soil may be disturbed. Any soil erosion resulting from this activity would be temporary and would be minimized by the installation of erosion control measures such as temporary vegetation around the shoreline until the lake is flooded.

There are no anticipated cumulative effects on the environment from fish attractors within the lake treated or downstream.

Shoreline Deepening

The purpose of shoreline deepening is to reduce the amount of shallow water. This process deepens the lake edge in selected places by taking the current shoreline that is silted and rebuilding it with sediment deposits from the lake bed. This not only rebuilds the shoreline but also deepens the water next to the shoreline so that the depth drops quickly to three feet. This deepening process also includes the shallow flats located primarily in the upper end of lakes, where the excess soil is formed into islands.

Shoreline Deepening Environmental Effects

The direct effect of shoreline deepening in lakes is the reduction of shallow water that contributes to aquatic weed growth. Aquatic weeds need sunlight to grow. In most waters, sunlight is filtered out by three feet of depth.

Shoreline deepening requires use of heavy equipment when lakes have been drained. During this process, some soil will be disturbed. Loose soil that is exposed along the shoreline, islands, and land access piers would be mulched and seeded to establish temporary vegetation to reduce erosion. The minimal soil erosion that does occur would be temporary and contained with the lake basin.

Section 404 of the Clean Water Act requires a permit from the U.S. Army Corps of Engineers before dredged or fill material may be discharged into the waters of the United States. Before the permit is issued, the U.S. Army Corps of Engineers ensures that the proposed project has taken steps to avoid wetland impacts, or minimize potential impacts on wetlands. This permit is an essential part of protecting wetlands.

The indirect effect of shoreline deepening is improved fishing opportunities. The reworked shoreline extends on average 10 to 20 feet farther out in the lake and the depth of water increases approximately one to three feet. In addition, land piers are constructed from the excess soil extending bank angler access farther out in the lake near deeper water.

There are no anticipated cumulative effects on the environment from shoreline deepening within the lake deepened or downstream.

Aquatic Weed Control

There are four categories of aquatic weed control methods: chemical, mechanical, biological, and habitat manipulation. At the time when aquatic weed control is needed, the control method chosen will depend on type of plants, quantity of plants, area of coverage, control methods available, funding, work force, and managers choices. Aquatic weed control will be conducted where applicable.

Aquatic Weed Control Environmental Effects

The direct effect of aquatic weed control in lakes is the reduction of nuisance aquatic weeds. This is expected to cause no significant effects. The following discussion discloses the specific effect of each control method.

Chemical control involves the use of aquatic herbicides that have met strict Environmental Protection Agency standards for use in an aquatic environment. Improper use of chemicals could result in serious environmental damage, fish kills, contaminated water supplies, and danger to human health. If chemical treatment is used, the shallow water conditions conducive to aquatic vegetation growth would remain and the vegetation would become a problem again in two or three years. Therefore, a consistent treatment with chemicals would be required to keep the nuisance aquatic weeds under control. Low dissolved oxygen levels can result from the natural decay of treated (killed) aquatic weeds. Fish kills may result if the dissolved oxygen level becomes too low. However, with the following protective measures and guidelines implemented, chemical control should have no negative effects:

> Herbicides will be applied according to guidelines, rates, and restrictions specified on the label. Rates and methods of application would be controlled in order to prevent non-target species from exposures. Any herbicide used in swimming or fishing areas will be labeled for that use. A certified applicator will supervise application. Equipment and containers will be cleaned or disposed of according to label instructions. To avoid dissolved oxygen depletions, no more than half of the lake should be treated at one time.

Mechanical control is the actual removal of aquatic weeds by tools or machines. Mechanical removal of aquatic weeds is a very short term treatment. Most methods of mechanical control fragment aquatic vegetation and may in fact increase the problem in the future, since many species of aquatic vegetation reproduce vegetatively. Mechanical control is usually slower and more costly than other methods of control. There may be some significant biological impacts. Plant fragments left in a water body may deplete dissolved oxygen if they die and decompose. Dissolved oxygen depletion in turn may cause a fish kill. If mechanical treatment is used, the shallow water conditions conducive to aquatic weed growth would remain and the weeds would become a problem again in two or three years.

Biological control measures have potential for effective, economical, and permanent control of aquatic weeds. Biological controls are not intended to eliminate nuisance plant species but rather to reduce them to a non-nuisance density. Control is successful if the predator and nuisance plant reach a state of equilibrium. Grass carp (*Ctenopharyngodon idella*) is a non-native species of fish that consumes vegetation almost exclusively after they reach 10 inches in length. During warm weather, grass carp can consume 30 to 40 percent of their body weight in aquatic vegetation every day. When stocked at the proper rate, these fish can provide effective control of most types of submerged aquatic weeds. Compared to other methods of aquatic weed control, the grass carp is relatively inexpensive and may provide long-lasting effects. Unlike the common carp (*Cyprinus carpio*) found in Mississippi waters, grass carp feed primarily on submersed vegetation and do not stir up bottom mud. The possibility of grass carp having an adverse environmental impact on native aquatic plant communities is contingent upon their reaching streams, spawning successfully and the young surviving in large enough numbers to bring about harmful changes. Reproduction, however, normally does not occur in lakes because these fish need flowing water to successfully spawn. When stocked at recommended rates, displacement of or interference with existing fish species should not occur. With the following protective measures and guidelines implemented, grass carp should have no negative effects:

> Only certified triploid (sterile or non-reproducing) grass carp from licensed distributors will be stocked into National Forests in Mississippi lakes. Grass carp should only be used at the specific recommendation and guidance of a fisheries biologist.

Habitat manipulation limits plant growth by altering one or more of the physical or chemical factors critical to growth, such as, light, or physiological processes factors of the plant. Fertilization is an effective method of control for submersed aquatic weeds. Organic turbidity caused by increasing fertility increases phytoplankton and reduces visibility and water clarity which shades the submerged plants so they cannot photosynthesize. The effects of fertilization are discussed in the fertilization section. Water level manipulation is an effective method of control for rooted species of aquatic weeds. Drawdowns during the fall and winter can expose the aquatic weeds to drying winds and freezing temperatures thus reducing it to acceptable levels. A winter drawdown would have the least significant impact because: 1) fishing during this time of year would be at a minimum; 2) there would be greater predator-prey interaction in the lake because of concentration of fish. Flooding may reduce certain species of rooted aquatic vegetation if the water is raised and kept above the plants exposed leaf zone. If water level manipulation is used, the shallow water conditions conducive to aquatic weed growth would remain and the weeds would become a problem again in two or three years.

There are no anticipated cumulative effects on the environment from aquatic weed control within the lake treated or downstream.

Angler Access Improvement

Fishing piers and boat ramps may be provided. These structures enable the lake sport fish population to be managed for optimal recreational benefits. Access to angling opportunities should increase with the installation of these structures.

Angler Access Improvement Environmental Effects

The direct effect of installing fishing piers and boat ramps in lakes is that they improve angler access. Fishing piers provide bank anglers with access to deeper water. Many wooden piers in recreation area lakes are constructed to allow use by physically challenged anglers. Boat ramps are constructed to allow anglers to launch boats on trailers with minimal difficulty.

The construction of fishing piers and boat ramps sometimes requires use of heavy equipment when lakes have been drained. During this process, some soil may be disturbed. Any soil erosion resulting from this activity would be temporary and would be minimized by the installation of erosion control measures such as temporary vegetation around the shoreline until the lake is flooded.

There are no anticipated cumulative effects on the environment from angler access improvement within the lake receiving the improvements or downstream.

Fish Population Management

There are three means of fish population management: stocking, removal, and harvest restrictions. At the time when fish population management is needed, management method chosen will depend on current population assessment, funding, work force, and managers choices.

Fish Population Management Environmental Effects

The direct effect of fish population management in lakes is the establishment and maintenance of the proper species balance and size structure.

Stocking – Renovated lakes or newly constructed lakes are typically stocked with a combination of largemouth bass, bluegill, redear, and channel catfish. In addition, species such as threadfin shad and fathead minnows are sometimes stocked to provide additional forage for largemouth bass.

Supplemental stocking involves replacing a segment of the fish population that is absent. In some instances, a species may experience poor recruitment of young fish into the population. This would require supplemental stocking to replace that missing year-class of fish.

Removal – This involves removing part or all of the fish population in a lake to restore balance. In some instances a non-native invasive species or an undesirable species has become established and all the fish in the lake will need to be eradicated and the lake restocked with desirable species. Eradication of the entire population may also be needed when it has become unbalanced beyond recovery. Partial removal may be needed when a particular species has become overabundant thus impacting the rest of the fish population.

The most efficient means of fish removal is rotenone, an Environmental Protection Agency approved pesticide. Rotenone is a natural substance contained in the stems and roots of certain tropical plants, such as the Jewel Vine or Flame tree (*Derris* spp.), Lacepod (*Lonchocarpus* spp.), or hoary pea (*Tephrosia* spp.). Brand names include Chem-Fish, Cube', Derrin, Derris root, Fish-Tox, Niclulins, Nusyn Nox-Fish, Prentox, Noxfish, and rotenone dust. Rotenone works by inhibiting a biochemical process in the fish cells, resulting in an inability of fish to use oxygen in the release of energy during normal body processes. In effect, the fish suffocate due to lack of oxygen. But contrary to popular belief, rotenone does not remove oxygen from the water. It is an unstable compound that, when exposed to light, heat, oxygen and alkaline water, will ultimately break down into carbon dioxide and water. At 80 degrees Fahrenheit, treated water will detoxify naturally in less than four days. At cooler water temperatures this breakdown process slows down and takes more time. Because of its rapid breakdown, most waters are safe for re-stocking within five to six weeks (Mississippi Cooperative Extension Service 1997). Rotenone is non-persistent so there is no accumulation in the soil, water, plants, or surviving animals. No secondary effect from consumption of rotenone killed fish is anticipated at any level of the food chain. If allowed to flow downstream of the lake, rotenone could impact non-target species of fish.

Treatment rate would depend upon whether total eradication or partial removal is the desired outcome. For total eradication, the treatment rate would be 3.0 parts per million, a concentration lethal to all fish species. The treatment area would be the entire lake. This would entail the re-stocking of largemouth bass, bluegill, redear sunfish, and channel catfish and allow the new fish population to be restructured in a manner that would provide the angler with quality fishing in the future. The lake would have to be closed for a minimum of two years to allow for the growth of the restocked fish.

Partial removal of overabundant species of fish generally involves the use of rotenone at lower treatment rates less than 3.0 parts per million) in specific habitat zones where the target species is located. The treatment would be lethal to the target species but should have a minimal effect on other species of fish. Treatment would be done in one or two days, beginning early in the morning and gradually building up to the desired level. Generally this buildup requires from six to eight hours each day, and should avoid excessive loss of sportfish. Loss of some sportfish in this type of operation is inevitable; however, weight percentages should not be significant. The reduction of the target species within the overall population of fish will restructure the target species population into a smaller size class that sportfish can more readily utilize. Thus, the ratio of sportfish species and the average size and numbers of sportfish in the angler's harvest should increase, thereby improving the quality of the angling experience by the public.

Regardless of whether total eradication or partial removal is implemented, there will be some temporary adverse effect on the recreational use of the lake treated. The lake would be closed to the public for 7 to 10 days to minimize the negative aesthetic effects from fish decomposition. It is estimated that the residual odor and visual effects will persist for this length of time also. With the following protective measures and guidelines implemented, the use of rotenone should have no negative effect on the environment:

> Rotenone will be applied according to guidelines, rates, and restrictions specified on the label. A certified applicator will supervise application. Equipment and containers will be cleaned or disposed of according to label instructions. Prior to treatment, the lake will be drawn down to prevent water flow through the spillway or outflow structure. The drainage structure would also be closed to prevent water flow downstream. If rotenone escapes the treated area, potassium permanganate ($KMnO_4$) should be used to neutralize it. Fish pickup (to the extent possible) and disposal should be done on the day of treatment.

While less efficient, electrofishing may also be used for partial removal. This will require an electrofishing boat with two people dipping fish and a boat operator. The lake would be periodically electrofished until the desired population balance and size structure is achieved. Shocker efficiency, depth of the target species within the lake, underwater visibility, and sheer numbers of the target species present will all play a role in removal success. It is unlikely that more than twenty percent of the target species population would be removed. Negative impacts to sportfish would be minimal; however, some sportfish would be lost. No downstream areas would be impacted.

Harvest Restrictions – This involves the use creel and length limits for designated species of fish to maintain balanced fish populations and quality fishing. Forest Supervisor Order (2007-00-1) provides for flexible creel limits and closures based upon the management needs of each individual body of water.

Nuisance Animal Control

Beavers, muskrats, nutria, otters, and alligators can be a nuisance or even cause damage. Burrowing and damming activities can cause dam failure or flood adjacent landowners. Angler access and fish habitat improvements can also be flooded. A family of otters can virtually eliminate catchable-size fish in a small lake. Alligators can present a safety concern in lakes with swimming. Trapping and removal will be practiced to maintain nuisance animal populations at acceptable levels.

Nuisance Animal Control Environmental Effects

There are no anticipated direct, indirect, or cumulative effects on the environment from nuisance animal control within the lake treated or downstream.

4.15 Wilderness

Based on findings in the wilderness evaluations (DEIS appendix C), no areas were found on the National Forests in Mississippi that qualified for placement on the potential wilderness inventory. At this time there are no recommended additions to the wilderness system. Wilderness management will not vary by alternative.

4.15.1 Re-evaluation of RARE II Study Areas

In the RARE II evaluation for Mississippi in 1979, Sandy Creek was identified for "further planning." In 2008, as part of the forest plan revision process, Sandy Creek was again re-evaluated and the area did not meet the statutory definition of wilderness based upon FSH 1909.12 Chapter 70, section 71 inventory criteria. However, approximately 300 acres of the Sandy Creek area is being proposed for designation as a special botanical area. This designation is incorporated in alternatives C, D and E. Also, the deferred decision on oil and gas leasing availability on the Sandy Creek RARE II study area is now being evaluated and addressed in this environmental impact statement. Alternatives A and B would not authorize oil and gas leasing in the Sandy Creek RARE II Study area. Alternatives C, D, and E would permit oil and gas leasing in the Sandy Creek RARE II Study area subject to the 2001 Roadless Area Conservation Rule restrictions. See the minerals affected environment section on oil and gas on page 119 for additional background and 4.20 for an analysis of the effects of a leasing availability decision.

4.15.2 Wilderness Environmental Effects

The wilderness areas will contribute positively to providing medium (100-2499 acre) and large (2500 acre and over) potential old-growth areas.

Wilderness has many positive effects. Wilderness preserves natural systems and provides places of solitude for visitors. There are no expected direct effects across alternatives to influence the amount of total existing acres for wilderness. Additionally there is no expectation for new acres to become eligible for wilderness study in the near future. Future purchases should include the mineral rights as well as surface rights.

Generally, recreational use can pose negative impacts to the quality, character and integrity of the wilderness resource due to overuse. However, these two areas are not overused and increase in use to critical levels is not anticipated. In fact the opposite is expected. The current forest recreation and health challenge is that 60 percent of trees were damaged in recent hurricanes. Wilderness use was not recorded in the latest national visitor use monitoring studies. Monitoring as set up under the limits of acceptable change will continue.

There are environmental effects within wilderness boundary that can rise from many sources, such as insect infestations or wildfire. Other environmental effects which impact the integrity of the natural systems in wilderness include air pollution from outside sources, interruption of natural functioning ecosystems by fire suppression, and threats to native plant species from the introduction and spread of noxious weeds.

However the increase in remote roaded natural and semi-primitive nonmotorized buffers around these properties may increase remoteness; however, even over time, the low wilderness visitation in

Mississippi, recreational use is not expected to change much due to the large amounts of blow down in the wilderness forest.

4.16 Wild and Scenic Rivers

As required during the forest plan revision process, staff review indicated that further investigation was warranted to determine if recent land acquisitions, which increased the percent of public ownership within the Black Creek Scenic Corridor, improved the possibilities for additions to the current designation. During the forest plan revision process, no public suggestions were made to add potential wild and scenic rivers. (See appendix C for more details on the evaluation for potential wild and scenic rivers).

No change is planned from current management in any alternative. However, the additional reaches of Black Creek within the DeSoto National Forest will continue to be managed (for all alternatives) to protect the character that would make them eligible for designation as wild and scenic. Therefore, management of wild and scenic river designation will not vary by alternative. The current allocation of this stream corridor management area, to promote and preserve the wild and scenic river characteristics, does contribute to development and protection of a large sized old-growth area. This area is contiguous with the Black Creek Wilderness and comprises an area of approximately 10,000 acres of potential old growth.

No rivers outside the Black Creek Scenic Corridor are identified at this time as eligible for further study. Portions within the corridor may be studied as a result of this forest plan but are protected by the prescription managing it like the designated section.

However, the river does not suffer, nor is close to, overuse and increase in use reaching critical levels is not anticipated.

In all alternatives, protection is provided within 0.25 miles of the river bank of the Black Creek corridor which includes the designated sections of the Black Creek Scenic River and non-designated sections of the Black Creek River on National Forest System lands. Management activities within the corridor are designed to meet the minimum protection requirements, given the rivers' classification system.

4.17 Special Areas

Special area designations or management do not negatively affect other resource areas to an unreasonable degree. Additional designations are analyzed in alternatives C, D and E. Alternatives A and B do not provide for these designations. Additional botanical areas and research natural areas remove acres from the land base suitable for timber production. The additional 3,881 acres of special area designations (3,447 acres of botanical areas and 434 acres of research natural areas) will not have a significant effect on timber production in any alternative. Timber production is limited by budget constraints to levels well below growth and biological potential. Therefore, many areas would have limited sale activity. By designating special areas, the areas not receiving harvest treatments are better focused on areas with unique character. The old-growth management guidance for region 8 requires the protection of medium sized (100 – 2499 acre) old-growth areas. Botanical area and research natural area designations contribute to development and protection of medium sized old-growth areas.

One effect of placing unique areas in special area designations under alternative C, D or E is that it encourages visits to the area by individuals interested in natural history, observing rare plants or other scenic values. This can result in damages due to trampling or other impacts such as littering or recreational plant collecting in the areas. The National Forests in Mississippi have had special areas designated since shortly after land acquisition in the 1930s. These kinds of impacts have not surfaced as a problem during this time.

Under alternatives A or B where the 18 new areas are not designated, the unique character of the area would remain largely unrecognized by the public. The areas would lack special protection from normal management activities, and may suffer from lack of management designed to enhance the unique character of the areas. Delay in designation could be precluded by activities such as road building, harvests or the effects or response to natural events such as fire, wind or flood.

4.18 Cultural Resources

Cultural resources are potentially affected by ground disturbing activities. Management activities that have the greatest potential of affecting cultural resources are road construction, vegetation management, insect and disease control, utility rights-of-ways, and mineral extraction. Other management activities that affect cultural resources to a lesser degree are habitat improvement projects, prescribed fire, fire suppression, land adjustment, developed recreation facilities, and elements of dispersed recreation.

Some activities affecting cultural resources would vary by alternative and some are unlikely to change. Those activities that are not likely to vary by alternative are: insect and disease control, fire suppression, land adjustment, management of developed recreation facilities, special use utility rights-of-way and mineral extraction. When such activities occur it could impact management’s ability to protect cultural resources in an area. Vegetation management, habitat improvements, prescribed fire, and road maintenance potential impacts to cultural resources would vary by alternative. Alternatives A through E would have progressively higher levels of ground disturbing activities with A being the least and E having the most ground disturbing activity.

The following standards and guidelines to minimize negative impacts should be incorporated into the forest plan:

- If previously undocumented cultural resources are encountered during ground disturbing activities, those activities should be halted until site significance is determined.
- Access to cemeteries should meet or exceed the type that existed when it became Federal property.
- Land ownership adjustments should not dispose of significant historical or archeological sites within the boundaries of the national forest except with another Federal or State agency or a tribal government with equivalent responsibility for cultural resources.

The potential for impacts will increase from alternative A to alternative E based on the increased levels of vegetation management, habitat improvements, prescribed fire, and road maintenance. However, compliance with the forest plan guidelines will result in no unreasonable impacts under any alternative.

4.19 Forest Products

4.19.1 Forest Products Markets and the National Forests in Mississippi’s Timber Supply Role

The National Forests in Mississippi comprise one to six percent of the forest lands in their market areas. However, these National Forest System lands account for proportions of growing stock greater than its proportion of acreage within the market area. Also, projections were that these growing stock proportions would increase. Pine growing stock proportions on National Forests were two to eighteen percent of pine growing stock in their market areas. Hardwood growing stock proportions for National Forests ranged from two to seven percent. Hardwood growing stock proportion increases was projected to be greater than the increases in pine growing stock proportions.

Despite these projected increases in growing stock proportions on the National Forests in Mississippi, the proportions are still small percentages of the total growing stock in each market area.

Based on the percentage of firms in each market area actively bidding on the Forests' timber the demand for the Forests' timber was limited. Five of the market areas had participation by four to seventeen percent of the forest products firms in their market areas. One Forest, the Homochitto National Forest, had participation of 39 percent of the firms in the Homochitto market area.

Documentation identifying the market areas for the six National Forests in Mississippi was provided by McConnell (1997) in a report titled Timber Supply and Demand Analysis for National Forests in Mississippi. This assessment made projections of the National Forests in Mississippi market share based on growing stock on the Forests and industry utilization as compared to other ownerships. Though this information is from a 1997 analysis, the Forests' role in their market areas as providers of timber products is relatively the same. It is likely that the recent economic recession and depressed housing market has lowered the demand for products of which the National Forests in Mississippi were a minor provider. In Mississippi's Assessment of Forest Resources and Forest Resource Strategy (Mississippi Forestry Commission 2010), it was reported that there have been no new wood utilization mills since 1989. Further it is stated that in the five years prior to the report 19 percent of the State's forest product mills had closed or were idle.

The report indicated that though there was insufficient information to validate it, the general opinion of forest products industries in Mississippi was that the National Forests in Mississippi timber would become increasingly important to their operations.

Despite the recent worldwide recession and depressed construction market in the United States, the National Forests in Mississippi have been able to successfully place all offered timber sales under contract at current market prices.

4.19.2 Forest Land Suitability for Timber Production

Most of the land base on the National Forests in Mississippi (97 percent) is considered tentatively suitable for timber production. Exceptions to that include areas administratively or congressionally withdrawn from such practices and non-forest land.

The tentative classifications were reviewed for accuracy and appropriateness for the various forest ecosystem vegetation types. As a result of this review, acres in the near coast flatwoods system and areas identified on the National Forests in Mississippi preliminary list of possible old growth were identified as not appropriate for timber production. Timber production is not compatible with the open woodland savanna and bog or old growth desired condition of these sites. Other areas were also identified as not appropriate for timber production due to site characteristics, uses, barriers to management or red-cockaded woodpecker management guides. Each alternative analyzed utilizes this same allocation of acres to the land base suitable for timber management. Most of the land base on the National Forests in Mississippi (81 percent) is considered suitable for timber production after identifying lands not appropriate for timber production.

Table 71. National Forests in Mississippi timber suitability total acres

Classification	Approximate Acres
Total National Forest System Land	1,172,524
Non-forest lands	18,826
Lands that have been withdrawn from timber production	14,426
Lands where technology is not available to ensure timber production would not cause irreversible resource damage	
Lands where there is no reasonable assurance they can be adequately restocked	
Lands Tentatively Suitable for Timber Production	1,139,272
Lands where timber production is not compatible with achieving desired conditions and objectives (Lands not appropriate for timber production)	185,017
Lands Suitable for Timber Production	954,255
Lands Not Suitable For Timber Production	218,269

Table 71 summarizes acres for the timber land classification categories. The table quantifies lands that are suitable for timber production and those lands that are not appropriate for timber production. These land classifications are subject to change based on field inventory and subsequent classifications.

4.19.3 Vegetation Management and Timber Production Consequences of Alternatives

The implementation under each alternative evaluated would be based on the same desired conditions and vegetation management priorities. The basic difference between alternatives is program level determined by funding and staffing levels. Alternative C is the proposed action alternative which would be an increase in vegetation management over alternative B (the no-action alternative based on current management program levels). Alternative A, the custodial management alternative, would be a strategy to focus very limited resources on threatened species and their critical habitat needs under a minimal program level. Outcomes for programs based on increased funding are analyzed in two alternatives. Alternatives D and E utilize stepped up funding for increased restoration emphasis in D and increased thinning emphasis in alternative E for forest health improvement.

Estimated Vegetation Management Practices

Table 72 shows the estimated acres of harvests for vegetation treatment to implement the forest plan objectives and priorities for the first decade under five alternatives. These likely program acres are provided in the tables below for lands suitable for timber production, or where timber harvests are needed to meet other resource objectives on lands not suitable for timber production.

The harvest acre outcomes from these alternatives represent a range likely to occur based on alternative emphasis or funding and resources available. The custodial management alternative (A) reflects an outcome of approximately 79,000 acres total harvest in the first decade of implementation. This alternative represents a management strategy resulting from reduced funding and program implementation resources. Emphasis under this alternative would be placed on meeting legal mandates for threatened and endangered species by accomplishing vegetation management through timber harvest where needed for species recovery. The harvests under this alternative would primarily be thinning to maintain or improve condition of exiting habitat. The no-action alternative (B) total harvest of approximately 114,000 acres represents an outcome likely from current funding and resources available to achieve timber management. The proposed action (C) represents a program increase to around 168,000 acres of total harvest. This represents about a 50 percent increase to a more desirable program level.

These three previously described alternatives emphasize thinning as a priority to attain optimal ecological conditions for species recovery. The accelerated restoration alternative (D) represents an increased timber harvest program level with about 164,000 acres harvested. This alternative emphasizes restoring historical vegetation types. This resulted in slightly lower thinning acres at the program level modeled. The enhanced forest health alternative (E) represents a higher but biologically sustainable level program of both thinning, regeneration and restoration harvests of 223,000 acres. The emphasis of the alternative is to improve the health of the forest through thinning, restoration of historical forest types and an improved mix of age classes. More details related to these harvest treatments can be seen in section 3 of appendix B.

Table 72. Estimated vegetation management practices

Likely Acre Accomplishments for First Decade					
Practice	**Alternative A Custodial**	**Alternative B No-action**	**Alternative C Proposed Action**	**Alternative D Accelerated Restoration**	**Alternative E Enhanced Forest Health**
Lands where Timber Production Achieves, or is Compatible with Desired Conditions and Objectives					
Regeneration Cutting (even- or two-aged)	1,061	16,095	25,063	42,885	33,633
Uneven-aged Management			83	82	83
Intermediate Harvest					
Commercial Thinning	77,599	97,103	140,708	117,213	186,470
Salvage / Sanitation					
Other Harvest		531	799	1211	1178
Subtotal Acres	78,660	113,729	166,653	161,391	221,364
Lands Not Suited for Timber Production					
Regeneration Cutting (even- or two-aged)	73	79	160	999	160
Uneven-aged Management					
Intermediate Harvest					
Commercial Thinning	125	184	478	1435	478
Salvage / Sanitation					
Other Harvest Cutting		33	1168	47	1168
Subtotal Acres	**198**	**296**	**1806**	**2,481**	**1806**
Grand Totals Acres	**78,858**	**114,025**	**168,459**	**163,872**	**223,170**

Allowable Sale Quantity (ASQ); Timber Sale Program Quantity (TSPQ); Long Term Sustained Yield (LTSY)

Each alternative results in different levels of forest products being made available for harvest and utilization. The following tables show the estimated outputs in MMBF (million board feet), and MMCF (million cubic feet) from the harvesting described in the previous section for the first decade of forest plan implementation for five alternatives. The allowable sale quantity (ASQ) is the maximum volume that can be harvested on lands suitable for timber production over the first decade. The timber sale program quantity (TSPQ) is the volume harvested from lands suitable for timber production, along with the estimate of volume harvested to meet other resource objectives on lands not suitable for timber production. Timber sale program quantity is the quantity of timber that is likely to be removed by implementing the direction in the alternatives.

Harvesting may occur on lands that are not suitable for timber production. This harvesting is included in the timber sale program quantity estimate to provide info on possible ecological restoration and management needs within experimental forests, harvests to restore prairies or other special areas and habitat improvement within possible old growth.

Allowable sale quantity and timber sale program quantity for the first decade are displayed by alternative in Table 73. For additional info the timber sale program quantity is displayed by estimated products likely to be produced by alternative in Table 74.

Table 73. Timber sale program quantity (first decade)

Likely Volume Outputs for First Decade (MMBF and MMCF)					
	Alternative A Custodial	**Alternative B No-action**	**Alternative C Proposed Action**	**Alternative D Accelerated Restoration**	**Alternative E Enhanced Forest Health**
Allowable Sale Quantity					
Total Volume (MMBF)	373.0	599.5	893.5	1000	1178.5
Total Volume (MMCF)	74.6	119.9	178.7	200.0	235.7
Timber Sale Program Quantity					
Total Volume (MMBF)	373.5	601.0	906.0	1011.5	1184.5
Total Volume (MMCF)	74.7	120.2	181.2	202.3	236.9

In the context of the current market for wood products, the alternative harvest levels may have effects on other timber land owners and wood utilization mills. These effects would generally be small because of the minor contribution to the total timber supply from National Forests in Mississippi.

The custodial management alternative (A) may provide more opportunity for non-Forest Service timber to be marketed at a higher demand due to reduced Forest Service timber supply. This effect would vary by unit because this alternative would execute timber sales only on units in central and south Mississippi with threatened and endangered species habitat improvement needs, resulting in no planned volume offer on the Holly Springs, Tombigbee and Delta National Forests. This alternative's reduced volume offer would likely have minimal effect on the wood utilization mills in the current depressed market. However, the reduced supply may have an increased but still small effect on these mills in the future as the construction demand for wood products increases.

Conversely the proposed action (C), accelerated restoration (D) and enhanced forest health (E) alternatives would have the opposite effects on the demand for private timber and volume available to wood utilization mills. At the no-action alternative (B) volume offer level, there is adequate demand resulting in all sales for several years being successfully placed under contract. In the currently depressed market for construction materials, the higher timber offer levels might result in low interest for some sale offers.

The custodial alternative (A) harvest levels would result in reduced revenue to the U.S. Treasury or that could be used to fund resource improvement projects. Conversely, each alternative with higher volumes would result in increased revenue.

Table 74. Timber sale program quantity product mix (first decade)

		Alternative A Custodial	Alternative B No-action	Alternative C Proposed Action	Alternative D Accelerated Restoration	Alternative E Enhanced Forest Health
Timber Sale Program Quantity (MMCF)		**75**	**120**	**181**	**202**	**237**
Products	**Product Mix Percentage**					
Pine Sawtimber	46 %	35	55	83	93	109
Pine Pulpwood	40 %	30	48	72	81	95
Hardwood Sawtimber	4 %	3	5	7	8	9
Hardwood Pulpwood	9 %	7	11	16	18	21

The long term sustained yield is calculated to provide a base line from which to evaluate sustainability of timber harvests. The long term sustained yield calculations are based on the amount of timber that could be harvested assuming the desired conditions were achieved and the silvicultural management strategy for the desired condition was being implemented. This estimate was based on the amount of timber that could be removed in perpetuity on an annual basis. The long term sustained yield for the National Forests in Mississippi is the same for all alternatives. The long term sustained yield doesn’t change by alternative because desired future condition and silvicultural strategies for management are the same in all alternatives. The alternatives differ mostly in level of program based on resources available and some variation in which harvest methods to utilize in moving toward the desired conditions. The following chart depicts a long term sustained yield of 307 million cubic feet per decade for lands suitable for timber production. The allowable sale quantity of each alternative analyzed for the National Forests in Mississippi is projected to be almost level and less than the long term sustained yield for the five decades modeled. The allowable sale quantity is nearly level in the alternative projections because the program level is constrained to an assumed level budget and program implementation capability for each alternative. The custodial alternative (A) allowable sale quantity is approximately 74 million cubic feet per decade. The no-action alternative (B) allowable sale quantity is approximately 120 million cubic feet per decade. The proposed action (C) allowable sale quantity is approximately 179 million cubic feet per decade. The accelerated restoration alternative (D) allowable sale quantity is approximately 200 million cubic feet per decade. The enhanced forest health alternative (E) allowable sale quantity is approximately 236 million cubic feet per decade.

The USDA Forest Service Southern Research Station Forest Inventory and Analysis 2006 report on Mississippi’s Forests indicates that the National Forest Lands in Mississippi have an average net annual growth of 71.4 million cubic feet (Oswalt et al. 2009). This same report estimated average annual removals at 42.2 million cubic feet. Therefore the gross growth per decade for National Forest System lands in Mississippi based on Southern Research Station Forest Inventory and Analysis has been 1,136 million cubic feet. This is well above all alternatives. The enhanced forest health alternative (E), with the highest analyzed harvest is 21 percent of this estimated growth. The proposed action (C) is 16 percent of growth.

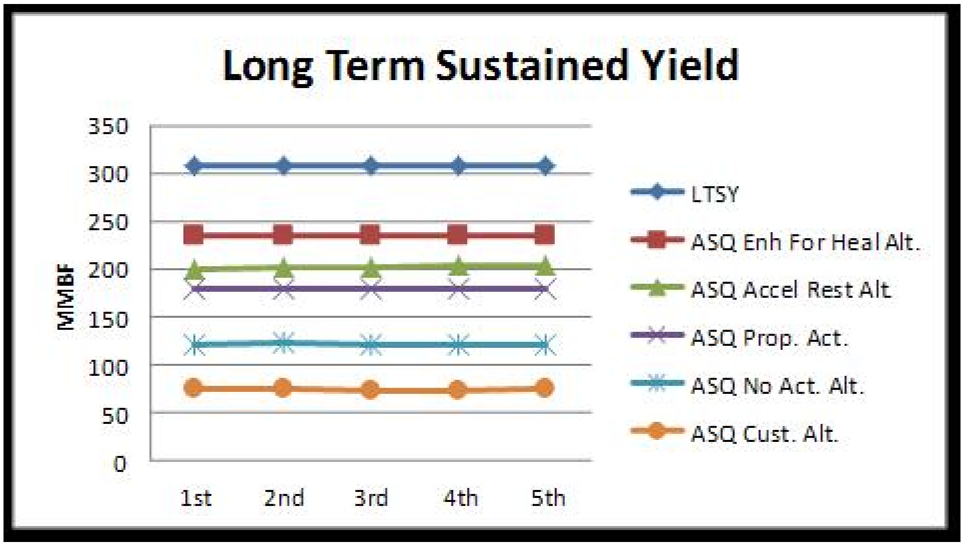

Figure 115. Long term sustained yield (million board feet)

This excess of growth over the harvest removals in all alternatives is likely to result in higher densities and older stands. High density and older age results in reduced forest health and increased mortality. This density and age based stress and mortality will be greatest in alternatives with lower harvest volumes. Of course, a positive effect of older stands resulting from an excess of growth over removals is an increase in conditions beneficial to ecosystem components dependent on older, less disturbed forest conditions.

Anticipated Changes for Key Vegetation Types to Accomplish Restoration

This section provides a summary of priority pine regeneration outcomes for the first decade from modeling. Changes in total acres and age structure for longleaf and shortleaf pine are displayed for each alternative. Based on the priority to be placed on longleaf and shortleaf restoration these vegetation types will have the greatest positive changes in acres and associated effects on age classes. Upland loblolly, mesic loblolly and slash pine will have the greatest negative changes in acres because these vegetation types will be cut to allow for longleaf and shortleaf restoration. Acres of harvest for these three vegetation types for restoration purposes are also displayed. There will be some restoration of loblolly and slash pine acreage to hardwood systems as well. However, hardwood restoration is lower priority than longleaf and shortleaf. Data for these hardwood acreages are not displayed in this section. The comparison between the alternatives for hardwood would be similar to the outcomes in longleaf and shortleaf, just of a smaller magnitude. Historically hardwood has been increasing in comparison to pine types. This is likely primarily due to natural succession, and the effects of storm events and insects. More details on vegetation changes can be seen in section 6 in appendix B.

Upland Longleaf Pine and Shortleaf Pine Forest

Restoration of the longleaf and shortleaf pine forest ecological systems to appropriate sites is the highest priority for long-term sustainability of these ecological systems. The acres of forest in regeneration (0-10 years) and mature condition (age 60 years and over) are important for evaluating ecological conditions of each system. For longleaf, the acres in regeneration are all the result of conversion from loblolly and slash pine. Shortleaf regeneration acres represent acres converted from loblolly pine as well as even-aged regeneration of shortleaf pine. The values represent conditions at the end of the first decade of forest plan implementation.

Table 75. Age structure of longleaf pine and shortleaf pine forests after first decade

	Longleaf Pine Forest Age Structure After 1st Decade			Shortleaf Pine Forest Age Structure After 1st Decade		
	Acres of Longleaf Pine	**Acres in Regeneration**	**Acres of Mature Forest**	**Acres of Shortleaf Pine**	**Acres in Regeneration**	**Acres of Mature Forest**
Existing:	238,027	11,018 (5%)	140,386 (59%)	59,139	3,543 (6%)	36,862 (62%)
Alternative A Custodial	238,876	847 (.4%)	152,776 (64%)	59,139	0	48,960 (83%)
Alternative B No-action	246,660	8,632 (3.5%)	152,775 (62%)	60,819	2,346 (3.9%)	50,368 (83%)
Alternative C Proposed Action	251,152	13,125 (5.2%)	152,775 (61%)	61,815	4,033 (6.5%)	41,121 (67%)
Alternative D Accelerated Rest.	261,285	23,256 (8.9%)	152,775 (58%)	68,049	9,281 (13.6%)	48,589 (71%)
Alternative E Enhanced Forest Health	251,705	13,678 (5.4%)	152,775 (61%)	66,616	10,279 (15.4%)	46,159 (69%)

Upland Loblolly, Mesic Loblolly and Slash Pine Forest

Overabundance of the loblolly and slash pine forest ecological systems on the landscape is the most important characteristic of these systems. Conversion of most of the loblolly and slash pine forest ecological systems to appropriate ecological systems is a high priority for long-term sustainability of the forest. Table 76 projects the proposed level of acres converted by regeneration to appropriate ecological systems during the first decade for each of the alternatives. The values represent a decadal total.

Table 76. First decade pine forest conversions (acres converted)

	Upland Loblolly Pine	Mesic Loblolly Pine	Slash Pine	Totals
Alternative A Custodial	431	60	571	1062
Alternative B No-action	8,728	696	4,099	13,523
Alternative C Proposed Action	14,246	1,183	5,307	20,736
Alternative D Accelerated Restoration	29,928	2,424	9,219	41,571
Alternative E Enhanced Forest Health	22,890	1,983	4,296	29,169

Jackson Prairie and Woodland

This rare ecological system represents open grassy areas dominated by characteristic prairie species. Jackson prairie occurs as calcareous islands (less than 1 to 160 acres) on gently sloping uplands surrounded by pine and hardwood forest on generally acid soils. It occurs on the Bienville Ranger District. Restoration and maintenance of this system is likely to require tree removal. Noncommercial woody vegetation removal is expected on 381 acres in addition to the commercial restoration shown below. Table 77displays proposed harvests in the first decade converting forested prairie soils to open Jackson prairie for each of the alternatives:

Table 77. Conversion to Jackson prairie and woodland (acres converted)

	Upland Loblolly	Shortleaf Pine	Upland Hardwood	Totals
Alternative A Custodial	288	0	0	288
Alternative B No-action	507	28	29	564
Alternative C Proposed Action	789	28	33	849
Alternative D Accelerated Restoration	789	28	29	846
Alternative E Enhanced Forest Health	789	28	29	846

Restoration work in other rare systems is needed, but was deemed lower priority than Jackson prairie restoration. The acres of restoration of other rare systems would be lower in the first decade but, would be similarly affected by alternatives.

4.20 Minerals

The management activities which vary by alternative such as vegetation management, habitat improvements, prescribed fire, and road maintenance are not likely to have any effect on minerals resources or their utilization. Minerals exploration and extraction has the possibility to impact air, soil, water, and ecological resources. The same standards and guides included in this document to protect other natural resources for activities which disturb ground or vegetation should be used when there are minerals activities on National Forest System lands.

Reserved or special areas must be provided protection for exploration or extraction impacts as appropriate for the purpose of their designation.

In August 2010, the National Forests in Mississippi renewed its decision for Lands Available for Oil and Gas Leasing (USDA Forest Service 2010). The 2010, oil and gas leasing decision authorized all lands on the National Forests in Mississippi, except for congressionally designated wilderness areas (Black Creek and Leaf) and the deferred Sandy Creek RARE II Further Study Area), to be available for Federal oil and gas leasing through the Bureau of Land Management (BLM). These lands, approximately 1.2 million acres, would be administratively available subject to 1) management direction in the National Forests in Mississippi Forest Plan, 2) oil and gas lease stipulations, 3) the wide range of laws and regulations that require environmental protections for oil and gas exploration and development and 4) site-specific environmental analysis as detailed exploration or development proposals are made by lease holders. Additionally, all administratively available lands will be available for lease by the BLM, subject to the stipulations identified in the analysis, the standard USDA stipulation, and the environmental requirements of the standard federal lease terms detailed in appendix B of the National Forests in Mississippi Lands Available for Oil and Gas Leasing Environmental Assessment, August 2010.

The August 2010 oil and gas leasing decision, as described above, is being incorporated into the revised forest plan. All alternatives incorporate the 2010 oil and gas leasing decision as continuation of management direction. The deferred decision on oil and gas leasing availability on the Sandy Creek RARE II study area is addressed in this environmental impact statement. Alternatives A and B would not authorize oil and gas leasing in the Sandy Creek RARE II study area. Alternatives C, D, and E would permit oil and gas leasing in the Sandy Creek RARE II study area subject to the 2001 Roadless Area Conservation Rule restrictions. The restrictions include no new road construction permitted in the former RARE II study area; therefore existing system roads would be utilized as access for lease activities.

Alternatives C, D, and E would add 2,558 acres to the total acres being available for leasing on the National Forests in Mississippi. Making the lands in the Sandy Creek RARE II study area not available for leasing in alternatives A and B would result in no federal oil and gas activities occurring in the area and the potential for any resource impacts from federal oil and gas exploration/development activities would not occur. However any potential revenues to the government and contributions to the energy supply from this area would be foregone. By having the lands in the Sandy Creek RARE II study area available for leasing in alternatives C, D, and E, there is the potential for impacts to the resources in the area, however these impacts should be mitigated through the application of the standard USDA stipulation, the requirements of the federal lease terms, and the requirements to meet the set of environmental laws that are applicable to all national forest system lands, which will be applied when a site-specific application for proposal to drill is received.

The Sandy Creek RARE II study area was identified in the 2001 Roadless Area Conservation Rule Environmental Impact Statement, and the Roadless Area Conservation Rule restrictions are applicable to this area. These Roadless Area Conservation Rule restrictions are meant to protect areas to maintain their “roadless” characteristics. However, as is documented in appendix C, this area no longer contains “roadless” characteristics (i.e., does not meet the criteria for it to be considered as a potential wilderness area). As such, should any exploration/development activities take place in the Sandy Creek RARE II study area; these activities will not create an adverse impact on this area’s “roadless” characteristics. The area would continue to be subject to the Roadless Area Conservation Rule restrictions that preclude new system road construction. The existing road system that is currently in place is capable of providing sufficient access for oil and gas development in the area. New well sites would be located adjacent to existing roads, no new system roads would be authorized to facilitate oil and gas exploration/development within the Sandy Creek RARE II study area. However, short spurs may be permitted for access to well pads that utilize a vegetative screen to mitigate visual impacts, if deemed appropriate for a specific site.

4.21 Infrastructure

The effect of vegetation management which varies by alternative on infrastructure is that alternatives C, D and E which have higher levels of timber harvests will provide higher levels of funding to upgrade and maintain existing roads. Alternative A because of being a minimal level of timber harvest would provide less funding for road maintenance.

Because there is very little need for new road construction under any alternative, road infrastructure is expected to have little impact on other resources based on alternative. However, road maintenance and reconstruction would vary by alternative with greater need for these activities as vegetation management activities increase from alternative A through E. Projects which include road maintenance and reconstruction may have impacts on threatened and endangered, sensitive, and locally rare species. Under alternatives with low levels of vegetation management lower road maintenance may increase sedimentation because of reduced road surface stability. Road closures will reduce this impact and will be most necessary under alternative A.

Management of structural facilities and trails should only be minimally effected by alternative. The primary effect would be to overall Forest funding resources under alternatives C, D and E. The plans for managing these facilities do not vary by alternative except as may be dictated by funding.

The following guidelines should prevent unreasonable impacts from infrastructure development or maintenance:

- Planning and implementation of road construction, fireline construction, wildlife pond and opening construction, timber harvests, and other ground disturbing projects should include measures to provide protection for threatened and endangered, sensitive, and locally rare species that are susceptible to damage or extirpation from ground disturbance. These are referred to as species sensitive to soil disturbance and species sensitive to recreational traffic.

- Before buildings, bridges, wells, cisterns, and other man-made structures are structurally modified or demolished, they should be surveyed for bats. If significant bat roosting is found, these structures should be maintained where consistent with multiple use objectives, or alternative roosts suitable for the species and colony size should be provided prior to adverse modification or destruction when feasible.
- New road bridge construction should include bat friendly technology and construction materials to provide roosting habitat for bats.
- New communication tower installation and ridge-top developments should be designed to mitigate collision impacts to migratory birds through coordination of project planning and implementation with the USDI Fish and Wildlife Service.
- When planning new structures, they should be as maintenance free, aesthetically pleasing and energy efficient as reasonably possible while optimally located to serve their intended purpose. All structures should be monitored to ensure they are necessary to support recreation or administrative activities on the National Forests in Mississippi.
- OHVs may be used for administrative uses such as maintenance and inspection of trails, open lands and prescribed fire, and emergencies such as wildfire and search and rescue.
- If unacceptable resource damage is identified in a section of any trail, that section should be closed for mitigation, rerouted or obliterated.
- OHV use by the public may occur on routes and areas specifically designated as open to such vehicles on the National Forests in Mississippi motor vehicle use map. Permits may be issued for special events according to appropriateness and timing of the event.
- Planning and development of trails, campsites, and other recreational facilities should include measures to provide protection for known occurrences important to conservation of threatened and endangered, sensitive or locally rare species that are susceptible to damage or extirpation from trampling or other forms of human disturbance.
- Where recreational uses are negatively affecting rare ecological systems, and wetland systems, the use should be modified to reduce or eliminate negative effects. New recreational developments should be designed to avoid adverse effects to rare ecological systems, and wetland systems.
- Trail marking should be considered and evaluated as part of routine trail condition surveys.

4.22 Land Use and Ownership

Land exchange, procurement or disposal will not vary by alternative, nor will the implementation of any alternative effect the government’s ability to pursue any of these land adjustment opportunities. Areas identified for disposal could contain areas with important biological diversity or habitat for threatened and endangered species. Likewise, areas identified for disposal could contain areas with historical or archeological importance.

Special use authorizations are issued for multiple purposes to individuals, corporations, and other government agencies. The predominant uses are for public roads, communication facilities, and utility rights-of-way. Special use authorizations for personal use are a minor land commitment such as private road easements and permits. Neither these uses nor their impacts will vary by alternative. Areas identified for use could contain areas with important biological diversity or habitat for threatened and endangered species. Likewise, areas identified for use could contain areas with historical or archeological importance.

The following forest plan guidelines will reduce or mitigate impacts to natural resources associated with implementation of special use and/or land ownership adjustment activities:

- Land exchanges should not detract from the biological diversity of the forest, as determined in the biologist reports associated with the land exchange.
- Land ownership adjustments should not dispose of habitat for threatened and endangered species within the boundaries of the National Forests in Mississippi except with another agency or a tribal government with equivalent responsibility for the species' protection.
- Land ownership adjustments should not dispose of significant historical or archeological sites within the boundaries of the National Forests in Mississippi except with another Federal or State agency or a tribal government with equivalent responsibility for cultural resources.
- Special use authorizations for utilities should generally utilize the existing corridors across the National Forests in Mississippi.
- New land acquisitions should generally be managed according to the adjacent or surrounding area's forest plan direction.

4.23 Other Effects

4.23.1 Benefits and Costs

Revenues and costs were calculated in an Excel spreadsheet for all alternatives. The revenues were derived from various Forest Service data sources. Minerals revenue were from recent Minerals Management Agency receipt reports. Recreation values were calculated from Forest Service National Visitor Use Monitoring estimates for the National Forests in Mississippi recreational uses. Timber sale revenue was calculated based on recent timber sale bid values and estimates of volume from the vegetation model Excel spreadsheet. Costs were developed based on each resource area's budgeted costs in the fiscal year 2012 budget year.

Costs and revenues were estimated for five decades of plan implementation and discounted to present values. The present net value of these revenues and costs are displayed in the table below for each alternative as decadal totals.

All alternatives have very positive present net values based on this analysis. Most of the benefit value is derived from recreational uses, primarily hunting and fishing. These resource areas use research determined values based on user values placed on their experiences as well as actual revenue from developed use areas. The minerals program is a positive contributor to the Forest present net value because of high revenue compared to a relatively low agency cost to administer the program. Timber is a negative contributor to present net value at the program levels of alternatives A (custodial) and alternative B (no-action). Timber becomes positive at the program level of alternative C the Proposed action alternative. Timber is increasingly positive at the higher program levels of alternative D (accelerated restoration) and alternative E (enhanced forest health).

Table 78. Cumulative Decadal Present Values of Costs and Benefits in $M

	Alternative A Custodial	Alternative B No-action	Alternative C Proposed Action	Alternative D Accelerated Restoration	Alternative E Enhanced Forest Health
Cumulative Total Present Net Value	$3,004,322	$5,556,813	$6,109,475	$6,049,826	$6,041,772
Present Value benefits by Program:					
Range	$0	$0	$0	$0	$0
Timber	$75,374	$120,431	$179,981	$202,576	$235,579
Minerals	$73,384	$73,384	$73,384	$73,384	$73,384
Recreation	$1,278,868	$2,218,825	$2,411,057	$2,411,057	$2,411,057
Wildlife	$2,244,271	$3,929,540	$4,266,602	$4,266,602	$4,266,602
Present Value of Benefits	$3,671,897	$6,342,181	$6,931,023	$6,953,618	$6,986,622
Present Value costs by Program:					
Range	$87	$109	$109	$131	$131
Timber	$108,128	$127,198	$133,075	$146,376	$153,038
Roads/Engineering	$183,275	$215,602	$225,551	$248,126	$259,402
Minerals:	$6,313	$7,423	$7,750	$8,534	$8,925
Recreation	$39,729	$46,739	$48,894	$53,792	$56,230
Wildlife	$63,087	$74,211	$77,629	$85,401	$89,276
Soil, Water, Air	$15,064	$17,720	$18,526	$20,376	$21,312
Protection/Forest Health	$218,802	$257,421	$269,285	$296,236	$309,689
Lands	$15,826	$18,634	$19,483	$21,443	$22,422
Planning, Inv., Monitoring	$17,263	$20,311	$21,247	$23,380	$24,425
Present Value Costs	$667,575	$785,368	$821,549	$903,793	$944,850

4.23.2 Effects on the Local Economy

The management of the National Forests in Mississippi has the potential to affect jobs and income within its area of influence. The Forest Service uses IMPLAN (impact for planning) software and FEAST (forest economic analysis spreadsheet tool) to estimate these impacts and contributions. The database in IMPLAN represents Census information for 528 economic sectors. On the Forests, effects are based on changes in six major Forest-level outputs – the amount of timber volume and type of product to be harvested, payments to counties, Forest Service expenditures, recreation use, and minerals. For purposes of estimating the socio-economic impact, counties that contain forest acreage were selected as the impact area. The input / output analysis is based on the interdependencies of the production and consumption elements of the economy within the impact area. Industries purchase from primary sources (raw materials) and other industries (manufactured goods) for use in their production process. These outputs are sold to either to other industries for use in their production process or to final consumers. The structure of interdependencies between the individual sectors of the economy forms the basis of the input/output model. The flow of industrial inputs can be traced through the input/output accounts of the IMPLAN model to show the linkages in the impact area economy. This allows the determination of estimated economic effects (in terms of employment and income). (See appendix B for more information on IMPLAN and FEAST).

Table 79 below illustrates the percentage contribution of the National Forests in Mississippi current management program to the area's economy. The National Forests in Mississippi are associated with 0.033 percent of the total local economy's jobs, and 0.034 percent of the labor income. Agriculture, mining, retail trade, accommodation and food services, and government are the sectors of the economy that show the most benefit from the forest's activities.

Table 79. Current role of Forest Service-related contributions to the area economy

	Employment (jobs)		Labor Income (Thousands of 2011 $)		Value Added (Thousands of 2011 $)	
Industry	**Area Totals**	**FS - Related**	**Area Totals**	**FS - Related**	**Area Totals**	**FS - Related**
Agriculture	19,561	138	$542,771	$5,438	$628,614	$5,473
Mining	7,133	208	$385,962	$7,774	$837,501	$21,121
Utilities	3,282	7	$277,810	$530	$1,083,188	$2,035
Construction	36,054	36	$1,212,558	$1,210	$1,506,580	$1,499
Manufacturing	63,881	68	$3,521,495	$3,938	$6,059,229	$6,942
Wholesale Trade	9,344	62	$567,411	$3,710	$1,005,484	$6,568
Transportation and Warehousing	16,503	42	$789,624	$1,817	$985,475	$2,306
Retail Trade	55,301	293	$1,421,845	$6,912	$2,064,781	$10,491
Information	4,770	9	$191,787	$329	$548,766	$843
Finance and Insurance	21,995	38	$747,830	$1,357	$1,333,620	$2,289
Real Estate and Rental and Leasing	14,913	37	$179,512	$544	$3,688,459	$8,393
Prof, Scientific, and Tech Services	18,215	38	$917,624	$2,004	$1,124,145	$3,538
Management of Companies	2,604	4	$176,712	$276	$206,714	$328
Admin, Waste Management and Removal Services	25,987	33	$568,743	$700	$728,002	$895
Educational Services	6,965	10	$173,537	$248	$157,352	$224
Health Care and Social Assistance	39,872	74	$1,814,620	$3,203	$1,954,965	$3,497
Arts, Entertainment, and Rec	8,563	85	$155,624	$1,379	$344,899	$3,153
Accommodation and Food Services	40,653	230	$761,788	$3,702	$1,247,539	$5,614
Other Services	28,351	46	$840,434	$1,339	$882,584	$1,453
Government	113,334	321	$6,204,177	$26,892	$7,479,663	$27,426
Total	537,280	1,778	$21,451,862	$73,301	$33,867,557	$114,088
FS as Percent of Total	---	0.33%	---	0.34%	---	0.34%

The economic impacts of the current direction and the alternatives are given in the tables below (Table 80-Table 83).

Table 80 illustrates how employment varies by alternative, defined as the average annual number of workers, be they part time, full time, seasonal, or temporary. Due to possible substitution effects from competing non-government sources (such as similar volume of timber harvesting which may occur on private lands if national forest timber is not offered to the market), these jobs are characterized as being associated with local economic activity initiated by Forest Service programs and activities, rather than caused by these activities.

Alternatives A and E are the alternatives that show the greatest change in employment across all programs.

Table 80. Employment by program by alternative (average annual, first decade)

	Total Number of Jobs Contributed				
Resource	**Current**	**A**	**C**	**D**	**E**
Recreation	249	168	264	264	264
Wildlife and Fish	385	269	409	409	409
Grazing	0	0	0	0	0
Timber	257	159	387	432	506
Minerals	288	288	288	288	288
Payments to States/Counties	147	147	147	147	147
Forest Service Expenditures	452	384	461	506	530
Total Forest Management	1,778	1,416	1,955	2,046	2,143
Percent Change from Current	--	- 20.4%	10.0%	15.1%	20.6%

Employment and income found in Table 80 and Table 81, respectively, are divided into the major sectors of the National Forests in Mississippi economy in Table 82 and Table 83. For each alternative, agriculture, manufacturing, retail trade, and accommodation and food are the sectors most affected by Forest Service programs and expenditures. Labor income in the form of wages and proprietors' earnings follows a similar pattern, with the aforementioned sectors benefitting the most as well.

Labor income (employee compensation, being the value of wages and benefits, plus income to sole proprietorships) shows the same pattern as employment, with alternatives A and E showing the greatest change in labor income.

Alternative A would create a decrease in employment opportunities, while alternative E would provide the greatest increase in opportunities. Overall, the economic impacts of changing the management of the National Forests in Mississippi would have a limited impact on the total economy in the Forest's area of influence, but the analysis does show which sectors would be effected the most from changes in Forest Service management.

Table 81. Labor income by program by alternative (average annual, first decade; $1,000)

	Thousands of 2011 dollars				
Resource	**Current**	**A**	**C**	**D**	**E**
Recreation	$6,168	$4,162	$6,549	$6,549	$6,549
Wildlife and Fish	$10,381	$7,253	$11,010	$11,010	$11,010
Grazing	$0	$0	$0	$0	$0
Timber	$11,081	$6,887	$16,705	$18,650	$21,840
Minerals	$10,495	$10,495	$10,495	$10,495	$10,495
Payments to States/Counties	$5,858	$5,858	$5,858	$5,858	$5,858
Forest Service Expenditures	$29,318	$24,921	$30,670	$33,737	$35,271
Total Forest Management	$73,301	$59,575	$81,287	$86,299	$91,022
Percent Change from Current	---	- 18.7%	10.9%	17.7%	24.2%

Table 82. Employment by major industry by alternative (average annual, first decade)

	Total Number of Jobs Contributed				
Industry	**Current**	**A**	**C**	**D**	**E**
Agriculture	138	94	194	213	244
Mining	208	208	208	208	208
Utilities	7	5	8	8	9
Construction	36	34	38	38	39
Manufacturing	68	44	99	109	127
Wholesale Trade	62	44	67	68	70
Transportation and Warehousing	42	31	47	49	51
Retail Trade	293	218	314	322	329
Information	9	7	10	10	10
Finance and Insurance	38	31	43	45	47
Real Estate and Rental and Leasing	37	30	40	42	44
Prof, Scientific, and Tech Services	38	32	41	44	46
Management of Companies	4	3	5	5	5
Admin, Waste Management and Removal Services	33	25	38	40	42
Educational Services	10	8	11	12	12
Health Care and Social Assistance	74	61	82	87	92
Arts, Entertainment, and Rec	85	59	90	91	92
Accommodation and Food Services	230	166	247	251	255
Other Services	46	37	52	56	59
Government	321	277	322	348	362
Total Forest Management	1,778	1,416	1,955	2,046	2,143
Percent Change from Current	--	- 20.4%	10.0%	15.1%	20.6%

Table 83. Labor income by major industry by alternative (average annual, first decade)

	Thousands of 2011 dollars				
Industry	**Current**	**A**	**C**	**D**	**E**
Agriculture	$5,438	$3,614	$7,810	$8,632	$9,973
Mining	$7,774	$7,770	$7,777	$7,778	$7,780
Utilities	$530	$419	$613	$652	$699
Construction	$1,210	$1,138	$1,262	$1,288	$1,317
Manufacturing	$3,938	$2,535	$5,776	$6,413	$7,453
Wholesale Trade	$3,710	$2,678	$4,023	$4,101	$4,188
Transportation and Warehousing	$1,817	$1,344	$2,056	$2,139	$2,246
Retail Trade	$6,912	$5,185	$7,417	$7,610	$7,773
Information	$329	$262	$362	$377	$394
Finance and Insurance	$1,357	$1,107	$1,504	$1,575	$1,653
Real Estate and Rental and Leasing	$544	$476	$581	$601	$622
Prof, Scientific, and Tech Services	$2,004	$1,709	$2,155	$2,279	$2,378
Management of Companies	$276	$224	$314	$327	$346
Admin, Waste Management and Removal Service	$700	$545	$793	$832	$879
Educational Services	$248	$203	$274	$289	$304
Health Care and Social Assistance	$3,203	$2,634	$3,537	$3,745	$3,942
Arts, Entertainment, and Rec	$1,379	$970	$1,470	$1,479	$1,488
Accommodation and Food Services	$3,702	$2,683	$3,970	$4,038	$4,100
Other Services	$1,339	$1,078	$1,517	$1,607	$1,707
Government	$26,892	$23,003	$28,078	$30,536	$31,780
Total Forest Management	$73,301	$59,575	$81,287	$86,299	$91,022
Percent Change from Current	---	- 18.7%	10.9%	17.7%	24.2%

4.23.3 Environmental Justice

The concerns of environmental justice encompass specific considerations of equity and fairness in resource decision-making. As required by Executive Order 12898, all federal actions must consider potentially disproportionate effects on minority or low-income communities. The principles for considering environmental justice outlined in Environmental Justice Guidance under the National Environmental Policy Act (Council on Environmental Quality 1997) were considered in this analysis. Chapter 4 of this EIS discloses the environmental effects of the alternatives. The social and economic overview of chapter 3 identifies the demographics of the local area. The Executive Order also requires agencies to work to ensure effective public participation and access to information.

To fulfill these principles, environmental justice was considered throughout the land management planning process in the following phases:

1. Scoping and public participation – Efforts were made by the Forests to reach as many people in the area as possible, through mailings, newspaper articles, news releases, radio interviews and contacts with federal, state, and local governments, libraries, non-profit organizations, civic associations, industries, academia, and other types of organizations. Participation was sought in various locations and formats throughout the planning area.
2. Determining the Affected Environment – The social and economic environment section of chapter 3of this EIS presents information related to population growth, minority populations, population density, income, unemployment, and economic diversity in the area directly affected by the National Forests in Mississippi management and compared this with a more regional context when appropriate. There were no segments of the population identified that depend on subsistence consumption of fish, wildlife, or vegetation within the planning area.

Benefits to the economy from National Forests in Mississippi management would accrue to all Counties where the National Forests occur, and are demonstrated in the social and economic environment sections of this document. There are no disproportionate negative environmental or health effects to minority or low-income populations anticipated from any alternative. Public involvement during forest plan revision was inclusive and provided ample opportunity for issues of environmental justice to be raised.

4.23.4 Relationship of Short-Term Use and Long-Term Productivity

The relationship between the short-term uses of the environment and the maintenance and enhancement of long-term productivity is complex. Short-term uses are generally those that occur irregularly on parts of the Forests, such as prescribed burning. Long-term refers to a period greater than ten years. 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 an EXCEL spreadsheet model (See Appendix B – The Planning and 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 National Forests in Mississippi. The management prescriptions and the effects of implementing the proposed action will be monitored. Evaluation of the data collected will determine if standards for long-term productivity are being met, or if management practices need to be adjusted.

4.23.5 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable commitments of resources are normally not made at the programmatic level of a forest plan. Irreversible commitments are decisions affecting nonrenewable resources such as soils, minerals, plant and animal species, and cultural resources. Such commitments of resources are considered irreversible because the resource has been destroyed or removed, or the resource has deteriorated to the point that renewal can occur only over a long period of time or at a great expense. While a forest plan can indicate the potential for such commitments, the actual commitment to develop, use, or affect non-renewable resources is normally made at the project level. Irretrievable commitments represent resource uses or production opportunities, which are foregone or cannot be realized during the planning period. These decisions are reversible, but the production opportunities foregone are irretrievable. An example of such commitments is the allocation of management prescriptions that do not allow timber harvests. For the period of time during which such allocations are made, the opportunity to produce timber from those areas is foregone, thus irretrievable.

The forest plan decision includes elements related to land allocations which will include irretrievable forgone production opportunities. There are designations for research natural areas and botanical areas for which the decision will forgo opportunities to extract timber resources commercially. This will not have an unreasonable effect on timber harvest opportunities. In the vegetation management section 0 the data indicates that the timber harvest under alternative C (proposed action) will only be 16 percent of growth. Allocation of these unique areas to these designations will simply be making a determination that some of the harvest forgone mostly due to budgetary constraints will be in areas to be protected for their unique natural resource values.

The forest plan decision will also be making the Sandy Creek Rare II area available for minerals and commodity extraction by making a decision not to further consider the area for wilderness. A part of the Sandy Creek area will be included in the botanical area designations mentioned above. The Sandy Creek Rare II area would; by the forest plan decision; be managed under the Consent to Lease decision for minerals (see section 4.17).

4.23.6 Effects on Wetlands and Floodplains

No significant adverse impacts on wetlands or floodplains are anticipated. Wetlands values and functions would be protected in all alternatives through the implementation of management area prescriptions and standards and guidelines. Under the requirements of Executive Order 11990 and the Clean Water Act, Section 404, wetland protection would be provided by ensuring that new construction would not have an adverse effect on sensitive aquatic habitat or wetland functions. In addition, wetland evaluation would be required before land exchanges or issuance of special-use permits in areas where conflicts with wetland ecosystems may occur. Forest plan components have been designed to conserve riparian areas and protect floodplains through the management area prescriptions or standards and guidelines. Executive Order 11988 also requires site-specific analysis of floodplain values and functions for any project occurring within the 100-year floodplain zone, and prior to any land exchange involving these areas. Effects to wetlands are also discussed in soils, water, ecological systems, and aquatic species associations sections of chapter 4.

4.23.7 Unavailable or Incomplete Information

The National Forests in Mississippi 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 will always exist in our knowledge. The Council on Environmental Quality regulations present 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.

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Morgan, Sr., Purvis L., MS
Morris, Stanley, MS
Morrow, Dwight, MS
Moseley, Henry, MS
Moseley, Ken, MS
Moss, Hushel Lamar, MS
Mounger, Davis, MS
Mullens, Eve, MS
Murphy, M. R., LA
Murrey, George, MS
Myatt, Bryant, MS
Myatt, Henry, MS
Myers, Larry G. & Jane, MS
Myers, Tommy E., MS
Myrick, Brodie A., MS
Napier, J. E. & Reba, MS
Napier, Wenda G., MS
Nasakaitis, Micheal, MS
Nations, Angelia, MS
Nations, Wayne, MS

Neil, Jr., Jesse A., LA
Nelson, Ed, AL
Nesbit, Linda, MS
Nesmith, Gene & Joyce, MS
Nesseler, Frank, FL
Nesseler, Jordan, MS
Nevelett, Tritta, MS
Newman, James, MS
Nichols, Gary W., MS
Nickens, Bob, LA
Nielsen, Glenn & Gloria R., MS
Nolan, James, AL
Novick, Kathy B., MS
Ochs, Clifford, MS
O'Connell, Meg, MS
Oglesbee, Debra, MS
Oliver, Grace M., MS
O'Neal, Jed, MS
O'Quin, Rickey, MS
O'Quinn, Darrell, LA
Osborne, Jay, MS
Ott, Paul, Ms
Overstreet, Hal, MS
Owen, Robert W., MS
Page, Millie, MS
Palmer, James, MS
Palmer, Jerry, MS
Palmer, Rayland, MS
Palmer, Robert M., MS
Palmisano, Morgan, LA
Parinio, Donny, MS
Parke, Randy, MS
Parker, Barbara, MS
Parker, Christopher D., MS
Parker, Larry, MS
Parker, Roy C., MS
Parker, Veronica, MS
Parker, Jr., Stanley R., MS
Parkman, Louie, MS
Patterson, Dianne, MS
Patton, Jr., Wendell W., MS
Paulson, Oscar, MS
Payne, Robert L., MS
Peacock, Evan, MS
Pearce, Jr., William J., MS
Pearson, Doris, MS
Pease, JoRee, MS
Pedersen, Joel, SC
Peek, Mitchell, MS
Perdue, Tammy, MS
Pettigrew, Gary, MS
Pettigrew, Johnny, MS
Pettigrew, Joseph, MS
Petty, Ken, MS
Phillippi, PhD, Ann, MS
Phillips, Jody, MS
Phillips, Lacey, MS
Pickering, Gary, MS
Pickering, J., MS
Piner, Ken, MS
Pinkins, Davis C., MS
Pinkins, Sylvester, MS
Pipkins, Angela, MS
Pittman, Fred, MS
Pittman, Judith, MS
Pitts, Josh, MS
Pitts, Keith, MS
Pitts, Sue, MS
Pitts, Thomas, MS
Polk, Charlie, MS
Polk, John D., MS
Polk, Kevin, MS
Pollan, Gayden L., MS
Pope, Bill, MS
Pope, Billy, MS
Pope, Bryant, MS
Pope, Richard, MS
Pope, Sebastian, MS
Porter, Jerry, MS
Posey, Kenneth, MS
Posey, Ralph, MS
Posey, Robert, MS
Powe, Willie Fred, MS
Prather, Harold, Ms
Presley, Charles M., MS
Prewitt, John, MS
Price, Dr. Carroll, MS
Price, Thomas L., MS
Prichard, Charles, MS
Prine, Thomas, MS
Pry, Darryl, LA
Puckett, James F., MS
Puckett, James F., MS
Pugh, Billy & Ollie, MS
Pullen, Tom & Ruth, MS
Purvis, Dale, MS
Purvis, Danny G., MS
Purvis, John, MS
Purvis, Lavon & Mark, MS
Pyron, Allen, MS
Quinney, S. J., UT
Ramsey, Herbert, MS
Rand, Kelly & Wm L., MS
Rarita, Joseph, MS
Ratcliff, J., MS
Ratcliff, Ted, MS
Rath, Henry, MS
Rawls, Ed, MS
Rawls, Ed, MS
Ray, Ruthann, MS
Redd, Gordon, MS
Reddock, Cody, MS
Reed, Lonnie, MS
Reeves, Wesley, MS
Reid, Daymon, MS
Reid, Dewayne, MS
Reid, Joby, MS
Reid, Lee, MS
Reid, Pedo, MS
Reid, Shannon & Thomas, MS
Reinecke, John, MS
Reinecke, Lonna, MS
Reul, Johnny Ray, MS
Revette, Clyde, MS
Reynolds, Reggie, MS
Reynolds, Robert, MS
Reynolds, Jr., Les, MS
Rhea, Charles, MS
Richie, Bobby, MS
Ricks, William & Camelia, MS
Riddle, Davis, MS
Risk, Jason, MS
Risk, II, Nick, MS
Robbins, Ben, MS
Roberts, Charles R., MS
Roberts, W. P., MS
Robinson, A. A., MS
Rockco, Robert R., MS
Roederer, David, MS
Rogers, Albert, MS
Rogers, Lydia, MS
Rogers, Patty, MS
Rogers, Roy, MS
Rollins, Avery & Jackie, MS
Ross, Ben, MS
Ross, Dr. Stephen T., MS
Ross, Semmes, MS
Ross, Sidney, MS
Rosso, Sam W., MS
Rowell, William, MS
Ruffin, William R., MS
Rushing, Felder, MS
Rushing, Richard, MS
Russell, Cathy, MS
Russell, Jr., Jessie, MS
Rutland, Nelson, MS
Rutland, Travis J., MS
Sashy, Alexa, MS
Schalski, Alan, MS
Schiefer, Randall N., MS
Schiefer, Terence Lee, MS
Schnieder, John C., MS
Schoenwolf, Walter, MS
Schultz, Cherie, MS
Schweizer, Peter E., MS
Scoggin, Robert, MS
Scott, Susan, MS
Scott, Jr., O. Merl, MS
Seale, Jimmy, MS
Seale, Joe, MS
Seiss, Ron, MS
Self, Joseph A., LA
Selman, Cory, MS
Selman, Kay, MS
Selman, Wayne, MS
Sessums, Greg, MS
Shank, Brett, MS
Sharp, Julian, MS
Shaw, Phillip C., MS
Shehane, Lyle, MS
Shell, Matt, MS
Shell, Mike, MS
Shell, Roy, MS
Shell, Wilber C., MS
Shelton, Kathy, MS
Shepard, Steve, MS
Shepherd, James, MS
Shepherd, Steve, MS
Sherman, Ross A., MS
Shipp, Jr., John W., TN
Shoemake, Sam O., MS
Shoemaker, Billy Dale, MS
Shows, Ernie, MS
Shows, Glenn, MS
Shows, Hon. Danny R., MS
Shows, Jacqueline, MS
Shropshire, Cathy, MS
Siegfried, Ed, MS
Sierra Club, Mississippi Chapter, MS
Sills, Bob, MS
Sims, John R., MS
Singleton's, The, MS
Singley, Joseph, AL
Sirmon, Gene, MS
Skinner, M. E., MS
Sledge, Jim, MS
Smistik, Robert, MS
Smith, A., MS
Smith, A. J., MS
Smith, B. J., MS
Smith, Benita, MS
Smith, Brian, NJ
Smith, Chris R., MS
Smith, Clyde, MS
Smith, Dewayne, MS
Smith, Donald, MS
Smith, Donny, MS
Smith, J. Larry & Linda B., MS
Smith, Jerry K., MS
Smith, Kelcy, MS
Smith, Larry J., TN
Smith, Lillie, MS
Smith, Nyla, MS
Smith, Pam G., MS
Smith, Patrick O., MS
Smith, Richard, MS
Smith, Roy, MS
Smith, Steve, MS
Smith, Tony S., MS
Smith, Walter, MS
Snyder, David, LA
Snyder, Mark, LA
Southerland, David, MS
Spence, Scott, MS
Spivey, Grady, MS
Spradley, Danny, MS
Springfield, Bill, MS
Stanford, Linday, DC
Steadman, Billy, MS
Stegall, Gary, MS
Stegall, Maurice, MS
Stegall, Stacey, MS
Stegall, Thomas W., MS
Stennis, Mildred H., MS
Stephan, Mark, LA
Stephens, Christine, MS
Sterling, Dale, MS
Stewart, Doug, MS
Stewart, Harold D. & Peggy, MS
Stewart, Russell R., MS
Stile, John, MS
Stokes, Billy, MS
Stokley, Roger, MS
Stokly, Donna, MS
Stonecypher, Susan & Richie, MS
Stowell, Michael, MS
Strawn, Kenny, MS
Stribling, Jack, MS
Strickland, Scott, MS
Stringer, Scott, MS
Stuart, Rev. Leon, MS
Suarez, Esq., Emma T., CA
Sudduth, Kenny, AL
Sullivan, Edward G., MS
Sullivan, Sue, MS
Sulser, Floyd, MS
Summers, Randy, MS
Sumrall, Sam, MS
Swagger, Ken, MS
Swanson, John, MN
Syrjala, Edward S., MA
Tadlock, Paul, MS
Tadlock, Roger D., MS
Talberth, John, NM
Talley, Scotland, LA
Tally, Joe, MS
Tang, Juliet D., MS
Tankson, James, MS
Tanner, Rick, MS
Taylor, Ester, MS
Taylor, Gene, MS
Taylor, George R., MS
Taylor, John, MS
Taylor, Paul, MS
Taylor, Robert, MS
Taylor, Ronny, MS
Temple, Matthew, MS
Temple, Jr., F. Lee, MS
Thames, Bill, MS
Thibodeaux, Don, LA
Thomas, Bobbie, MS
Thomas, David, MS
Thomas, Lona B., MS
Thompson, Earnestine, MS
Thompson, Frances, MS

Thompson, Keith, MS
Thompson, Lowell, MS
Thompson, Michael, MS
Thompson, Paul F., MS
Thompson, Sidney W., MS
Thompson, Zena, MS
Thornhill, Polly, MS
Thornton, Donnie Pat, MS
Thornton, Tommy Lynn, MS
Thrash, Dewayne, MS
Threadgill, Don, MS
Tindle, Greg, MS
Tingle, Lynette, MS
Tisdale, Jim, MS
Todd, Sally, MS
Tolbert, Chad, MS
Tolbert, Rod, MS
Topp, Sandra, MS
Torrey, James, MS
Touchstone, Jessica, MS
Townsend, Jennifer, MS
Townsend, Michael, MS
Townsend, Michael P., MS
Traxler, Edward, MS
Trousdale, Austin W., MS
Troyka, Robbie & Jeff, MS
Tubbs, Elisa E., LA
Turnage, Rollin, MS
Turner, George, MS
Turner, Keith, MS
Turner, Russell, MS
Turner, Wayne, MS
Tynes, Paul, MS
Tyson, Dr. Robert E., MS
Ukeiley, Lawrence, MS
Ulmer, Josh, MS
Valentine, Alec, MS
Van Fossen, Eric, MS
Varnado, Mike, MS
Vassey, Paula, MS
Vaughan, Ray, AL
Verdey, Christopher, MS
Vick, Cecil, MS
Vines, Buddy, MS
Waggoner, Guy, MS
Waite, Cile, MS
Walker, James, MS
Walker, Michael, MS
Walker, Mike, TX
Walker, Scott, MS
Wallace, Craig & Dale T., MS
Wallace, John Paul, MS
Wallace, Ernest & Patrick W., MS
Waller, Jill D., MS
Waller, Pauline, MS
Walley, J. D., MS
Walley, Jamie, MS
Walley, Paul & Marie, MS
Walley, Pete, MS
Walley, Reggie, MS
Walling, Rick, MS
Walls, Eddie, MS
Ward, Martha, MS
Warren, James, MS
Washington, Lee A., MS
Watkins, Bryant, MS
Watkins, Christopher, MS
Watkins, Jeff, MS
Watkins, Jerry, MS
Watkins, Randy, MS
Watson, Billy, MS
Watson, Charles E., MS
Watson, Ray, MS
Watson, Walter L., MS
Watts, Donald, MS
Watts, Lee, MS
Weathersby, Tony, MS
Weaver, Gerald, MS
Webb, Anita, MS
Webb, Bob, MS
Webb, Buford F., MS
Webb, Casey, MS
Webb, David, MS
Webb, Mary, MS
Webb, Terry, MS
Webster, Ed, AL
Wedgeworth, David, MS
Wegman, Ken, MS
Welborn, Larry, MS
Wellborn, Charles, MS
Wells, Ray G., MS
Wesley, John, MS
West, R. M., MS
West, Jr., Roy V., MS
Westbury, William, MS
Whisler, Sandra L., MS
White, Anthony, MS
White, David, MS
White, David H., MS
White, John B., MS
White, Mark, MS
Whitfield, Robin, MS
Whitt, Scott, MS
Whittiger, Elie, MS
Whittington, Charles, MS
Whittington, Jackie, MS
Whittington, Russell, MS
Whitworth, Bill, MS
Wicker, Joe, MS
Wieland, Ron, MS
Wieland, Ronald, MS
Wilemon, Donnie, TN
Wilkinson, James M., MS
Wilkinson, Rodney & Karen, MS
Williams, Adam, MS
Williams, Beachman, MS
Williams, Charles G., MS
Williams, Donald F., MS
Williams, James E., MS
Williams, Jimmy & John, MS
Williams, Marda, MS
Williams, Mitch, MS
Williams, Richard H., MS
Williamson, David, MS
Williamson, David & Brenda, MS
Williston, Hamlin L., MS
Wilson, Bobby, MS
Wilson, Christine, MS
Wilson, David, MS
Wilson, Earl, MS
Wilson, Jerry D., MS
Wilson, Tony, MS
Wimberly, JoAnn, MS
Windham, Dale, MS
Windham, Donald M., MS
Windham, Paul, MS
Windman, Robert, MS
Wirletski, Margaret, MS
Wirth, Peter, MS
Wise, Rick, MS
Wolfe, Elizabeth, MS
Wolgemuth, Andrew, MS
Wollard, Mark, MS
Woltmann, Stefan, MS
Wood, David, LA
Wood, Forrest, MS
Wood, James, MS
Wood, Joe, MS
Woodard, Allen, MS
Woodard, Susan, MS
Woodard, PA, Allen S., MS
Woolley, Randy, Ms
Woolworth, Stevi, MS
Wright, Keith, MS
Yates, Lori D., MS
Yeager, Lisa, MS
Young, Bruce, MS
Yount, Janette and Lester, MS
Yount, Ken, MS
Zimmerman, Karl, FL

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Glossary

A

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.

affected environment: The relationship of the physical environment to the changes that will or may take place as a result of human activity.

analysis area: A collection of lands, not necessary contiguous, sufficiently similar in character, that they may be analyzed at the forest plan level.

appropriate management response: The response to a wildland fire based on an evaluation of risks to firefighter and public safety. Evaluation includes the consideration of 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: System that includes streams, lakes, the stream channel, lake and estuary beds, water, biotic community, and associated habitat features.

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.

B

basal area (BA): the area, in square feet, of the cross section of a single tree measured at 4.5 feet above ground, usually expressed as square feet per acre.

best management practices (BMP): A series of guidelines or minimum standards for proper application of forestry operations, designed primarily to prevent soil erosion and water pollution, and to protect certain wildlife habitat values in riparian and wetland areas.

biodiversity: The variety of life, 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.

C

calcareous: Composed of, containing, or characteristic of calcium carbonate, calcium, or limestone; chalky.

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, landform, soil and geology, and the application of management practices and protection from fire, insects, and disease.

cluster: The aggregate of cavity trees used by one group of red-cockaded woodpeckers for nesting and roosting. This includes all active and inactive cavity trees plus at least a 60 meter (200-foot) zone around them. If this area is less than 4 hectares (10 acres), additional area of the best nesting habitat contiguous with the cavity trees is delineated to establish the minimum 4-hectare stand.

Coastal Plain: In the United States, an ecoregion or physiographic province located near the Atlantic Ocean or Gulf of Mexico.

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 thinning: Any type of thinning producing merchantable material at least equal to the value of the direct cost of harvesting.

condition class: The dominant existing vegetation or physical features found on a unit of land. Forested condition classes are described by the dominant existing timber species and size class.

Continuous Inventory of Stand Conditions (CISC): the USDA Forest Service, Southern Region's forest stand database containing descriptive and prescriptive data about mapped stands of forest land.

conversion (forest management): A change from one forest type to another in a stand on land that has the capability of both forest types.

cooperative management unit:

critical habitat: Habitat as defined by the U.S. Fish and Wildlife Service to be essential to meet the needs of an endangered species.

cultural resources: Physical remains of districts, sites, structures, buildings, networks or objects that were used by humans. They may be historic, prehistoric, archaeological, architectural, or spiritual in nature. Cultural resources are nonrenewable.

D

demand species: Wildlife species with high social, cultural, or economic values.

den tree: A tree with cavities that provide shelter and nesting sites for various wildlife species.

developed recreation site: Relatively small, distinctly defined area where facilities are provided for concentrated public use. Examples include campgrounds, picnic areas, and swimming areas.

developed recreation: Recreation that requires facilities that in turn result in concentrated use of an area. Examples of recreation areas are campgrounds and ski areas; facilities in these areas might include roads, parking lots, picnic tables, toilets, drinking water, and buildings.

diameter at breast height (d.b.h.): the standard method for measuring tree diameter at 4.5 feet from the ground.

dispersed recreation: A general term referring to recreation use outside a developed recreation site, this includes activities such as scenic driving, rock climbing, boating, hunting, fishing, backpacking, and recreation in primitive environments.

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.

diversity: The distribution and abundance of different plant and animal communities and species within the area covered by a forest plan.

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.

E

early successional habitat: Vegetative condition typically characterized by low density to no canopy cover and an abundance of herbaceous ground cover. May include forest 0 to 10 years of age, maintained openings, pastures, balds, or open woodlands.

ecosystem management: An ecological approach to natural resource management to assure productive, healthy ecosystem by blending social, economic, physical and biological needs and values.

ecosystem/cover type: The native vegetation ecological community considered together with nonliving 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.

endangered species: Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified or proposed by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act.

endemic: Species restricted to a particular geographic area. Usually limited to one or a few small streams or a single drainage.

environment: All the conditions, circumstances, and influences surrounding and affecting the development of an organism, or group of organisms.

environmental analysis: An analysis of alternative actions and their predictable short and long-term environmental effects, which include physical, biological, economic, social and environmental design factors and their interaction. (36 CFR 219.3)

environmental consequence: The result or effect of an action upon the environment.

environmental impact: Used interchangeably with environmental consequence or effect.

ephemeral stream: A watercourse that may or may not have a well-defined channel, and which flows only for short periods (less than 10 percent of an average year) during and following precipitation. Ephemeral stream bottoms are usually above the water table and do not contain fish or aquatic insects with larvae that have multi-year life cycles.

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.

even-aged: A forest (stand) composed of trees having no, or relatively small, differences in age.

even-aged management: The application of a combination of actions that results in the creation of stands in which trees of essentially the same age grow together. Managed even-aged forests are characterized by a distribution of stands of varying ages (and, therefore, tree sizes) throughout the forest area. The difference in age between trees forming the main canopy level of a stand usually does not exceed 20 percent of the age of the stand at harvest rotation age. Regeneration in a particular stand is obtained during a short period at or near the time that a stand has reached the desired age or size for regeneration and harvested. Clearcut, shelterwood, or seed tree cutting methods produce even-aged stands. (36 CFR 211.3)

existing road system: All existing roads, owned or administered by various agencies, which are wholly or partly within or adjacent to and serving the national forests and other areas administered by the Forest Service, or intermingled private lands (FSM 7705.21). These roads may or may not be included on the current Forest transportation inventory, but are evident on the ground as meeting the definition of a road.

F

federally listed: Any plant or animal species listed as threatened or endangered under the Endangered Species Act.

filter strips: Belts of grass, shrubs, or trees maintained along streams to trap sediment and chemicals before they enter waterways.

fire condition class: Based on coarse scale national data, classes measure general wildfire risk:

- class 1: 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 2: 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 3: Fire regimes on these lands have been significantly altered from their historical return interval. The risk of losing key ecosystem components from fire is high. Fire frequencies have departed from historical ranges by multiple return intervals. Vegetation composition, structure, and diversity have been significantly altered.

fire management plan: Strategic plans that define a program to manage wildland fires based on an area's approved forest 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 set of recurring conditions of fire that characterizes a given ecosystem. A specific range of frequency, fire behavior, severity, timing of burn, size of burn, fire spread pattern, and pattern and distribution of burn circumscribe those conditions

flatwoods: Mesic pine communities on the Gulf and Atlantic coastal plains with a well-developed woody shrub or midstory layer.

floodplains: The lowland and relatively flat area adjoining inland waters, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year, and soil inundated by the 100-year flood.

forage: All browse and non-woody plants that are available to livestock or game animals used for grazing or harvested for feeding.

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 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 supervisor: The official responsible for administering the National Forest System lands in a Forest Service administrative unit. This may consist of two or more national forests or all the forests within a state. The forest supervisor reports to the regional forester.

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.

fragmentation: Habitat loss that results in isolated patches of remaining habitat.

fuel loading: The amount of fuel (flammable natural materials) expressed quantitatively in terms of weight of fuel per unit area.

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.

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.

groundwater: Subsurface water in a saturated zone or geologic stratum.

growing-season burn: A prescribed fire that generally occurs during the time period of leaf expansion to leaf off of deciduous tree species. Growing seasons vary depending on local climate and geography. It can also vary by crop, as different plants have different freezing thresholds and leaf retention.

H

habitat: The native environment of an animal or plant in which all the essentials for its development, existence, and reproduction are present.

hydric soils: Soils developed in conditions where soil oxygen is limited by the presence of saturated soil for long periods during the growing season.

hydrologic function: The natural behavioral characteristics (water quality, water quantity, and timing) of surface water and ground water that maintain channel capacity, protect native aquatic organisms, sustain riparian habitats and communities, protect wetlands and other unique or uncommon communities, and provide for recreational, scenic, and research purposes.

hydrologic unit code (HUC): A cataloging system developed by the U.S. Geological Survey and the U.S. Natural Resource Conservation Service to identify watersheds and to standardize hydrological unit delineations for geographic description and data storage purposes. They are typically reported at a large river basin or smaller watershed scale.

I

instream flow: The volume of surface water in a stream system passing a given point at a given time.

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. IPM is a decision making and action process which includes biological, economic, and environmental valuation of pest-host systems to manage pest populations. IPM strategies apply a comprehensive systems approach to silvicultural, wildlife, range, recreation and corridor management practices. These strategies consist of a range of practices that include prescribed burning, manual, mechanical, biological, and chemical tools that may be used alone or in combination.

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 (trails, sites, signs): 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.

invasive species: A species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

L

landscape character: Particular attributes, qualities, and traits of a landscape that give it an image and make it more identifiable or unique. Levels include Natural Evolving, Natural Appearing, Pastoral/Agricultural, Historic, Transitional, Suburban, and Urban.

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.

loess: a light-colored fine-grained accumulation of clay and silt particles that have been deposited by the wind; usually yellowish and calcareous, common in the Mississippi Valley.

M

maintenance: The upkeep of facilities, buildings, or roads. Maintenance is not for upgrading a facility, but rather, to bring it to the originally constructed or subsequently reconstructed condition.

management action: A set of management activities applied to a land area to produce a desired output.

management area: An area with similar management objectives and a common management prescription.

management concern: An issue, problem, or a condition which constrains the range of management

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: a general term that refers to the reproductive bodies of plants and is often associated with wildlife food sources. Mast is often divided into categories of "hard mast" and "soft mast". "Hard mast" is the production of hard-shelled seeds, such as acorns and hickory nuts. "Soft mast" describes seeds that are covered with fleshy fruit, as in apples and berries. Mast may also include seeds and fruits of all other plants such as grasses, herbs (forbs), pines, hardwoods, and fungi.

mesic: Sites or habitats characterized by intermediate moisture conditions, i.e., neither decidedly wet nor dry.

midstory: A stratum of smaller trees that occur under the dominant overstory. The midstory can include small pines, but it is usually associated with hardwoods such as oaks and sweetgum.

mineral exploration: The search for valuable minerals on lands open to mineral entry.

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 is currently or potentially feasible.

mineral soil: Weathered rock materials without any vegetative cover.

minerals, leasable: Coal, oil, gas, phosphate, sodium, potassium, oil shale and geothermal steam on public domain and acquired status lands, and hard rock minerals on acquired lands.

minerals, locatable: Hard rock minerals on public domain status land. May include certain nonmetallic minerals and uncommon varieties of mineral materials.

minimum level: The minimum level of management which complies with applicable laws and regulations, including prevention of significant or permanent impairment of the long-term productivity of the land, and which would be needed to maintain the land as a national forest, and to manage uncontrollable outputs, together with associated costs and inputs.

mitigation: Actions to avoid, minimize, reduce, eliminate, or rectify the impact of a management practice.

multiple use: Management of all the various resources of the National Forest System so that they are utilized in the combination that will best meet needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some lands will be used for less than all of the resources and services; and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of the uses that will give the greatest dollar return or the greatest unit output. (36 CFR 219.3)

N

National Forest System land: Federal land that is within the National Forest System, which is defined at 16 USC 1609.

national historic landmark: Cultural properties designated by the Secretary of the Interior as being nationally significant. These cultural properties may be buildings, historic districts, structures, sites, and objects that possess exceptional value in commemorating or illustrating the history of the United States.

national recreation trails: Trails designated by the Secretary of the Interior or the Secretary of Agriculture as part of the national system of trails authorized by the National Trails System Act. National recreation trails provide a variety of outdoor recreation uses, in or reasonably accessible, to urban areas.

National Register of Historic Places: The National Register of Historic Places is the Nation's official list of cultural resources worthy of preservation. Authorized under the National Historic Preservation Act of 1966, the National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect our historic and archaeological resources. Properties listed in the National Register include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archaeology, engineering, and culture. The National Register is administered by the National Park Service, which is part of the U.S. Department of the Interior.

National Visitor Use Monitoring: A systematic process to estimate annual recreation and other uses of National Forest System lands through user surveys.

nonconsumptive use: That use of a resource that does not reduce its supply; for example, nonconsumptive uses of water include hydroelectric power generation, boating, and swimming.

nongame: Species of animals which are not managed as a sport - hunting or trapping resource.

nonmotorized recreation: A recreational opportunity provided without the use of any motorized vehicle. Participation in these activities is accomplished using foot or horseback travel.

O

objective: A concise, time-specific statement of measurable planned results that respond to pre-established goals. An objective forms the basis for further planning to define the precise steps to be taken and the resources to be used in achieving identified goals. (36 CFR 219.3)

off-highway vehicle (OHV): Any vehicles capable of being operated off established roads.

old growth: Old-growth forests are ecosystems 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 which may include tree size, accumulation of large wood material, number of canopy layers, species composition, and ecosystem function. The age at which old growth develops and the specific structural attributes that characterize old growth will vary widely according to forest type, climate, site conditions, and disturbance regime.

overstory: That portion of trees in a two or multi-layered forest stand that provides the upper crown cover.

P

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.

perennial stream: Permanently present surface water. Flows occur throughout the year except during extreme drought or during cold when ice forms.

physiographic region: A region of similar geologic structure and climate that has had a unified geomorphic history.

population: A group of individuals of the same species occupying a given area. Methods of specifying such an area differ according to purpose. A common specification is the area within which gene flow is sufficient to avoid genetic differentiation.

population trend: Rate of change of a wildlife population. In general, populations that are increasing or decreasing by a rate less than 5% annually are considered to be stable.

potential breeding group: An adult female and adult male red-cockaded woodpecker that occupy the same cluster, whether or not they are accompanied by a helper, attempt to nest, or successfully fledge young.

precommercial thinning: The selective felling or removal of trees in a young stand primarily to accelerate diameter increment on the remaining stems, maintain a specific stocking or stand density range, and improve the vigor and quality of the trees that remain.

prescribed burning: Controlled application of fire to wildland fuels in either their natural or modified state, under such conditions of weather, fuel moisture, soil moisture, etc. as allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to further certain planned objectives of silviculture, wildlife management, grazing, fire hazard reduction, etc. NOTE: It seeks to employ fire scientifically to realize maximum net benefits with minimum damage and at acceptable cost.

prescribed fire plan: A written statement defining the objectives to be attained as well as the conditions of temperature, humidity, wind direction and speed, fuel moisture and soil moisture under which a prescribed fire will be allowed to burn.

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.

primary core population: A population identified in recovery criteria that will hold at least 350 potential breeding groups at the time of and after delisting. In Mississippi, the Bienville National Forest and Chickasawhay Ranger District contain primary core populations of red-cockaded woodpeckers.

primitive: A classification of the recreation opportunity spectrum that characterizes an essentially unmodified natural environment of a size or remoteness that provides significant opportunity for isolation from the sights and sounds of man, and a feeling of vastness of scale. Visitors have opportunity to be part of the natural environment, encounter a high degree of challenge and risk, and use a maximum of outdoor skills but have minimum opportunity for social interaction.

program: Sets of activities or projects with specific objectives, defined in terms of specific results and responsibilities for accomplishments.

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.

public access: Usually refers to a road or trail route over which a public agency claims a right-of-way for public use.

R

ranger district: Administrative subdivision of the national forest, supervised by a district ranger who reports to the forest supervisor.

rare communities : Communities that are naturally small in scale or distribution relative to the broader systems they occur within because the sites they occur on are of limited extent or have been reduced due to historical land uses. On the National Forests in Mississippi these systems are: xeric sandhills; rock outcrops; black belt calcareous prairie and woodland; Jackson prairie and woodland; ephemeral ponds and emergent wetlands; cypress dominated wetlands; wet pine savanna; seeps, springs, and seepage swamps; and herbaceous seepage bog and flats.

recreation: Any socially desirable leisure activity in which an individual participates voluntarily and from which he derives satisfaction.

recruitment cluster: A recruitment stand that has artificial cavities located in suitable nesting habitat. When possible, recruitment clusters should be located within 1.2 km (0.75 mi) of existing active clusters. Foraging habitat must be provided now and in the future around recruitment clusters. Recruitment clusters will contain at least 4 suitable cavities or 3 suitable cavities and 2 start holes. Recruitment clusters should be provided at the rate of 10 percent of the total active clusters per management unit.

recruitment stand: A stand of pine trees at least 4 ha (10 ac) in size identified and managed as potential nesting habitat. The number required equals the population objective minus the number of active clusters. They are located within ¼ to ¾ mile of an active cluster or another recruitment stand.

regeneration: Young trees (seedlings and saplings) which will grow to become older trees of the future forest (i.e. reproduction). Also, the process of forest replacement or renewal, which may be done artificially by planting or seeding, or through natural seed fall and sprouting.

region: An administrative unit within the National Forest system. The United States is divided into nine geographic regions. Each region has a headquarters office and is supervised by a Regional Forester. Within each region are located National Forests and other lands of the Forest Service.

regional forester: The official responsible for management of National Forest System and within a Forest Service region.

relative abundance: The number of organisms at one location or time relative to the number of organisms at another location or time. Generally reported as an index of abundance.

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.

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 ecosystem: A transition between the aquatic ecosystem and the adjacent terrestrial ecosystem identified by soil characteristics (alluvial soils inundated by a 100-year flood, wetland soils) and distinctive vegetative communities that require free and unbound water.

riparian-dependent species: Species dependent on riparian areas during at least one stage of their life cycle.

roaded natural: A classification of the recreation opportunity spectrum that characterizes a predominantly natural environment with evidence of moderate permanent alternate resources and resource utilization. Evidence of the sights and sounds of man is moderate, but in harmony with the natural environment. Opportunities exist for both social interaction and moderate isolation from sights and sounds of man.

roads analysis process (RAP): Roads analysis is an integrated ecological, social, and economic science based approach to transportation planning that addresses existing and future road management options. The intended effects are to ensure that decisions to construct, reconstruct, or decommission roads will be better informed by using a roads analysis. Roads analysis may be completed at a variety of different scales, but generally begins with a broad forest-scale analysis to provide a context for future analyses.

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.

S

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 attractiveness: The scenic importance of a landscape based on human perceptions of the intrinsic beauty of landform, rockform, waterform, and vegetation pattern. Classified as A (Distinctive), B (Typical or Common), or C (Undistinguished).

scenic integrity: A measure of the degree to which a landscape is visually perceived to be "complete." The highest scenic integrity ratings are given to those landscapes that have little or no deviation from the character valued for its aesthetic appeal. Scenic integrity is used to describe an existing situation, standard for management, or desired condition.

scenic integrity objectives: A desired level of excellence based on physical and sociological characteristics of an area. Refers to the degree of acceptable alterations to the valued attributes of the characteristic landscape. Objectives include very high, high, moderate, and low. These categories are defined below:

- Very High – Generally provides for only ecological changes in natural landscapes and complete intactness of landscape character in cultural landscapes.
- High – Human activities are not visually evident to the casual observer. Activities may repeat attributes of form, line, color, and texture found in the existing landscape.
- Moderate – Landscapes appear slightly altered. Noticeable human created deviations remain visually subordinate to the landscape character being viewed.

secondary core population: A population identified in recovery criteria that will hold at least 250 potential breeding groups at the time of and after delisting. In Mississippi, the De Soto Ranger District and the Homochitto National Forest contain secondary core populations of red-cockaded woodpeckers.

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.

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.

silviculture: The theory and practice of controlling the establishment, composition, structure, and growth of forests to achieve management objectives.

snag: A standing, dead tree.

seral stage: a developmental, transitory stage in the ecological succession of a biotic community.

soil productivity: The capacity of a soil to produce a specific crop such as fiber, forage, etc., under defined levels of management. It is generally dependent on available soil moisture and nutrients and length of growing season.

Southern Region: The Forest Service organizational unit consisting of thirteen southeastern states and Puerto Rico.

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: An aggregation of trees occupying a specific area and sufficiently uniform in species composition, age, arrangement, and condition so as to be distinguishable from the forest on adjoining areas.

stream: A water course having a distinct natural bed and banks; a permanent source which provides water at least periodically; and at least periodic or seasonal flows at times when other recognized streams in the same area are flowing.

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 for timber production: 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.

suppression (fire suppression): Any act taken to slow, stop or extinguish a fire. Examples of suppression activities include line construction, backfiring, and application of water or chemical fire retardants.

T

terrestrial: Of, or pertaining to, land as distinct from water.

thinning: A silvicultural treatment removing some trees in a stand to reduce tree density.

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 or proposed as a threatened species in the Federal Register by the Secretary of Interior.

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.

topography: The configuration of a land surface including its relief, elevation, and the position of its natural and human-made features.

trail: A general term denoting an access route for purposes of travel by foot, stock or trail vehicle. (A trail vehicle is one which is 40 inches or less in width and is designated for trail use.)

trailheads: The parking, signing, and other facilities available at the terminus of a trail.

U

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.

V

vertical structure: Division of an ecosystem type into distinguishable layers on the basis of height of the vegetation creating understory, midstory, and overstory and divisions within each.

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 waterbody.

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

water rights: Rights given by State or Federal governments for the diversion and use of water.

watershed: The entire area that contributes water to a drainage system or stream.

wetlands: Those areas that are inundated by surface or ground water with a frequency sufficient to support that, and under normal circumstances, do or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, and natural ponds.

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: Any federal land designated by Congress as part of the National Wilderness Preservation System.

wildland fire: Any nonstructural fire on wildlands other than one intentionally set for management purposes. Confined to a predetermined area. Not to be confused with “fire use,” which includes prescribed fire.

wildland-urban interface: The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

wildlife 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.

X

xeric: Pertaining to sites or habitats characterized by decidedly dry conditions.

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