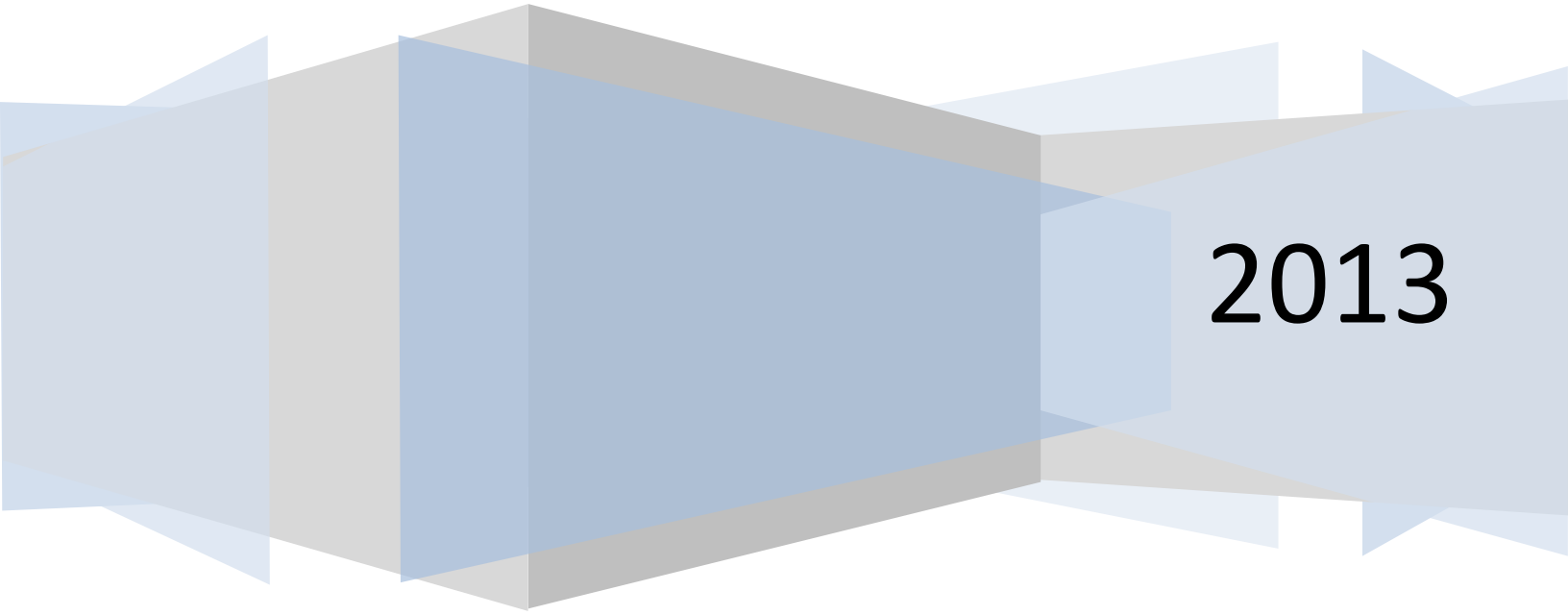
Forest Service

National Forests in Texas Wind Event Environmental Assessment

Adaptive Management

Jackson, Lynn -FS



2013

1.0 Purpose and Need

1.1 Purpose and Need for Action

Since the 1850's, there have been 64 documented hurricanes affecting the state of Texas. Over the last 15 years, the National Forests in Texas (NFT) have experienced three major and several small wind events (hurricanes, tornados, and straight line winds). We have learned that rapid treatment of the damaged areas is critical in order to utilize commercial sales as a method for treatment. If not sold commercially, the cost of treating the dead timber is beyond current and expected agency budgets. Ninety to one hundred and twenty days after a wind event, the timber is often not merchantable or sells at a loss so having an environmental assessment in place would recover some of the economic value of the timber. By preparing an environmental document before an event occurs, with all conditions of treatment identified and analyzed ahead of time, when the event occurs, rapid treatment is possible.

The purpose of the project is to improve the ability of the NFT to respond quickly and efficiently to the issues created by wind events. Specifically, the proposed action would:

- Provide for public and firefighter safety,
- Reduce fuels loads from damaged, dying, and dead trees,
- Improve RCW habitat,
- Reduce smoke management issues.

1.2 Existing and Desired Conditions

1.2.1 Existing Condition

Forest Vegetation

Wind Events 1998-2012

The NFT is still recovering from the effects of Hurricane Rita (2005) and Hurricane Ike (2008). While these areas were salvaged after the storms came through, there is still residual debris remaining that could not be salvaged. Where it was necessary, mulching was done in the Wildland Urban Interface (WUI) to control hazardous fuels around private property, mainly private homes. The Davy Crockett National Forest (DCNF) was hit by tornados on November 24, 2004, April 23, 2011, and December 25, 2012. The November 2004 tornado damaged RCW habitat in Alabama Creek Wildlife Management Area. The 2011 tornado damaged the Ratcliff Lake Recreation Area and RCW habitat. The Christmas Day 2012 tornado near Pennington, Texas on the DCNF caused damage to 223 acres of habitat. Figure 1-1 below shows extensive damage on the Angelina National Forest (ANF) after Hurricane Rita in 2005. Table 1-1 displays these events over the last fifteen years with the number of acres impacted and the number of acres treated. Commercial removal after NFT wind events has ranged from several hundred acres after a tornado to several thousand acres after Hurricanes Rita and Ike. Commercial

removal occurred on 12,449 acres after Hurricane Rita in 2005 and 7,263 total acres after Hurricane Ike.

Table 1-1. Wind Events on the NFT 1998-2012.

Wind Event	District	Year	Total Acres Impacted	Total Acres Treated*
1998 Blowdown	Angelina, Sabine, and Sam Houston	1998	103,000 acres	32,500 acres
Hurricane Rita	Angelina	2005	6,400 acres	7,088 acres
Hurricane Rita	Sabine	2005	11,000 acres	5,361 acres
Compartment 44 Blowdown	Sabine	2008	300 acres	75 acres
Hurricane Ike	Davy Crockett	2008	5,535 acres	5,068 acres
Hurricane Ike	Sam Houston	2008	2,540 acres	2,195 acres
Ratcliff Tornado	Davy Crockett	2011	539 acres	530 acres
Christmas Day Tornado	Davy Crockett	2012	223 acres	216 acres

* Acres are from previous wind event decision documents.

Figure 1-1. Extensively damaged area on a hillside in Compartment 89 on the Angelina NF following Hurricane Rita in 2005. This area is representative of fuel model SB4.

Drought 2010-2013

Texas experienced extreme drought conditions across the Forest that lead to stressed conditions for vegetation and wildlife. The highest tree mortality was seen on the Sam Houston National Forest (SHNF) and with moderate mortality on the DCNF. Mortality was detected as early as the summer of 2011.

The drought conditions over the last three years have resulted in extreme fire conditions on the forest.

Wildfires 2011

Because of the drought conditions that worsened in 2011, large wildfires were more frequent and larger than in normal year. East Texas had the worst wildfire season in history in 2011 (Texas Forest Service, 2011 http://txforestservice.tamu.edu/main/article.aspx?id=12888). The Bearing Fire started on private land in Trinity County, Texas near the DCNF in September 2011. The fire impacted 22,000 acres mostly on private land and a small number of acres on the DCNF before the fire was contained. While only 230 acres were impacted on the DCNF, the Forest removed the dead timber and replanted the stand.

1.2.2 Desired Condition
Forest Vegetation

The Plan describes the desired condition as open pine forest with fire adapted oak and hickory trees interspersed within the uplands. The understory would be dominated by grasses, primarily little bluestem. Loblolly and hardwood forests would be interspersed along the streams and bottomland areas (The Plan, p. 86 and 98). From a fuels standpoint, the upland pine forests can be characterized as Fuel Model 2, where grasses are the primary fuels that carry low intensity surface fires (Figure 1-2).

Figure 1-2. Typical Fuel Model 2 conditions, representing the desired condition of upland sites.

The Proposed Action responds to the following Forest Plan Goals and Objectives:

1. Biological Environment- sustain the biologically diverse ecosystems that provide the many natural resources both living and non-living that occur on these NFT lands in east Texas;
   a) Protect and improve habitat for threatened, endangered, and sensitive plant and animal species.

b) Maintain, improve, or restore unique ecosystems using ECS information and restoration of ecological processes emphasizing the fire dependent longleaf and shortleaf pine ecosystems.
c) Manage riparian areas to provide vital corridors for biological exchange and connecting mature forests. Manage riparian areas to protect and enhance soils, water, and vegetation.
d) Manage fire-dependent ecosystems and communities through a prescribe burning program, providing resource protection and ecological management needs,

2. Social- provide social and cultural benefits for the American public and the many Forest and Grassland users from a recreational, environmental and aesthetic perspective;
   a) Protect forest visitors, forest resources, and facilities through adequate law enforcement and safety standards, and by upgrading, replacing or closing administrative facilities to ensure the health and safety of users. Provide for safe use and enjoyment of the NFT facilities by the public.
3. Economic – continue economic benefits that contribute to the support of communities within the planning area;
   a) Maintain future management options by sustaining ecological processes and ecosystems to help meet social and economic demands of the public.
   b) Establish, maintain and protect all landline boundaries.
   c) Provide cost-effective fire protection for public lands and prevent loss of human life.
4. Production – through sound Ecosystem Management practices, maintain the continual flow and the long-term productivity and sustainability of renewable natural resources without the long-term detriment to other resources values; and
   a) Manage for healthy, productive and sustainable forest and range ecosystems.
   b) Manage for multiple resource sustainability of renewable resources, without impairment to the future productivity of the land.
   c) Provide a continual flow of high quality pine and hardwood sawtimber and other forest products.
   d) Minimize losses from insects and diseases through and integrated pest management program.
   e) Improve Forest and Grassland resource production through a prescribed burning program.
5. Physical Environment – implement practices that ensure clean air, soils productivity, and water quality; which are the key to the sustainability of all other resources.
   a) Maintain or improve soils productivity and water quality.

1.3 The Proposed Action

After a wind event, the proposed action prescribes fuel reduction and RCW habitat improvement treatments such as removal, mulching, lop and scatter, and prescribed burning. The combination of all treatments would be limited to no more than 10,000 acres each year over a 10-year span. Over this 10-year span, any wind event that occurs could be treated using the analysis in this environmental assessment. Treatment acres are an estimate of damage that would likely be experienced based on previous large wind events (Table 1-1). The term of salvage sale contracts will be limited to one year from the contract award date. Only existing or temporary roads would be used for accessing the damaged areas since most of the Forest is within one mile of an existing road (Appendix F). The road bed of temporary roads would be pulled up so that the

road is no longer useable. Following timber removal, temporary roads would be obliterated, seeded, water barred, and the entrances would be blocked. The proposed action also includes an adaptive component to allow for modification of the proposed treatments if the desired objectives are not being met. Any proposed changes would be within the range of treatments described in Table 2-1.

Table 2-1 outlines the treatment options for the affected areas. After a wind event, a resource specialist would determine the appropriate treatment based on the characteristics of the area impacted. Treatments would be monitored to determine if the desired outcomes are being achieved and if follow-up treatments or changes in treatments are needed. The treatment of least impact to meet the objectives would be utilized.

The proposed action would remove hazardous fuels through a number of different treatments. Commercial and non-commercial removal would remove the larger diameter fuels but leave the smaller fuels. Mulching would be used to reduce the fuel loads, but does not remove the largest diameter trees. Lop and Scatter would also be used to reduce the size of the smaller diameter fuels. Prescribe burning would be used to remove the small finer fuels. None of the proposed treatments would remove all of the fuels from any of the sites.

Damage would be treated in all Management Areas (MAs) within the standards and guidelines for that MA, as allocated in the 1996 Revised Land and Resource Management Plan (the Plan): MA-1, Upland Forest Ecosystems MA-2, RCW Emphasis, MA-4, Streamside Management Zones, MA-5, Major Aquatic Ecosystems, MA-6, Longleaf Ridge Special Area, MA-8a, Research Natural Areas, MA-8b, Protected River and Stream Corridors, MA-8c, Scenic Areas, MA-8d, Natural Heritage Areas, MA-8e, Special Bottomland Areas, MA-8f, Cultural Heritage Areas, MA-9a, Developed Recreation Sites, MA-9b, Minimally Developed Recreation Sites, MA-10a, Administrative Sites, MA-10b, Special Use Permit Sites, and MA-11 SFA Experimental Forest.

Adaptive Management Monitoring

a. The Air Quality Specialist will:
    i. Monitor $PM_{2.5}$ to determine if smoke from prescribed burning is causing an exceedance on the Forest.

b. The Fuels Specialist will:
    i. Prescribe additional fuel reduction treatments if smoke from prescribe burning causes $PM_{2.5}$ exceedance.

c. The District Wildlife Biologist will:

    i. Monitor the coarse woody debris on site after treatments to determine if additional treatments are needed to remove more cwd or if treatments need to leave move cwd.

Adaptive Management

The NFT plans to use an adaptive management approach for reducing hazardous fuels and restoring RCW habitat after a wind event. Figure 1-3 below illustrates the adaptive management framework and how it will be incorporated into the design of the project. Adaptive management would allow NFT specialists to prescribe the right treatment based on the conditions on the ground. The least intensive treatment to accomplish the objectives would be utilized.

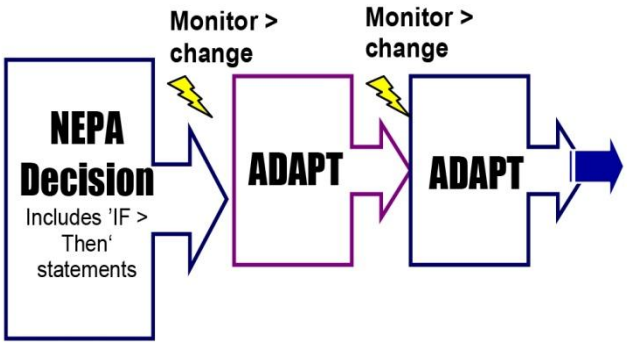


Figure 1-3. Adaptive Management Framework

Adaptive management is a concept for dealing with uncertainty in environmental management. Projects with built-in continuous assessment (monitoring- "If X happened") and processes for improvement ("Then the next action will be taken"). It allows managers the latitude to treat successive portions of the project based on local conditions, and to assess and monitor these activities while staying within the range of anticipated impacts described in this document. Adaptive management is used where managers are uncertain of any outcome but fairly certain of the direction they would pursue if a change were necessary.

1.4 Decision Framework

Given the purpose and need, the deciding official reviews the proposed action, the other alternatives, and the environmental consequences in order to make the following decisions:

- Whether the proposed activities and alternatives are responsive to the issues, accomplish Forest Plan direction, and meet the purpose and need as defined for the Wind Event EA,
- Which actions or alternative to approve and implement, and
- Whether the information in this analysis is sufficient to implement the proposed activities.

1.5 Public Involvement and Collaboration

A public meeting was held on December 6, 2011 at the NFT Supervisor's Office (SO) in Lufkin, Texas. The meeting was attended by four individuals representing varied outside interests and representatives of the NFT.

The NFT explained the Purpose and Need for the project and internal interest in using adaptive management to meet our project objectives. The Interdisciplinary Team (IDT) conducted scoping to determine the issues related to the proposed actions. Public notification began on July 18, 2012 when the Supervisor's Office mailed a scoping letter to interested and affected agencies,

organizations and individuals. Comments received during scoping were used to help in defining issues, develop alternatives and project design criteria, and analyze effects.

1.5.1 Public Involvement Post Wind Event

Public involvement after a wind event would be handled similarly to previous wind events. The NFT Public Affairs Office would develop an Information Operation Plan that outlines how information will be shared with the public. Once initial assessments of the damage have been completed and mapped, the public would have the opportunity to provide comment. Public input would be gathered either during a public meeting and/or a field visit of the wind damaged areas. This would occur after areas have been deemed safe or with a FS escort into damaged areas.

1.6 Issues

Comments received at the public meeting and during the scoping period expressed a general concern for resource issues on the NFT. Based on the comments received and the evaluation of the interdisciplinary team, the following issues were identified.

Issue 1 - Special Management Areas (SMAs)
There is a concern that salvage logging could cause damage to sensitive plants, sensitive plant communities, natural heritage areas, and cultural heritage areas that the SMAs were established to protect. The SMAs are designated as not suitable for timber management; however, timber harvest can occur to accomplish non-timber related goals: MA-8b-101, MA-8c-123, MA-8d-123, MA-8e-81, MA-8f-101). Some vegetation management could be necessary to protect the resources that the SMAs were designed to protect.
The following Forest Plan standards could be violated unless some management occurs within the SMA:
MA-8c-34: Allow fuels to accumulate at natural rates unless they threaten the objectives of Scenic Areas (8c-Scenic Areas).
MA-8d-33: Normally allow fuels to accumulate at natural rates unless they threaten the objectives of the area (8d- Natural Heritage Areas).
Measure: Acres of SMA impacted.

Issue 2 - Hazardous Fuels and Smoke Management
There is a concern that heavy fuel loads would cause smoke management issues and exceedances of National Ambient Air Quality Standards (NAAQS) for Particle Pollution ($PM_{2.5)}$. The Harris County $PM_{2.5}$ monitor is located 25 miles south of the SHNF (Environmental Protection Agency Site ID # 482010024).
The Proposed Action (Alternative 2) and Alternative 4 address the issue of hazardous fuels and smoke management by including MAs 1 and 2 in the areas to be treated.
Measure: Fuel load in tons/acre
Measure: $PM_{2.5}$ in micrograms per cubic meter of air ($\mu g/m^3$).

Threshold for $PM_{2.5}$: The Environmental Protection Agency (EPA) has established $PM_{2.5}$ to protect public health and the environment; the daily standard is set at 35 micrograms per cubic meter of air, while the annual standard is set at 12 micrograms per cubic meter of air. If $PM_{2.5}$ levels are exceeded, the Forest would reduce the size of its prescribed burns or reduce the size of fuels consumed by either mulching or lop and scatter until appropriate levels are met.

2.0 Alternatives

2.1 The Proposed Action

The National Forests in Texas proposes to remove hazardous fuels through a number of different treatments. Commercial and non-commercial removal would remove the larger diameter fuels but leave the smaller fuels. Mulching would be used to reduce the fuel loads but could not be used to remove the largest diameter trees. Lop and Scatter would also be used to reduce the size of the smaller diameter fuels. Prescribe burning would be used to remove the small finer fuels. None of the proposed treatments would remove all of the fuels from any of the sites. Treatments could occur in all management areas except MA-7 Wilderness.

After a wind event, the proposed action prescribes fuel reduction and RCW habitat improvement treatments such as removal, mulching, lop and scatter, and prescribed burning. The combination of all treatments would be limited to no more than 10,000 acres each year over a 10-year span. Over this 10-year span, any wind event that occurs could be treated using the analysis in this environmental assessment. Treatment acres are an estimate of damage that would likely be experienced based on previous large wind events (Table 1-1). The term of salvage sale contracts will be limited to one year from the contract award date. Only existing or temporary roads would be used for accessing the damaged areas since most of the Forest is within one mile of an existing road (Appendix F). The road bed of temporary roads would be pulled up so that the road is no longer useable. Following timber removal, temporary roads would be obliterated, seeded, water barred, and the entrances would be blocked.

Table 2-1 outlines how each potential affected area would be treated. After a wind event, a resource specialist would determine the appropriate treatment based on the characteristics of the area impacted. The treatment of least impact to meet our objectives would be utilized. The fuel specialist would determine if the fuel load after the wind event is light enough to be treated initially with prescribed burning, mulching or lop and scatter. Heavier fuel loads may require either commercial or non-commercial removal. Treatments would be monitored by the fuels specialist, wildlife biologist, botanist, or archeologist to determine if the desired outcomes are being achieved and if follow-up treatments or changes in treatments are needed.

Table 2-1: Treatment Table based on resulting wind event conditions. Individual Management Area guidance applies.

Area Condition Description	Damage < 30%	Damage 30-60%	Damage >60%
• Low commercial merchantability • Access is limited, • Fuel loading less than .5 ton/ac and/or, • Not adjacent to areas of concern	Prescribed fire	Prescribed fire	Prescribed fire
• Low commercial merchantability,	Prescribed fire,	Prescribed fire,	Prescribed fire,

Area Condition Description	Damage < 30%	Damage 30-60%	Damage >60%
• Access limited, • Fuel loading less than .5 ton/ac and/or, • Adjacent to areas of concern	Lop and Scatter,	Lop and Scatter, Mulch, Removal	Lop and Scatter, Mulch, Removal
• Low commercial merchantability, • Access not limited • Fuel loading between 1 and 3 tons/ac, and/or, • Adjacent to areas of concern	Prescribed fire, Lop and Scatter, Removal*	Prescribed fire, Lop and Scatter, Removal	Prescribed fire, Lop and Scatter, Removal
• Commercially merchantable, • Access limited, • Fuel loading between 1 and 3 tons/ac.	Prescribed fire, Lop and Scatter, Removal	Prescribed fire, Lop and Scatter, Mulch, Removal	Prescribed fire, Lop and Scatter, Mulch, Removal
• Commercially merchantable, • Access not limited, • Fuel loading in excess of 3 tons/acre, and/or.	Prescribed fire, Removal	Prescribed fire, Removal	Prescribed fire, Removal

* Removal could be commercial or non-commercial removal.

The following instructions pertain to the removal and marking designation of trees with tree marking paint (TMP) for Alternatives 2-4:

1. Pine trees leaning at a 30 degree angle or greater. An attempt should be made to leave those trees likely to survive (TMP designation not required).
2. Pine trees leaning greater than 45 degrees are designated for removal by contract provision (C2.53# *Designation by Damage Class, DxDAM*). If doubt exists on degree of lean, designate with TMP.
3. Pine trees that are root sprung. If the tree is leaning less than 45 degrees, designated with TMP.
4. Pine trees with severe crown damage or the crown is totally snapped off (see the definition of severe crown damage below). Designate with TMP if leaning less than 45 degrees.
5. Pine tree that have severe trunk damage i.e. major splits, cracks, breaks. Designate with TMP if leaning less than 45 degrees.
6. Within RCW clusters, the designation of trees leaning less than 45 degrees should be coordinated with District Wildlife Biologist.

The following actions are consistent among the Action Alternatives:

Streamside Management Zones (SMZ) associated with Management Area 4 (MA-4) - Pine trees falling across the 50-foot edge of the primary zone would be cut off. Only that portion of the tree outside of the primary zone would be removed. Leaners, snaps, root sprung, or dead trees that originate within the primary zone would not be removed. Trees outside the primary zone that are leaning into the primary zone could be removed. The secondary zone will be delineated from the primary zone outward to the extent of the streamside management zone, and will vary depending on biological and physical factors within the landtype association, historical use, and

topographical position. Delineation of the secondary zone will use one or more of the seven criteria listed on page 152 of the Plan.

The NFT does not plan to sell hardwood after a wind event. Standing or downed hardwoods that are contributing to a fuel problem or are a safety hazard, could be mulched, lopped and scattered, or sold to the public for personal use firewood. There may be rare occasions when a logging contractor may remove hardwoods in order to assist with general forest clean up where the contractor is already on site. This would only be done on a case-by-case basis and is the exception rather than the rule. Hardwoods that are not contributing to the fuel load and are not a safety hazard would be left on site **as** (to contribute to) coarse woody debris.

The FS would leave an average of 0.5 tons per acre of coarse, woody debris (CWD) per treatment area. For example, in a longleaf pine sawtimber stand 0.5 tons per acres would be equivalent to 10 downed trees that are 6 inches in diameter and 12 feet long. After evaluating the stand conditions, the district wildlife biologist would determine if additional CWD is needed. Future treatments would be coordinated with the fuels specialist and modified to leave more CWD in other damaged areas based upon the wildlife biologist's assessment.

Recreation trails occur on all NFT units. Hazard trees along the trail routes or at the trailheads present a safety issue. Tree removal methods may include standard logging equipment in some situations while the use of smaller equipment better suited to operation along a trail route may be needed. Removal of hazard trees occurring within 200 feet of either side of an existing designated recreation trail may be conducted with standard logging equipment limited to operation from the existing trail tread only. Use of smaller vehicular rubber tired equipment may also be used provided no new ground disturbance occurs and is confined to the existing trail tread. Log staging areas and/or landings and decks will be confined to existing hardened parking surfaces and roads. For treatment areas that would be only cut and consist of moving small segments of individual stems of timber to the interior of the forest away from the trail, small rubber-tired equipment may be used provided all operations do not extend beyond the 200-foot wide corridor on either side of the trail centerline. Pushing of cut stems of timber into the forest interior with large equipment would be prohibited.

2.2 Alternative 1 - No Action

No vegetation treatments would occur under this alternative.

2.3 Alternative 3 - High Priority Areas Only

Treat only high priority areas: roads, administrative and recreational areas, boundary lines, and within RCW clusters. Drop treatments in damage less than 30% except for prescribed fire (Table 2-2).

Table 2-2: Treatment Table based on resulting wind event conditions. Individual Management Area guidance applies.

Area Condition Description	Damage < 30%	Damage 30-60%	Damage >60%

Area Condition Description	Damage < 30%	Damage 30-60%	Damage >60%
• Low commercial merchantability • Access is limited, • Fuel loading less than .5 ton/ac and/or, • Not adjacent to areas of concern	Prescribed fire	Prescribed fire	Prescribed fire
• Low commercial merchantability, • Access limited, • Fuel loading less than .5 ton/ac and/or, • Adjacent to areas of concern	Prescribed fire	Prescribed fire, Lop and Scatter, Mulch, Removal*	Prescribed fire, Lop and Scatter, Mulch, Removal
• Low commercial merchantability, • Access not limited • Fuel loading between 1 and 3 tons/ac, and/or, • Adjacent to areas of concern	Prescribed fire	Prescribed fire, Lop and Scatter, Removal	Prescribed fire, Lop and Scatter, Removal
• Commercially merchantable, • Access limited, • Fuel loading between 1 and 3 tons/ac.	Prescribed fire	Prescribed fire, Lop and Scatter, Mulch, Removal	Prescribed fire, Lop and Scatter, Mulch, Removal
• Commercially merchantable, • Access not limited, • Fuel loading in excess of 3 tons/acre, and/or.	Prescribed fire	Prescribed fire, Removal	Prescribed fire, Removal

* Removal could be commercial or non-commercial removal.

2.4 Alternative 4 - Modified Alternative 3

Treatments would occur over more of the Forest and include roads and trails, administrative and recreational areas, RCW clusters (including those in MA 6 and 8), MA 2, MA 6, boundary lines, and MA 1. Treat in MA 4 primary zone only where there is damage near a private boundary line (this would be done to maintain fire breaks). Drop treatments in damage less than 30% except for prescribed fire (Table 2-3).

Table 2-3: Treatment Table based on resulting wind event conditions. Individual Management Area guidance applies.

Area Condition Description	Damage < 30%	Damage 30-60%	Damage >60%
• Low commercial merchantability • Access is limited, • Fuel loading less than .5 ton/ac and/or, • Not adjacent to areas of concern	Prescribed fire	Prescribed fire	Prescribed fire
• Low commercial merchantability, • Access limited, • Fuel loading less than .5 ton/ac and/or,	Prescribed fire	Prescribed fire, Lop and Scatter, Mulch, Removal*	Prescribed fire, Lop and Scatter, Mulch, Removal

Area Condition Description	Damage < 30%	Damage 30-60%	Damage >60%
• Adjacent to areas of concern			
• Low commercial merchantability, • Access not limited • Fuel loading between 1 and 3 tons/ac, and/or, • Adjacent to areas of concern	Prescribed fire	Prescribed fire, Lop and Scatter, Removal	Prescribed fire, Lop and Scatter, Removal
• Commercially merchantable, • Access limited, • Fuel loading between 1 and 3 tons/ac.	Prescribed fire	Prescribed fire, Lop and Scatter, Mulch, Removal	Prescribed fire, Lop and Scatter, Mulch, Removal
• Commercially merchantable, • Access not limited, • Fuel loading in excess of 3 tons/acre, and/or.	Prescribed fire	Prescribed fire, Removal	Prescribed fire, Removal

* Removal could be commercial or non-commercial removal.

2.5 Comparison of Alternatives

A comparison of the alternatives as they relate to the issues from scoping are located in Table 2-4. The issues to be analyzed were discussed in Chapter 1.

Table 2-4. Comparison of Alternatives as they relate to the issues from scoping.

Issue	Alternative1 – No Action	Alternative 2- Proposed Action	Alternative 3 – High Priority Areas Only	Alternative 4 – Modified Alternative 3
Special Management Areas (SMAs)	No treatments would occur so there would be **0 acres of SMA** impacted.	Acres of SMA that could potentially be impacted by the proposed action: MA 6: 32,300 acres MA8a: 225 acres MA8c: 4,757 acres MA8d: 2,721 acres MA8e: 11,475 acres MA8f: 2,380 acres Total acres of SMA that could potentially be impacted by the proposed action: **53,858 acres**	No treatments would occur so there would be **0 acres of SMA** impacted.	Treatments would occur in RCW clusters in Longleaf Ridge Special Area MA 6-32,300 and in Fox Hunter's Hill MA 8d-451 acres. Total acres of SMA that could potentially be impacted by the proposed action: **32,751 acres**
Hazardous Fuels and Smoke Management.	No treatments would occur. Hazardous fuels would continue to build up after a wind event leading to fuels and smoke management issues.	Treatments are proposed in all Management Areas (MAs) except MA7 Wilderness. **Treatments would occur on a maximum of 10,000 acres in any one year.**	Areas treated in priority order are: roads, administrative and recreation sites, trails, boundary lines and RCW clusters and recruitment stands. Treatments would occur on a maximum of 5,000	Areas treated in priority order are: roads, trails, administrative and recreation sites, RCW clusters, rest of MA2, MA6, boundary lines, and MA1. **Treatments would occur on a maximum of 10,000 acres in any single year.**

			acres in any single year.	
Potential treatments acres by Alternative:	**0 acres treated.**	MA 1: 218,000 acres MA 2: 250,000 acres MA 4: 49,800 acres MA 5: 16,300 acres MA 6: 32,300 acres MA 8: 21,558 acres MA 9: 6,094 acres MA 10: 129 acres MA 11: 2,600 acres **Total potential acres 596,781 acres** Miles of Roads: 2,396 miles Miles of Trail: 823 miles **3,219 acres miles**	MA 9: 6,094 acres MA 10: 129 acres RCW clusters: 10,267 acres **16,490 acres** Miles of Roads: 2,396 miles Miles of Trail: 823 miles **3,219 miles**	MA 1: 218,000 acres MA 2: 250,000 acres MA 6: 32,300 acres MA 8d: 451 acres MA 9: 6,094 acres MA 10: 129 acres **Total potential acres 506,974 acres** Miles of Roads: 2,396 miles Miles of Trail: 823 miles **3,219 miles**

2.6 Management Requirements and Monitoring

2.6.1 Management Requirements

Specific requirements that apply to the project actions are found in Chapter IV of the Plan, under forest-wide standards and guidelines (p. 53-84), and the standards and guidelines for each Management Area (the Plan, p. 85-288).

2.6.2 Monitoring

The following monitoring will occur:

1. Inactive clusters would be checked prior to project implementation to ensure cluster is not active.
2. Use of open and closed roads will be evaluated on a case-by-case basis, through consultation with USFWS, to determine if specific open roads can be used during nesting season without causing incidental take.
3. During tree removal operations, a Forest Service timber Sale Administrator will inspect operations regularly to ensure compliance with mitigation measures and contract provisions. During periods of wet weather or marginal conditions, at the beginning of sale operations, and at other critical periods, inspections will be done on a daily basis when timber sale contractors are working. These inspections will be documented, and violations will be promptly reported to the Contract Administration Team and District Ranger.
4. Road improvements such as culvert installation will be monitored to ensure proper fish passage.
5. The damaged areas will be evaluated during and after tree removal for soil movement.
6. After completion of the project, fuel specialists will evaluate the fuel loading in the treated areas to determine the need for further treatments.
7. Monitoring the treated areas for snags and coarse woody debris. Treatments could be modified to leave or remove more cwd.
8. Monitoring would be similar to that which is being conducted as part of the NFGT 1996 Plan and Non-Native Invasive Plant Species (NNIPS) EA. Monitoring of environmental

conditions would occur during direct NNIPS treatments. Monitoring of non-target resources, including wildlife, plant and animal abundance, and aquatic resources would also occur. Effectiveness monitoring would be implemented during the next growing season following treatment. Inventories for new infestations as a result of the proposed activities would be conducted every growing season. The monitoring and inventories would be conducted by qualified NNIPS, Range, and/or Botany personnel on the NFGT.

Project and contract administrators would perform much of the project monitoring during project implementation. Other resources specialists would monitor specific progress including application of design criteria and mitigation related to their resource of concern.

3.0 Environmental Impacts

3.1 Introduction

This section summarizes the key environmental impacts of the Proposed Action as described in the specialist reports. It provides the necessary information to determine whether or not to prepare an Environmental Impact Statement (EIS). The analysis and conclusions about the potential effects of concern are summarized and cited below. Effects to recreation are negligible except for the safety effects to forest visitors which are discussed in Section 3.8 Public Health and Safety. The reports, which disclose the full analysis of the direct, indirect, and cumulative effects, are available online at http://www.fs.usda.gov/projects/texas/landmanagement/projects or in the Project File, located at the Supervisor's Office in Lufkin, Texas.

3.2 Water Resources, Wetlands, Floodplains

WATER

Affected Environment

Numerous major stream systems drain the project area. The primary beneficial uses of the streams in the project area are fisheries and recreation. All of the streams flow into the major tributaries of the Neches, Trinity, and Sabine Rivers. Stream courses within the project area exhibit characteristics common to most streams in the East Texas region. Some intermittent and ephemeral tributaries of the main streams show successional head cutting of the stream channel. This condition is believed to have been initiated when the area was cutover in the 1930's. The successional head cutting will continue until the channel reaches the natural angle of repose.

The project area contains an extensive road network, and approximately 16 percent of the land within the project area consists of non-wooded pasture and crop lands (Fry et al. 2011). Both roads and non-wooded agricultural lands have a higher run-off than areas with timber.

FEMA floodplain designations indicate that approximately 80 percent of the project area is outside the 500-year floodplain with less than 0.2 percent annual probability of flooding, and that 20 percent of the project area has an annual probability of flooding of 1 percent or greater in the event of a 100-year flood.

Cumulative Effects

The cumulative effects area for water consists of 2,243,367 acres in 97 watersheds. Seventy-three percent of the watershed area is in private lands (1,616,000 ac) and twenty-three percent (627,367 ac) is in Forest Service lands. Details for the watersheds are displayed in Appendix A.

Activities that have occurred, or would occur, in the watersheds in the event of impacts from wind events would be considered in the cumulative effects to water for this project. Treatment

options based on damage severity and impacts for Management Area (MA) 4 Streamside Management Zones and MA 5 Major Aquatic Ecosystems are listed in Table 3-1.

Environmental Consequences

Alternative 1 - No Action
No additional management-initiated impacts to water would occur under this alternative. Conditions would generally remain the same. Changes to water properties would result mainly from other natural disturbances, such as wildfire. The overall risk to water resources from natural events is low.

Cumulative Effects
While no activities would take place in the project area, under this alternative, other actions would still go forward. Prescribed burning is planned throughout the Forest on a two to three year cycle. The biggest cumulative impact to water in the project area, even with the ongoing activities listed above, would be the continued sedimentation from roads.

Table 3-1. Treatment options based on damage severity and impacts in MAs 4 and 5.

[1]Damage Severity	Damage to Streams within 200 ft of Property Boundary	Treatment Options
Light	No	No action, prescribed burning
Light	Yes	No action, mulch, lop and scatter, prescribed burning
Moderate	No	No action, prescribed burning
Moderate	Yes	No action; [2]mulch, lop and scatter, prescribed burning
Extensive	No	No action, prescribed burning
Extensive	Yes	No action; [2]commercial removal, mulch, lop and scatter, prescribed burning

[1]Light: <30%, Moderate: 30-60%, Extensive: >60%.
[2]No mechanized equipment used in the primary zone.

Alternative 2 – Proposed action
Water yields would increase temporarily after timber removal, mulching, lop and scatter, and/or prescribed burning treatments are implemented. The effect is more related to reduced water use by vegetation than effects on soil properties (USDA 1989, Blackburn et al. 1989). Surface runoff could cause erosion where water becomes channeled and mineral soils are exposed. Skid trail and temporary roads would produce most of the soil movement. Establishment of stream protection zones, waterbarring, and seeding, and fertilizing of bare soil areas would mitigate the potential for sediment delivery to streams.

Underburns have a negligible effect on stream nutrients, water yields, and stream sediment loads (USDA 1989). To minimize the potential for effects on soil and water resources, firelines would

not be plowed near stream course zones. Water diversion structures and prompt revegetation would prevent soil loss and sedimentation in stream courses.

Temporary road improvements would disturb soil, but they are designed to improve the stability of road surfaces and improve drainage of the roads. In the long-term, the amount of sediment produced by the road system would be reduced. Temporary road reconstruction would create the potential for soil movement. Skid trails and temporary roads would produce most of the sediment resulting from logging activities. Initial ground disturbance produces the greatest sediment yield (Blackburn et. al. 1989). Sediment production from Coastal Plains forest roads having little or no slope can be dramatically reduced through road management practices (Appelboom et. al 2002). Following any commercial removal, temporary roads would be obliterated, seeded, water bars installed and entrances blocked.

Cumulative Effects
Thinning, midstory reduction, and prescribed burning, and road maintenance are the typical activities that have occurred in the cumulative effects area in the last three years on the National Forests, in the watersheds that surround the project area. The cumulative effects to water from the activities, combined with those proposed under the Proposed Action, would result in some risks to water quality, mainly through sedimentation.

Temporary road reconstruction and improvements needed to access the harvest areas anticipated in the Proposed Action present the greatest potential for watershed effects in the project area. All roads would be reconstructed to *The Plan's* standards and guidelines. The measures in the *Plan* would minimize the potential for stream sedimentation.

Commercial removal and fuels reduction activities (e.g., mulching, lop and scatter) would be implemented over a one to three year period. Ground disturbance would not be concentrated in any one area during any time period at levels that would result in cumulative effects. No management activities that would affect water resources are expected on the private land in the area.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, Ma 6, or MA 8 the direct, indirect, and cumulative effects on water resources would be similar to Alternative 1. Treatments would only occur on 16,490 acres which is approximately 2% of the total Forest acres. This would have little impact on Forest water resources.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. No treatments would occur in MA 4 (Streamside management Zones), except along boundary lines, or in MA 5 (Major Aquatic Ecosystems) so there would be additional protections in place for water resources on the Forest.

3.3 Soil
Affected Environment

The project area lies predominantly within the Outer Coastal Plain Mixed Forest and the Southeastern Mixed Forest Provinces based on Ecological Classification System (ECS) variables of geomorphology and climate (Van Kley et al. 2007). Subsections reflect climate, vegetation, and geomorphology. Subsections within the project area include the Southern Loam Hills, Piney Woods Transition, South Central Arkansas, Sand Hills, Neches Alluvial, and Sabine Alluvial.

Land Type Associations (LTAs) are based on ECS landforms, soil associations, and natural overstory communities. LTAs with the greatest extents in the project area are the Clayey Uplands, Raven Hills, Alluvial Floodplains and Terraces, Big Thicket, and Lignitic Uplands. Other LTAs in the project area include the Sandy Uplands, Redlands, Mayflower Uplands, Sparta Sandhills, and San Jacinto Flatwoods.

The Clayey Uplands LTA occurs on the slightly rolling terrain of the Cook Mountain, Yegue, Yazoo, Moodys Branch, and Caddell formations. The Cook Mountain formation consists of marine and littoral, clay, and glauconite. The Yegua formation consists of continental and palustrine sand and sandy clay. The Yazoo, Moodys Branch, and Caddell formations consist of marine clay and glauconitic sands and marl. Clayey soils with small amounts of loamy topsoil are common. Pre-settlement vegetation was probably variable, and included beech-white oak, loblolly pine-oak, shortleaf pine-oak, and longleaf pine-little bluestem communities. The Clayey Uplands occupies most of the DCNF and the ANF.

The Raven Hills LTA occurs on the gently rolling to undulating terrain of the Fleming and Willis formations. The Fleming formation consists of Miocene calcareous clays, silt, and sandstone. The younger Willis formation occurs as topographically higher patches overlying Fleming clays and consists mainly of Pleistocene fluviatile sand. Soils consist of loam to loamy sand over clay subsoil, and calcareous clay outcrops. On the Fleming formation, mixed hardwood-shortleaf-loblolly pine forests are dominant and small blackland prairie openings with herbaceous little bluestem-Indiangrass communities occur on outcrops of calcareous clays. The Willis sand-caps typically support shortleaf pine-post oak forests. The Raven Hills occupy most of the northern and western portions of SHNF.

The Alluvial Floodplain and Terrace LTA represents the broad, nearly level floodplains and associated terraces of the numerous rivers and larger streams (excluding the Red River) that pass through the West Gulf Coastal Plain landscape. Soils developed in Holocene and Pleistocene alluvial clays, loams, and sands. Fluvaquents, udifluvents and other alluvial soils are common on the active floodplains of these rivers. The LTA occupies the easternmost edge of the Sabine NF and the center section of the ANF.

The Big Thicket LTA is found on broad, gentle slopes and well-defined drainages associated with the Willis formation. Within this LTA, the Willis formation occurs as a continuous band of Pliocene to upper Pleistocene fluviatile sand and gravel. Soils generally consist of sandy loam to loamy sand surface soil over sandy clay loam subsoil. Characteristic vegetation includes shortleaf pine-oak and loblolly pine-oak forests on the uplands, hardwood forest on lower slopes and minor stream bottoms, and sweetbay magnolia forested seep communities in groundwater seepage areas. The LTA occupies most of the southeastern portion of SHNF.

The Lignitic Uplands LTA occurs on the Paleocene Wilcox group of formations, which consists of a heterogeneous series of sands and lignitic clays of continental and near-shore origin. Terrain is level to rolling. The dominant historical natural vegetation is believed to have been shortleaf pine-oak or loblolly pine-oak forest. Although natural fires were likely important historically in structuring upland vegetation, longleaf pine communities were probably restricted to isolated patches on dry uplands in the transitional LTA. The northern portion of the SNF is within the LTA.

ECS Land Type Phase (LTP) is derived from soil types, landscape position, and natural vegetative communities. The soil macrogroups loam (36%) and claypan (28%) are common in the project area, followed by deep sand (11%) and sandy soil (10%) (Diamond and Elliott 2010). To a lesser degree, soil macrogroups consist of bottomland (6%), clayey (4%), flatwoods (2%), claypan savannah (1%), blackland (1%), and nine other types that account for less than 2% of the total (Diamond and Elliott, 2010). Generally LTP landscape position in the project area tends to be lower (63%) rather than higher (37%). LTP vegetative communities are variable and are dominated by shortleaf, loblolly, and longleaf pine, and oak types (Diamond and Elliott 2010).

Analyses of the NRCS SSURGO soils database (NRCS 2009) indicate that the predominant soil series in the southwestern portion of the project area are the Depcor, Conroe, and Pinetucky series. In the northwestern part, the Fuller, Kurth, and Keltys soil series predominate. In the east central area, the most common soils are the Moswell, Alazan, and Rosenwall series. In the eastern portion, typical soils are the Eastwood, Moswell, and Metcalf series. Characteristics of the predominant soils in the project area are detailed in Table 3-2. The complete list of soil series in the project area can be found in Appendix B.

The Alazan series consists of very deep, moderately well drained, moderately permeable soils that formed in loamy alluvial or marine sediments. The nearly level soils are on Pleistocene terraces. Slopes range from 0 to 2 percent.

The Conroe series consists of deep, moderately well drained, slowly permeable soils on uplands. The soil formed in acid clayey and loamy sediments. Slopes range from 0 to 12 percent.

The Depcor series consists of deep, moderately well drained, slowly permeable soils that formed in unconsolidated loamy sediments. These gently sloping to strongly sloping soils are found on uplands. Slopes range from 1 to 12 percent.

The Eastwood series consists of deep to densic, well-drained soils. The nearly level to gently sloping soils are formed of clayey residuum weathered from sandstone and shale. Slope ranges from 1 to 3 percent.

The Fuller series consists of very deep, somewhat poorly drained, nearly level and gently sloping soils on uplands. They have a fine sandy loam surface layer and were formed from loamy sediments over mudstone. Subsoil for this series is a silty clay loam.

The Metcalf series consists of deep, somewhat poorly drained, very slowly permeable soils that formed in Pleistocene-age loamy marine or alluvial sediments over Tertiary age clayey deposits.

The soils are on broad level, nearly level marine or stream terraces on the Coastal Plain. Slope ranges from 0 to 2 percent.

The Pinetucky series consists of deep, moderately well drained, moderately slowly permeable soils that formed in loamy coastal plain sediments of Pleistocene age. The gently sloping to sloping soils are found on uplands. Slopes range from 1 to 8 percent.

The Keltys series consists of very deep, very gently sloping to moderately sloping, slowly permeable, moderately well drained soils on uplands. The surface layer is fine sandy loam with fine sandy loam subsoil.

The Kurth series consists of soils that are very deep to geologic materials of sandstone and/or mudstone. They are moderately well drained, slowly permeable soils. The soils were formed in loamy coastal plain sediments. The gently sloping to moderately sloping soils are generally found on uplands. Slopes range from 1 to 8 percent.

The Moswell series consists of deep, well- drained, gently sloping to moderately steep soils on uplands. They have a loamy surface texture with dense clay subsoil. Slopes are dominantly 3 to 8 percent, but can range from 1 to 15 percent.

The Rosenwall series consists of moderately deep, moderately well drained soils. The gently sloping to moderately steep soils formed in clayey marine sediments derived from interbedded shale and sandstone. Slope ranges from 1 to 15 percent.

Table 3-2. Characteristics of Predominant Soils in Project Area.

Map Unit	Soil Name	Harvest Equipment Operability[1]	Off Road/Trail Erosion Hazard Potential[2]	Fire Damage Hazard Potential[3]
AaB	Alazan very fine sandy loam, 0-2% slopes	Well/moderately suited	Slight	Somewhat limited
CrB	Conroe gravelly loamy fine sand, 1-5%	Well/moderately suited	Slight	Not limited/ somewhat limited
9	Depcor-Huntsburg assoc., gently undulating	Well/moderately suited	Slight	Somewhat limited/ very limited
10	Depcor-Huntsburg-Gunter assoc., gently rolling	Well suited	Slight	Somewhat limited/ very limited
EeB	Eastwood very fine sandy loam, 1-5% slopes	Moderately suited	Slight	Somewhat limited
FuB	Fuller fine sandy loam, 1-3% slopes	Well/moderately suited	Slight	Somewhat limited
KeB	Keltys fine sandy loam, 1-3% slopes	Well/moderately suited	Slight	Somewhat limited
KuB	Kurth fine sandy loam, 1-3% slopes	Well suited	Slight	Somewhat limited
Map Unit	**Soil Name**	**Harvest Equipment**	**Off Road/Trail Erosion**	**Fire Damage Hazard Potential[3]**

		Operability[1]	Hazard Potential[2]	
MsB	Moswell loam, 1-5% slopes	Moderately suited	Slight	Somewhat limited
MsD	Moswell loam, 5-15% slopes	Moderately suited	Moderate	Somewhat limited
MiS	Metcalf-Sawtown complex, 0-2 % slopes	Moderately suited	Slight	Somewhat limited
PfB	Pinetucky fine sandy loam, 1-5% slopes	Well suited	Slight	Somewhat limited
RoB	Rosenwall fine sandy loam, 1-5% slopes	Well suited	Slight	Somewhat limited

[1]Harvest equipment operability ratings indicate the suitability for use of forestland harvesting equipment. The ratings are based on slope, rock fragments on the surface, plasticity index, content of sand, the Unified classification of the soil, depth to a water table, and ponding. Standard rubber-tire skidders and bulldozers are assumed to be used for ground-based harvesting and transport. Rating class terms indicate the degree to which the soils are suited to this aspect of forestland management. "Well suited" indicates that the soil has features that are favorable for the specified management aspect and has no limitations. Good performance can be expected, and little or no maintenance is needed. "Moderately suited" indicates that the soil has features that are moderately favorable for the specified management aspect. One or more soil properties are less than desirable, and fair performance can be expected. Some maintenance is needed. "Poorly suited" indicates that the soil has one or more properties that are unfavorable for the specified management aspect. Overcoming the unfavorable properties requires special design, extra maintenance, and costly alteration.

[2]Potential off road/trail erosion hazard ratings indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. The ratings are based on slope and soil erosion factor K. The soil loss is caused by sheet or rill erosion in off-road or off-trail areas where 50 to 75 percent of the surface has been exposed by logging, grazing, mining, or other kinds of disturbance. The hazard is described as "slight," "moderate," "severe," or "very severe." A rating of "slight" indicates that erosion is unlikely under ordinary climatic conditions; "moderate" indicates that some erosion is likely and that erosion-control measures may be needed; "severe" indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised; and "very severe" indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

[3]Potential fire damage hazard ratings are based on texture of the surface layer, content of rock fragments and organic matter in the surface layer, thickness of the surface layer, and slope. The soils are described as having a "not limited," "somewhat limited," or "very limited" potential for this kind of damage. "Not limited" indicates that fire damage is unlikely. Good performance can be expected, and little or no maintenance is needed. "Somewhat limited" indicates that fire damage can occur because one or more soil properties are less than desirable. Fair performance can be expected, and some maintenance is needed. "Very limited" indicates that fire damage can occur because of one or more soil properties and that overcoming the unfavorable properties requires special design, extra maintenance, and costly alteration.

The boundaries for the watersheds define the cumulative effects area for soils. Activities that have occurred on the Forest in the last three years (2010-2012) would be considered, since this is the amount of time it is estimated for an area to recover from disturbances such as timber removals. Timber harvest, prescribed buring, road maintenance, and the drilling of oil and gas wells have taken place during the last three years.

Environmental Consequences

Alternative 1 - No Action

In implementing this alternative, no additional activities would occur to impact soil properties. Conditions would generally remain the same. Changes to soil properties would be the result of natural disturbances, such as wildfire. A wildfire could kill overstory vegetation, expose soil, and result in soil nutrient losses and erosion. The overall risk to soil resources from natural events is low.

The NRCS Soil Inventory describes the potential fire damage hazard, which reflects the potential for damage to soil nutrients, physical, and biotic characteristics from fire (Table 3-2). Ratings assess the impact of fires, prescribed or wildfire, of moderate intensity (116-520 btus/sec/ft) that provide the necessary heat to remove the duff layer and consume soil organic matter in the surface layer.

Some areas in the project area have a severe potential fire damage hazard. Most likely, the no action alternative would result in a greater probability of soil damage to these areas, assuming that this compartment could eventually be burned by a wildfire under moderate to extreme weather conditions.

Cumulative Effects
Under this alternative, the greatest potential for cumulative impacts to soils would be from soil movement due to firelines constructed during planned prescribed burns, logging roads from on-going timber harvests, and roads accessing oil and gas well pads.

Alternative 2 – Proposed Action
Under this alternative, a maximum of 10,000 acres in a single year would be disturbed by timber removal, mulching, lop and scatter, and/or prescribed burning treatments after a wind events. Only existing or temporary roads would be used for access. The predominant soils in the project area generally are well-suited or moderately well-suited to harvest equipment operability (Table 3-2). Timber removal activities could cause compaction in the skid trails, log landings, and on temporary roads. The amount of compaction that would occur is a function of the volume being removed per acre, the number of acres being harvested, the logging equipment used by the timber purchaser, and soil moisture conditions. Mitigation measures to limit the operating period during wet conditions would help protect these soils. One compaction study found that compaction has little to no effect on early pine productivity. Eighty percent of soil compaction occurs after one pass by heavy equipment, and no differences can be found after four passes. Recovery from compaction depends on the soils, degree of compaction, and type of vegetation present (Scott, et. al 2004).

The removal of trees could increase the potential for erosion from an increase in run off caused by reducing the soil cover. Limiting operations to dry periods and the relatively infrequent entries into the stands provide adequate protection of soil by limiting soil movement and compaction. Remaining stands would maintain a tree canopy, resulting in a moderate potential from soil movement. The soils would have time to recover from the effects of compaction prior to the next timber harvest (USDA 1989).

The Plan contains coefficients to estimate potential soil erosion for the general soil types in the areas where activities are planned. *The Plan* states that tolerance levels provide an estimate of the

total soil loss that can be allowed from accelerated erosion without substantially or permanently lowering soil productivity.

Prescribed burning on a routine cycle would allow litter-duff biota to fully recover between burns: therefore, physical soil properties would not be affected. Underburns do not cause significant leaching losses because nutrients would be retained through the uptake by unburned plants. Loss of organic matter would be about five percent. Underburns are usually light to moderate in severity and expose little or no soil, so their effect on erosion is generally negligble. Overall risks to soil productivity from underburns are minimal (USDA 1989).

In general, predominant soils have a somewhat limited fire damage potential and fair performance can be expected (Table 3-2). Prescribed burning under Alternative 2 would be within acceptable limits on any areas with severe potential fire damage hazard, because weather and fuels would be optimum, minimizing damage.

To minimize the potential for effects on soil resources, firelines would not be constructed near stream course zones. Existing barriers such as roads, streams, and permanent fire lines would be used whenever possible to minimize fire line construction. Bladed lines are constructed or reconstructed as opposed to being plowed in order to minimize soil resource damage. Water diversion structures and prompt revegetation on constructed control lines would prevent soil loss. Post-burn monitoring determines the need for follow-up implementation of additional erosion control measures. The same firelines would be used for repeated burns.

The effects of fuel reduction activities (e.g., removals, mulching, lop and scatter) are similar to those associated with chopping and mowing, which rarely cause compaction. Most vegetation would be cut above the ground line, so little soil would be disturbed. Overall risks to soil productivity and nutrient displacement from this type of midstory control would be minimal (USDA 1989).

It is generally accepted that the majority of sediment produced by forest management practices comes from forest roads (Gucinski, et. al. 2001). Although road improvements would disturb soil, the work that would be done is designed to improve the stability of road surfaces and improve drainage of the roads. The activities would, in the long term, decrease the amount of sediment produced by the road system.

The reconstruction of temporary roads would create the potential for soil movement. Initial ground disturbance produces the greatest sediment yield (Blackburn et. al. 1989). Following timber removal, temporary roads would be obliterated, seeded, water bars installed and entrances blocked.

Cumulative Effects

The cumulative effects to soils from activities proposed in Alternative 2, would result in some risks to soil productivity, mainly through nutrient displacement and erosion.

Temporary road reconstruction and improvements if needed to access the timber removal areas present the greatest potential for both nutrient displacement and soil erosion in the cumulative

effects area. All roads would be reconstructed or improved to *The Plan's* standards and guidelines which would minimize the potential for erosion.

Ground disturbance from timber removal activities would not be concentrated in any one area during any time period at levels that would result in significant cumulative effects.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8, the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres. There are 3,219 miles of roads and trails on the NFT that would potentially need to be treated. Clearing roads and trails with chainsaws and simply moving the trees off the road or trail would have little impact on soils within the project area. If there are enough downed trees in one area to warrant a mechanical treatment, the number of acres treated would be so small that there would be no impact to soil resources.

Alternative 4 - Modified Alternative 3
Because no treatments would occur in MA 4 (Streamside management Zones) or MA 5 (Major Aquatic Ecosystems), there would be additional protection in place for soil resources on the Forest. Both MAs are important for the protection of water quality since existing vegetative cover filters sediment to maintain aquatic habitat.

3.4 Fuels

Affected Environment
In order to analyze the effects of the proposed treatments on fuels and fire behavior it is necessary to describe the likely fuel conditions that would result from a damaging wind event. The two best models for this analysis are the fuels and fire behavior analysis conducted in the aftermath of Hurricane Rita in 2005 and Hurricane Ike in 2008. The following analysis is based primarily on the Hurricane Rita work with references from the Hurricane Ike project.

Fuels

Three categories of damage are utilized in the assessment of potential wind damaged overstory conditions based on previous wind events:

Severe damage – Greater than 60 percent of the existing trees within an area are uprooted, broken off, or root-sprung.

Moderate damage – 30-60 percent of the existing trees within an area are uprooted, broken off, or root-sprung.

Light damage – 10-30 percent of the existing trees within an area are uprooted, broken off, or root-sprung.

Analysis following Hurricane Rita in 2005 and Hurricane Ike in 2008, revealed that most of the storm damage on the Forest was classified as only minimal or light; however, there were many scattered pockets with moderate to extensive damage particularly in open, mature stands such as

RCW habitat and stands adjacent to pastures and young timber. The more heavily damaged areas consisted of numerous uprooted trees, broken trunks, and heavy accumulations of needles, leaves, and branchwood. Even in the minimally damaged (less than 10% canopy damage) and lightly damaged areas, the increase in fine fuels (needle cast and twigs) has increased. It is the accumulation of these smaller diameter fuels (1 – 100 hour fuels) that would contribute most to changes in fire behavior at the flaming front as fire moves across the landscape. The heavier 1000-hr and larger diameter fuels have minimal influence on fire behavior in the flaming front under most burning conditions (Miller 2001) and are not included in following fuel model descriptions. However, these heavier fuels are of great concern regarding potential smoke management problems, resource damage and fire control issues. Under prolonged drought and severe weather conditions these fuels can ignite and burn for long periods, impede fire suppression efforts and require extended mop-up.

Fuel Models Used in the Analysis

The most common fuel models currently reported on the Forest are fuel models FM2, FM7, FM8 and FM9 (Anderson 1982). Due to the lack of burning, a few of the more productive areas may be more representative of FM4, but because these areas are so limited in extent they are not included in the analysis. A description of the fuel models and the parameters used in the analysis is provided in Table 3-3. Photographs of areas representing the different fuel models are included in Appendix C.

Desired Future Conditions for much of the dry uplands and upper slopes within the project area are best represented by FM2, with FM8 and FM9 primarily occurring on the moist, lower slopes or in other fire protected areas. Currently the only areas representative of FM2 are found in MA-2 and MA-6.

Following a wind event, lightly damaged areas that were previously reported as FM8 or FM9 would be more representative of FM10. These areas would consist of widely scattered downed trees and an increase in litter and small diameter dead woody fuels. Post-event fuel loadings for the 1- to 10-hour fuels are estimated to be approximately 50 to 100% greater than the pre-storm conditions. If fire is excluded from these lightly damaged areas, the fine fuels would decompose quite rapidly; however, a shrub component may increase on many areas within a few years resulting in a shift toward FM7. Most lightly damaged areas that were previously reported as FM2 would probably receive relatively light accumulations of fine fuels due to the more open canopies and, as a result, these areas would be still considered FM2 with the grassy fuels as the major fire carrier. Lightly damaged areas that were previously reported as FM7 would be still considered representative of FM7 with the shrub component remaining the major carrier of fire although there would also be a substantial increase in small diameter dead woody fuel. Generally, un-burned pine plantations would fall in this category.

Based on results of recent hurricanes, moderately and extensively damaged areas would likely occur primarily in scattered pockets within a matrix of FM2, FM7 or FM10. These areas would be best characterized by two new fuel models (SB3 and SB4, respectively) which represent logging slash or blowdown fuels. These models were developed by Scott and Burgan (2005) for use with the BehavePlus fire behavior modeling system.

On the moderately to extensively damaged areas, existing fine fuels would also begin to decompose rapidly; however, needles and woody fuels may continue to accumulate over time in some areas due to the delayed mortality of damaged timber in the residual stand. Also, a highly-flammable shrub component is expected to rapidly develop on some sites due to the reduced overstory. The continued accumulation of fine surface fuels, the emerging shrub community and the large amount of dead woody fuels would create hazardous fuel loadings for several years resulting in the potential for extreme fire behavior and elevated fire danger within these localized areas. To represent these conditions, two customized fuel models (SB3/sh and SB4/sh) were derived by adding a shrub component to the two slash-blowdown models.

The heavier 1000-hr and larger diameter fuels are not included in the fuel model descriptions because of their minimal influence on fire behavior in the flaming front under most burning conditions (Miller 2001). However, under prolonged drought and severe weather conditions these fuels can ignite and burn for long periods. They may also impede fire suppression efforts and require extended mop-up. For these reasons, consideration of the larger downed woody fuels is extremely important in assessing potential smoke management problems, resource damage and fire control issues.

Table 3-3. Fuel models and assigned parameters used in fire behavior analysis for the Adaptive Management Project.

Fuel Model	Damage category	Fuel Loading (tons/ac)				Canopy cover	Moisture of extinction	Fuel Bed Depth
		1 hr	10 hr	100 hr	live woody	%	%	ft
				Pre-Wind Event				
FM2	n/a	2	1	0.5	n/a	60	15	1
FM7	n/a	1.1	1.9	1.5	.37	85	40	2.5
FM8	n/a	1.5	1.0	2.5	n/a	85	30	0.2
FM9	n/a	2.9	0.4	0.15	n/a	85	25	0.2
FM2*	Light	2.5	1.5	.75	n/a	60	15	1
FM7*	Light	2	3	2	.37	85	40	2.5
FM10*	Light	4	2	2.5	n/a	85	25	1
SB3	Moderate	5.5	2.8	3	n/a	60	25	1.2
				Post-Wind Event				

SB3/sh**	Moderate	5.5	2.8	3	3	60	40	2.5
SB4	Severe	5.3	3.5	5.3	n/a	30	25	2.7
SB4/sh**	Severe	5.3	3.5	5.3	4	30	40	4

*Fuel loadings were revised from values in the original fuel model to reflect likely conditions based on recent wind events.

**Customized fuel models:

SB3/sh – dead and downed woody fuel loadings from SB3 are combined with high moisture of extinction, fuel bed depth and live woody fuel loading similar to FM7.

SB4/sh – dead and downed woody fuel loadings from SB4 are combined with high moisture of extinction, fuel bed depth and live woody fuel loading similar to FM4.

Predicted Fire Behavior

Fire behavior predictions for the pre- and post-wind event fuel conditions in the project area were generated using the BehavePlus fire modeling system (Andrews *et al*. 2005). The fuel and weather parameters used in the analysis are presented in Table 3-4. Fuel moistures represent the approximate threshold values for the 50th and 90th percentiles for Southeast Texas (Texas Interagency Coordinating Center). Weather parameters were selected to represent both normal and extreme conditions. Live woody fuel moistures reflect dry, fully-cured vegetation conditions typical of the late dormant season.

The results of the fire behavior analysis (Table 3-5) indicate increases in predicted fire behavior and fire danger in the wind damaged stands at both the 50th and 90th percentile thresholds as compared to pre-wind event conditions.

Table 3-4. Fire Behavior inputs used in the analysis. Fuel moistures represent threshold values for the 50th and 90th percentiles.

	50th Percentile	90th Percentile
1-hr Fuel Moisture	9%	6%
10-hr Fuel Moisture	11%	8%
100-hr Fuel Moisture	18%	16%
Temperature	75°	85°
20 ft Windspeed	10 mph	20 mph
Live Woody Fuel Moisture	60%	60%

Under normal burning conditions (50th percentile), fire behavior in the lightly damaged stands represented by FM10 is predicted to exhibit low rates of spread and flame lengths although there is a substantial increase over pre-storm conditions (FM 8 and FM9). In FM2 and FM7, low to moderate rates of spread and low flame lengths are predicted, representing only a slight change in fire behavior from pre-storm conditions. Handlines may be adequate to hold the fire, however, predicted fire behavior is approaching the limit of direct attack.

Table 3-5. Fire behavior outputs for pre- and post-wind event fuels within the proposed Wind Event Project. Fuel moistures and weather parameters for the 50th and 90th percentiles are found in Table 3-4.

Fuel Model	ROS ch/h		Fireline intensity Btu/ft/s		Flame length ft		Overstory mortality %	
	50th %	90th %	50th %	90th %	50th %	90th %	50th %	90th %
Pre-hurricane Conditions								
FM2	5.9	16.8	44	134	2.6	4.3	18	18
FM7*	6.0	14.7	54	143	2.8	4.4	35	35
FM8	0.4	0.8	1	3	0.5	0.7	29	29
FM9	1.2	3	8	20	1.1	1.8	29	29
Light Damage								
FM2	5.4	15.2	47	142	2.7	4.4	18	18
FM7*	6.7	16.5	100	270	3.7	5.9	35	47
FM10	3.5	8.5	59	156	2.9	4.6	29	29
Moderate Damage								
SB3	5.2	13.5	116	331	4.0	6.5	35	62
SB3/sh	11.2	27.5	545	1444	8.2	12.8	97	99
Extensive Damage								
SB4	37.6	122	899	3178	10.3	18.4	99	99
SB4/sh	62.2	181	3313	10344	18.7	31.6	99	99

*Overstory parameters used in the analysis for FM7 were based on typical conditions found in 30 year old loblolly pine plantations.

Under drier fuel conditions and with less favorable weather (90th percentile), moderate fire behavior is predicted for all lightly damaged areas (FM2, FM7, and FM10) with the greatest increase over pre-storm conditions found in FM10 followed by FM7. Fires are potentially dangerous to personnel and equipment and handlines cannot be relied on to hold fire. Equipment

such as dozers, engines and aircraft may be effective in direct attack. These results suggest that, within the first one or two years following a large wind event, fire managers should expect more active fire behavior across the affected area, and extra precautions should be taken when conducting prescribed burning particularly when burning at the high end of the prescription. The increased fire behavior in these areas should be short-lived as the finer fuels decompose rapidly.

On the moderately to severely damaged sites (SB3 and SB4), fire behavior predictions indicate a substantial increase in fireline intensity, flame lengths and rates of spread due to the large amount of dead fuel loadings and open canopy cover (Table 3-5). These conditions may continue to worsen as dense shrub communities develop in some areas (SB3sh and SB4sh) due to the more open canopy and lack of fire. Fuel model SB3 exhibits moderate fire behavior at both the 50^{th} and 90^{th} percentiles indicating the need for equipment in direct attack. For the remaining fuel models, predicted flame lengths of greater than 8 feet indicate high to extreme fire danger, the potential for long range spotting and torching of trees, and serious control problems. Control efforts at the fire head would likely be ineffective and indirect attack may be the only means of suppression. There would also a significant increase in the predicted overstory mortality in these fuel models resulting in a potential change in species composition and additional increases in fuels.

The impact of the large diameter (1000-hr timelag and larger) downed woody fuels on fire behavior is difficult to predict and these fuels are not included in the fire behavior models. Under normal burning conditions large diameter materials are not considered available fuels due to their high moisture content and the difficulty of ignition and sustaining combustion. With somewhat drier conditions, the surface layer of these fuels may initially support flames however they primarily burn in the glowing or smoldering phases of combustion and not in the flaming front of the fire. Under very dry conditions, the larger materials become more involved in the fire front resulting in increased fire behavior (Miller 2001, Brown 2000). Fuel burnout time would also increase resulting in long-duration smoldering fires. These conditions can potentially result in serious smoke management problems, increased difficulty in control, and added risks to firefighter and public safety.

The severe drought conditions on the Forest and the large amount of smaller sized fuels from a wind event would increase the likelihood that the heavier fuels would ignite and burn. Observed events during and following a prescribed burn conducted in early December 2005 following Hurricane Rita reinforced this concern. This fire resulted in the ignition and complete consumption of a number of large downed tree trunks and standing snags despite the high fine fuel moistures and cool conditions. Considerable smoke problems persisted for several weeks after the burn. Approximately one month after the burn, portions of the unit re-burned fueled by a significant amount of dry fine fuel that was not consumed in the initial prescribed burn. The ignition source of the re-burn was believed to be large dry woody material that had continued to smolder due to the lack of rainfall. The probability of residual burning of the heavier fuels would continue to increase for 5 or 6 years as they begin to decompose and become punky (Wade *et al*. 2000).

Alternative 1 - No Action

Without treatment, increased loadings of fine surface fuels, downed woody material and dense flammable shrub thickets would likely result in wildfires of uncharacteristically high flame

lengths and fireline intensities. Fire behavior analysis indicates that fireline intensities in areas of moderate to extensive damage could be 2 to 20 times more than FM2 with normal fuel loadings. Even in some lightly damaged areas, fireline intensities may approach eight times more than what was expected prior to storm damage. Where heavy fuel loadings occur near forest boundaries, there would be an increased risk of spotting and escape posing significant threats to adjacent human communities. Heavy fuel loadings would also pose a significant risk to nearby RCW cavity trees and other forest resources.

The ignition of snags, fallen trunks and large branchwood would also increase the risk of spotting due to the long duration of burning. Once ignited, these fuels would likely burn or smolder for a considerable time, increasing the risk of starting new fires outside the control line or initiating re-burns as newly fallen, scorched needles accumulate in the burned area. These risks would increase over years as the heavy fuels begin to decompose and become punky. This would also increase the potential for smoke management problems including smoke settling on nearby highways and bridges, reducing visibility and threatening public safety. Nearby residents and firefighters would also be exposed to the health hazards from the high levels of smoke pollutants and particulates in the air.

The increased fuel loadings with large concentrations of downed trees, tops and broken branches would create a safety hazard for firefighters by obstructing access to safety zones and increasing potential for injury while maneuvering through the debris and working with chainsaws. These fuel conditions are highly resistant to control and fireline production rates would be lowered due to the additional time in moving aside the larger materials. These heavier fuels would be difficult to extinguish and would create additional safety hazards by requiring firefighters to work long periods and often into the night. Additional staff and equipment resources would be necessary to address fire suppression needs. Resistance to control would increase as dense shrub growth develops.

The proposed mechanical treatments would have the direct effect of reducing hazardous fuels and lowering fire behavior and intensity in treated areas. Fire behavior in the treated areas would be significantly less due to the lighter fuel loadings and the change in the fuel profile. The removal of the large tree boles and downed tops, and the lopping and scattering of slash in RCW cluster sites would protect the habitat by lowering the risk of cavity trees igniting and burning and protecting future cavity trees.

Removing heavy fuels and mulching or lopping and scattering downed tops and branchwood near the boundary would prevent high fireline intensities and remove a source of residual burning and high spotting potential thus decreasing the likelihood of wildland fire moving onto adjacent private lands and posing a threat to human lives and property. Mulching tall shrub vegetation would also lower fire danger by removing fuel ladders, breaking up the continuity of dense shrub canopies and reducing the potential for torching of trees and long-range spotting. Lopping, bucking, and scattering the large downed tree boles near the boundary would reduce the potential for spotting and promote more rapid decomposition of woody material by increasing surface area and placing the material directly in contact with the soil.

Removing heavier fuels would also reduce smoke management problems. This would be most critical near boundaries and adjacent to homes and highways. However, large concentrations of downed fuels in interior areas could also result in heavy smoke accumulations that could move

great distances outside the burn area. Where access is feasible, removing large concentrations of heavy fuels in interior areas would decrease potential for smoke problems.

Mechanical treatments would also greatly improve access for firefighters and fire suppression equipment. This would provide for more effective fire suppression efforts, reduce the risks to adjacent homes and communities, facilitate prescribed burning, and reduce the potential for fire escape.

In addition to mechanical fuel treatments, an active program of prescribed burning would address both immediate and long-range fire management needs. Without prescribed burning, woody understory vegetation would rapidly re-emerge in the treated areas. These fuels combined with the fine fuels remaining in the treated areas would result in continued high fire danger should wildland fire occur under severe weather and fuel moisture conditions. In addition, the untreated fuel loadings in the interior of the compartment would continue to increase and many important ecosystem components would remain at risk.

Prescribed burning would enable the Forest to return to more normal fuel loadings and fire behavior while lowering the potential for the adverse effects that so often occur with high intensity or severity wildland fire. Prescribed burning would be conducted when weather and fuel conditions are moderate and the effects are generally within a normal range. On the other hand, wildland fires often occur when conditions exceed prescribed parameters, resulting in extreme fire behavior and detrimental effects to the ecosystem. For example, high intensity wildland fire could increase the potential for overstory mortality and the loss of key components of the ecosystem, such as red-cockaded woodpecker cavity trees and residual shortleaf pine and longleaf pine seed sources which are important components in ongoing ecosystem restoration efforts. Damage to these resources would be most evident in areas with heavy concentrations of downed trees and tops. High fire severity in heavy concentrations of fuel could also result in localized loss of soil organic matter and soil erosion leading to vegetation change and degradation of aquatic resources.

Prescribed burning would reduce the excessive fuel accumulations due to the wind event and control the re-growth of woody understory vegetation that would occur in storm damaged areas. Also, by using prescribed burning under normal fuel moisture conditions and with favorable smoke dispersion and transport winds, heavy fuels could be reduced over time with a lower risk of smoke impacting neighboring communities and reducing visibility on highways.

Prescribed burning would return fuel conditions on upland sites to the desired FM2, FM8 or FM9 and maintain fire behavior within normal parameters.

A major fire management objective for the Forest is to achieve Fire Regime Condition Class 1, in which vegetation and fuel conditions approximate the natural historic conditions and the threats to key ecosystem components due to high intensity or severity wildfires are relatively low. Most of the forest is currently in Condition Class 2 or 3, with vegetation and fuel conditions altered and a moderate to high threat to key ecosystem components. An active program of prescribed burning would reduce existing hazardous fuels in the short-term while moving the forest toward Condition Class 1 and the Desired Future Conditions (DFCs) described in the Plan.

Cumulative effects

Within the last century, most of the lands that comprise the NFT have undergone major changes in vegetation composition and structure due primarily to logging and fire suppression. Many sites have converted from open, pine woodlands to closed mixed pine-hardwood forests. Herbaceous communities have declined and fuel loadings in many areas have increased substantially due to the accumulation of litter and the development of a dense understory of highly flammable shrubs and small trees.

Damaging wind events have the potential to substantially increase the amount of fine fuel comprised of leaves and needles, and downed woody material including large trees, branches and tops. Although fine fuels tend to decompose rather quickly, fuel loadings may continue to increase in some areas due to additional mortality of damaged trees and the lack of fire. Large diameter fuels would persist for several years and would pose an even greater hazard as they begin to decompose and their outer surfaces become punky and more apt to ignite and smolder for long periods. In addition, the loss of the canopy in some areas would result in further encroachment of highly flammable understory shrubs.

Most climate change scenarios for the southern United States suggest an increase in temperature-induced drought and an increase in fires (Bachelet *et al.*, 2001). On average, biomass consumed by fire is expected to increase by a factor of two or three with an increase in fire season length, potential size of fires, and areas vulnerable to fire. There may also be changes in vegetation, which in turn would influence fuel loadings and future fire behavior. These conditions would result in increased fire danger on the Forest as well as hinder efforts to achieve prescribed burning targets. This is evidenced by the current widespread drought-induced tree mortality observed on the DCNF and SHNF. While efforts are underway to treat affected areas, there would still be an increase in fuels and additional tree mortality.

As human communities continue to expand around the Forest, and as recreational use continues to increase, there would also be greater risks for wildland fire and resulting adverse impacts to lives and property. A major concern would be to maintain a high level of fire protection capabilities with limited staffing and resources.

In recent years, prescribed fire has been successful in moving the Forest toward the Condition Class 1 and the Plan DFCs. However, recent wind events and drought mortality have increased fuel accumulations and created conditions that promote shrub encroachment. As a result, many areas that have recently burned are again in need of fire treatment. Without addressing the fuels created from wind events, constraints on prescribed burning such as smoke management concerns and hazardous fuels near forest boundaries and RCW cavity trees may result in fewer acres burned. The failure to implement the proposed fuel reduction treatments would likely result in the Forest moving away from the DFC with a continued departure from the historic vegetation and fuel conditions and a continued increase in the risks to public and firefighter safety, human communities, and important forest resources.

Alternative 2 - Proposed Action

Table 2-1 outlines options for how each Management Area (MA) on the Forest would be treated. Treatments would include no action, removal, mulching, lop and scatter and burning. The

proposed treatment for each situation would be determined by the district fuels management specialist. Areas that are initially not treated would be monitored by the fuels management specialist for follow- up treatment. Areas that are considered to have high fuel loads and pose a threat to communities or resources may receive treatment at a later date. The treatment of least impact would be utilized to accomplish the desired objective.

Direct and indirect effects of Proposed Action

Following an intense, large-scale wind event, many areas on the Forest may experience an increase in fuel loadings resulting in increased fire danger and risks to identified management priorities and resources. These risks may be exacerbated by the persistent drought and dry fuel conditions that currently exist and are predicted to continue on the Forest. The proposed actions would reduce fuel loads through mechanical fuel reduction treatments, and use prescribed fire to control re-sprouting flammable understory vegetation, reduce overall fuel loads, and restore fire-dependent ecosystems. The effects of these treatments on fuels and fire behavior in relation to the major fire management priorities on the Forest are discussed above.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres. Clearing roads and trails with chainsaws and simply moving the trees off the road or trail could have an impact on fuels within the project areas. Fuels that are left to accumulate could cause smoke management issues as well as possibly lead to damage to wildlife and timber resources.

Alternative 4 - Modified Alternative 3
The buildup of fuels in MA 4, MA 5 and MA 8 could cause smoke management issues. This could be a concern in areas of Wildland Urban Interface (WUI) which is an issue primarily on the SHNF. The acres not being treated are 16% of the total Forest acres so the impacts would be just slightly less than the total acres that could be treated under Alternative 2.

3.5 Vegetation

Affected Environment
The three major upland fire-adapted vegetation types that occur on the Forest are longleaf pine-little bluestem, shortleaf pine-oak-hickory and loblolly-hardwood communities. Historically, longleaf pine was the dominant species throughout much of the Forest east of the Trinity River. Many of these former longleaf pine sites now support shortleaf and loblolly pine forests and the only extensive areas of longleaf pine are found on the Catahoula formation across the southern end of the Angelina and Sabine forests. Shortleaf pine occurs on all four Forests, however the most extensive stands are found on the DCNF and the loamy and clayey soils on the northern portions of the ANF and SNF. Loblolly pine has become a major component in all forest types, and slash pine, an introduced species, has been planted in many areas. The SHNF consists primarily of natural loblolly pine-hardwood with some shortleaf pine on the drier sites. Due to the effects of fire suppression and past disturbance, most upland pine stands have an increased

shrub and hardwood component in the understory and lack the diverse, herbaceous communities that are associated with these fire-dependent ecosystems.

The proposed project would consider management treatments in the following Management Areas on the Forest.

- Management Area One (MA1), Upland Forest Ecosystems
- Management Area Two (MA 2), Red-cockaded Woodpecker Emphasis
- Management Area Four (MA 4), Streamside Management Zones
- Management Area Five (MA 5), Major Aquatic Ecosystems
- Management Area Six (MA 6), Longleaf Ridge Special Area.
- Management Area Eight (MA 8), Research Natural Areas, Scenic Areas, Natural Heritage Areas, Special Bottomland Areas, Cultural Heritage Areas
- Management Area Nine (MA 9), Developed Recreation Areas
- Management Area Ten (MA 10), Administrative Sites
- Management Area Eleven (MA 11), SFA Experimental Forest Service

The majority of the Forest is in MA 1, MA 2 and MA 6. The DFCs for these MAs are primarily open upland pine and pine-hardwood communities with varying amounts of understory grasses, shrubs and small trees and maintained by short-interval, low-intensity fire regimes. Due to the effects of fire suppression and past disturbance, most upland pine stands have a significant shrub and hardwood component in the understory and lack the diverse, herbaceous communities that are typically associated with these fire-maintained ecosystems.

Desired Future Conditions can also be described as a Fire Regime Condition Class 1. Condition Class is a measure of the amount of departure from the natural fire regime. Condition Class 1 is considered a low departure from natural conditions where vegetation characteristics, fuel composition, and fire behavior is within the historical range of variability and there is a low risk to key ecosystem components.

Most researchers agree that typical longleaf pine sites probably burned at fire return intervals of less than five years; typical low elevation shortleaf pine sites probably burned at fire return intervals of two to six years; and loblolly pine fire intervals typically ranged from three to ten years (Wade *et al*. 2000). In recent years, prescribed fire frequency on the Forest has been variable with fire return intervals for individual compartments ranging from two to over twenty years. As a result, most of the Forest is in Condition Class 2 or 3, where vegetation structure, fuel levels, and fire severity are outside the normal range and there are moderate to high risks of losing key ecosystem components.

Forest Vegetation

Alternative 1 – No Action

Under no action, the potential exists for bark beetles to first infest damaged green trees and move to undamaged trees needed by the RCW. As discussed in the fuels section, a flammable shrub component would develop on some sites where the overstory has been reduced, which could threaten potential habitat for the endangered RCW.

Alternative 2 – Proposed Action
The proposed action, by removing down and damaged trees, would scarify the soil in places, creating more opportunities for natural pine regeneration. These naturally regenerated early seral stage openings would include scattered individuals and clumps of pines and hardwoods. The removal of large logs would make midstory treatments and establishment control lines for prescribed burning much easier. Cumulatively, this project and the follow-up treatments likely to occur would maintain the open forest conditions in MA 1 and MA 2 as anticipated in the Plan.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres. Fuels that are left to accumulate could cause smoke management issues as well as possibly lead to damage to wildlife and timber resources.

Alternative 4 - Modified Alternative 3
Excessive vegetation in MA 4, MA 5 and MA 8 could cause smoke management issues. This could be a problem in areas of Wildland Urban Interface (WUI) which is an issue primarily on the SHNF. The acres proposed to be treated under this alternative are just slightly less than those proposed under Alternative 2. Only 16% of the total Forest acres would not be treated.

Coarse Woody Debris

Alternative 1 – No Action
The wind event itself would create snags and would add coarse woody debris to the ecosystem. Trees would continue to die after an event, developing more snags and coarse woody debris over time. Because no treatments would occur there would be no direct or indirect effects to these resources. A cumulative effect is that wildfires and prescribed fires occurring throughout the Forest would consume existing snags while at the same time creating more snags for the ecosystem.

Alternative 2 – Proposed Action
The wind event would create snags and would add coarse woody debris to the ecosystem. Trees would continue to die after an event, developing more snags and coarse woody debris over time. A direct effect is that proposed removal and mulching treatments would remove coarse woody debris from treated areas. An indirect effect is that here would be less downed timber to provide coarse woody debris for amphibians and reptiles. Not all of the damaged areas would be treated leaving coarse woody debris for ecosystem health and biodiversity. An action such as lop and scatter would not remove all this material, but only cut it into smaller sections and distribute it throughout the treated areas. No snags would intentionally be removed during any mechanical treatments. Slash remaining from mechanical treatments related to the wind event would contribute to coarse woody debris. An indirect effect of the proposed prescribed burning is that snags within these areas could be consumed. Treatments such as prescribed burning, thinning and pine restoration would be conducted in other areas of the Forest not associated with a wind event. These treatments would leave some residual coarse woody debris. While the proposed

action would remove some snags and coarse woody debris, overall on the Forest there are more snags and coarse woody debris being created.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres. The majority of the Forest would not be treated leaving the downed and damaged trees as coarse woody debris over most of the Forest.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. The acres proposed to be treated under this alternative are just slightly less than those proposed under Alternative 2. Only 16% of the total Forest acres would not be treated.

Old Growth

Alternative 1 – No Action
Since no treatments are planned, there would be no direct, indirect, or cumulative effects to any old growth stands.

Alternative 2 – Proposed Action
A characteristic of old growth stands is dead and downed material from natural events.
The proposed treatments could affect old growth stands that occur in MA 4 and MA 8 since down and damaged trees that are removed or mulched would no longer be contributing to old growth characteristics. Material that is lopped and scatted or prescribed burned would still contribute to the old growth characteristics of the stand.

Alternative 3 - High Priority Areas Only
Since no treatments are planned in MAs with old growth allocations, there would be no direct, indirect, or cumulative effects to any old growth stands.

Alternative 4 - Modified Alternative 3
A characteristic of old growth stands is dead and downed material from natural events.
The proposed treatments could affect old growth stands that occur in MA 4, MA 5, and MA 8 since down and damaged trees that are removed or mulched would no longer be contributing to old growth characteristics. Material that is lopped and scatted or prescribed burned could still contribute to the old growth characteristics of the stand.

Non-native Invasive Plan Species (NNIPS)
Surveys for invasive species within the National Forests and Grasslands in Texas are conducted on a yearly basis. The following invasive species are a concern:

Table 3-6. Species currently present on the NFT

Common Name	Scientific Name	Common Name	Scientific Name
Chinaberry	*Melia azedarach MEAZ*	Mimosa	*Albizia julibrissin ALJU*
Chinese wisteria	*Wisteria sinensis WISI*	Multiflora rose	*Rosa multiflora ROMU*
Chinese/European privet	*Ligustrum sinense LISI*	Nandina	*Nandina domestica NADO*
Cogongrass	*Imperata cylindrical IMCY*	Nodding thistle	*Carduus nutans CANU4*
Deep rooted sedge	*Cyperus enterianus CYEN2*	Chamber Bitter	*Phyllanthus urinaria PHUR*
English ivy	*Hedera helix HEHE*	Periwinkles	*Vinca major/Vinca minor VIMA*
Eurasian water-milfoil**	*Myriophyllum spicatum MYSP2*	Princesstree	*Paulownia tomentosa PATO2*
Giant reed or Arundo	*Arundo donax ARDO4*	Salt cedar	*Tamarix ramosissima TARA*
Golden bamboo	*Phyllostachys aurea PHAU8*	Sericea lespedeza	*Lespedeza cuneata LECU*
Hydrilla**	*Hydrilla verticillata HYVE3*	Tallowtree	*Triadica sebifera TRSE6*
Japanese climbing fern	*Lygodium japonicum LYJA*	Tree of heaven	*Ailanthus altissima AIAL*
Japanese/Glossy privet	*Ligustrum Japonicum LIJA*	Tropical soda apple	*Solanum viarum SOVE2*
Johnsongrass	*Sorghum halpense SOHA*	Tung-oil tree	*Vernicia fordii VEFO*
King Ranch bluestem	*Bothriochloa ischaemum* var. *songarica BOISS*	Water fern**	*Salvinia molesta SAMO5*
Kudzu	*Pueraria Montana PUMO*	Water hyacinth**	*Eichhornia crassipes EICR*

** Aquatic species

Table 3.7 Species Not Yet Present on the NFT, but Present Within the State of Texas

Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
Russian olive	*Elaeagnus angustifolia ELAN*	Climbing yams	*Dioscorea* spp DIOP
Autumn olive	*Elaeagnus umbellate ELUM*	Japanese knotweed	*Polygonum cuspidatum POCU6*
Bush honeysuckles	*Lonicera maackii LOMA6*	Skunkvine	*Paederia foetida PAFO3*
	Lonicera morrowii LOMO2	Spotted knapweed	*Centaurea stoebe CEST8*
	Lonicera tatarica LOTA	Peppertree	*Schinus terebinthifolius SCTE*
	Lonicera fragrantissima LOFR	Mourningbride	*Scabiosa atropurpurea SCAT*
Purple loosestrife	*Lythrum salicaria LYSA2*	Nepalese browntop	*Microstegium vimineum MIVI*

Alternative 1 – No Action
Since no treatments are planned, there would be no direct, indirect, or cumulative effects.

Alternative 2 – Proposed Action
The ground disturbing activities proposed in this project would have a high risk of NNIPS spread in (1) habitats that have high susceptibility to NNIPS invasion or (2) areas that are already disturbed. However, a comprehensive plan of NNIPS control and prevention would be integrated into the project design for all of the proposed activities regardless of where they would occur. This would reduce or contain NNIPS and improve the vigor of native vegetation, thereby increasing resistance to further NNIPS invasion. NNIPS treatment would include chemical, biological, mechanical, manual non-mechanical and cultural control and prevention measures and would be included in the project design criteria (USDA Forest Service, Guide to Noxious Weed Prevention Practices, Version 1.0, Dated July 5th 2001). Under the proposed action, treatment of NNIPS would occur anywhere within the project area. Treatments would be

commensurate with the location of existing occurrences and with individual risk of spread. Monitoring would take place to determine effectiveness of treatment.

Ongoing NNIPS management in the analysis area would include any other NNIPS control actions as a result of any existing signed environmental documents, the NNIPS Management Plan, and the programmatic NFT NNIPS EA. Any active NNIPS control for this analysis area would incorporate the NFT NNIPS EA by reference. Treatments would include prescribed fire, chemical, biological, cultural, mechanical, and manual non-mechanical control of NNIPS as well as education and preventive practices through an Integrated Pest Management Approach. The alternative selected would follow NFT Forest Plan management direction for NNIPS.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres. Most of the clearing work would be completed using chainsaws instead of mechanical equipment reducing the spread of NNIPS.

Alternative 4 - Modified Alternative 3
No treatments would occur in MA 4, MA 5, or MA 8 so there is less likelihood that NNIPS would be spread in these MAs. Other treatments in the remaining MAs would have the same effects as Alternative 2.

3.6 Heritage Resources

Affected Environment
This project falls under the provisions of the Region 8 Programmatic Agreement (R8PA) and the Memorandum of Understanding (MOU) among the Texas Historical Commission, State Historic Preservation Officer (SHPO), the Advisory Council on Historic Preservation (ACHP), The Caddo Nation of Oklahoma, the United Keetowah Band of Cherokee Indians in Oklahoma, the Alabama-Coushatta Tribe of Texas and the U.S. Forest Service.

Alternative 1 – No Action
With no action there would be no potential for direct or indirect effects to significant archaeological or historical resources. No cumulative effects to archaeological or historical resources would occur under this alternative.

Alternative 2 – Proposed Action
Under the terms of the MOU, the *proposed action* would be handled as an emergency action as described in the PA (pages 15-16). The NFT would prepare a Rapid Assessment within 120 hours of the emergency event (see FSM 2030). Known sites would be protected as described in Design Criterion #18 and would not be impacted. Where direct or indirect effects on heritage resources cannot be avoided and in discovery situations, the undertaking would be suspended in the vicinity of the property pending additional consultation and development of a treatment plan. Consultation with federally recognized tribes with ancestral ties to the NFT has been initiated by way of standard scoping for NEPA. By conducting the proposed action in accordance with the

stipulations of the MOU and HMP, this project would be in compliance with the consultation requirements of 36 CFR Part 800.

The scope of the analysis for potential effects to cultural resources includes the entire Wind Event environmental assessment (EA) (see Chapter 1.0) and considers the proposed activities within treatment areas (see Chapters 1.0 and 2.0), as well as access to these areas.

An effect to a cultural resource is the "…alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register." (36 CFR 800.16(i)) Any project implementation activity that has potential to disturb the ground has potential to directly affect archeological sites, as does the use of fire as a management tool. Specific activities outlined in the Wind Event EA that have potential to directly affect cultural resources include commercial and non-commercial removal, associated log landings, skid trails, and road reconstruction, and prescribed burning and associated fireline construction where ground disturbance takes place outside existing right-of-way areas.

In general, proposed project activities could have the potential to affect cultural resources by encouraging increased visitor use to those areas of the Forest in which cultural resources are located. Increased visitor use of an area in which archeological sites are located can render the sites vulnerable to both intentional and unintentional damage. Intentional damage can occur through unauthorized excavation in archeological sites and unauthorized collecting of artifacts from sites. Unintentional damage can result from such activities as driving motorized vehicles across archeological sites, as well as from other activities, principally related to dispersed recreation, that lead to ground disturbance. Effects may also include increased or decreased vegetation on protected sites due to increased light with canopy layer reduction outside of the protected buffer.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
No treatments in MA 4, MA 5 or MA 8 where many heritage resource sites are often located. This would provide more protection for the heritage resources on the Forest thereby reducing negative effects.

3.7 Air Quality

Affected Environment
Because air quality concentrations can vary based on local industry and nearby roads and highways, an assessment of air quality at each individual National Forest is warranted. It is generally accepted that air quality monitoring values at a particular location may be representative of the air quality within 25 miles (40 kilometers) of that site. Unfortunately, air quality monitoring sites are not located within 25 miles of each Forest. The two Harris County $PM_{2.5}$ monitors are part of the Clean Air Status and Trends Network

(CASTNET;http://epa.gov/castnet/javaweb/index.html) and are located near the southern end of Sam Houston National Forest. The graph below shows the 3-year averages of 24-hour and annual fine particulate matter concentrations at these two monitoring sites as compared to the NAAQS.

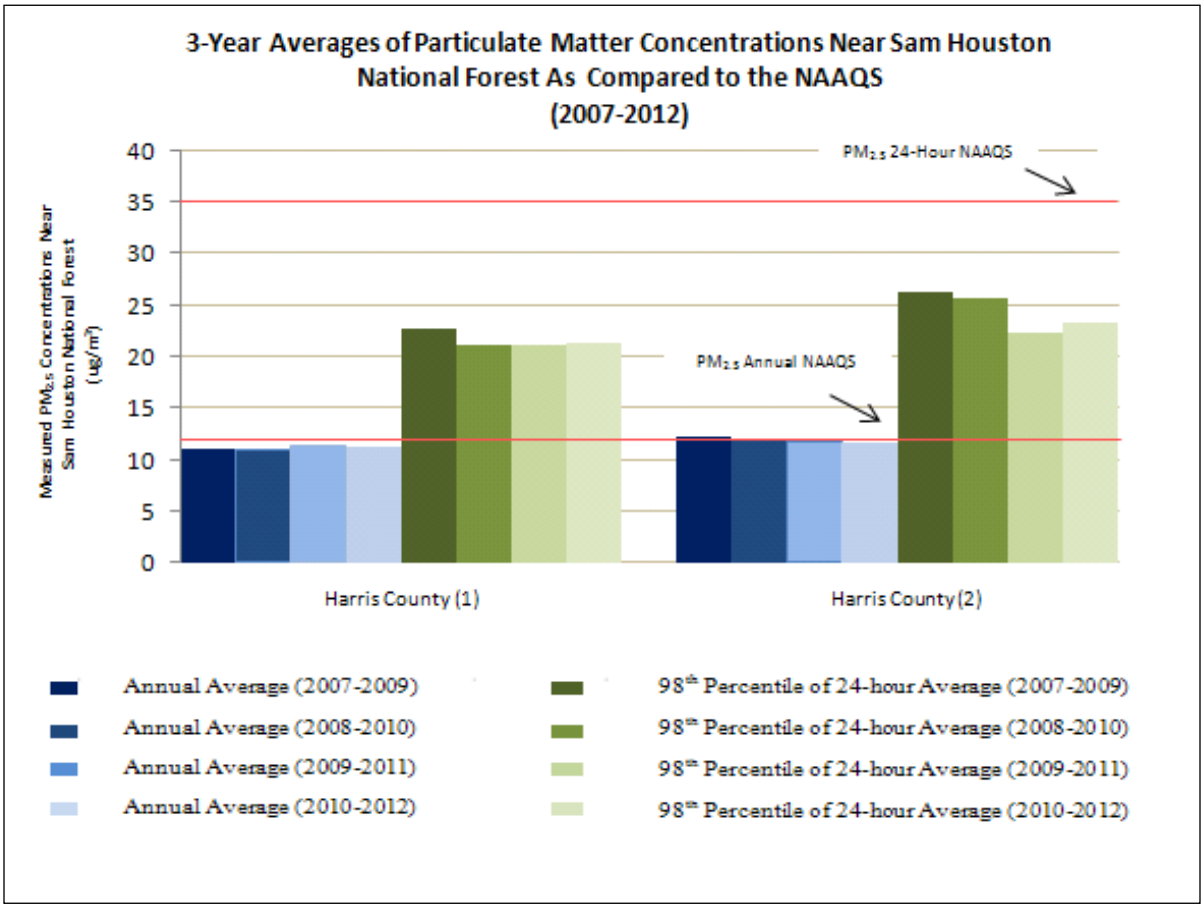


Figure 3-1. Three-Year average Fine Particulate Matter Trends Near the Sam Houston National Forest as Compared to the NAAQS.

As shown, fine particulate matter levels near the SHNF are below both the 24-hour and annual air quality standards, as averaged on a three year basis. The graph below shows the yearly monitoring data as compared to annual fine particulate matter emissions from prescribed fires on the Forest.

While air quality monitoring describes ambient pollution levels, emissions inventories provide information on the contribution of various pollution sources to total emissions for specific geographic areas. A review of the most recent National Emissions Inventory (NEI) for the counties that surround the NFT was conducted (Angelina, Cherokee, Houston, Hunt, Jasper, Lamar, Liberty, Montgomery, Nacogdoches, Newton, Polk, Sabine, San Augustine, San Jacinto, Shelby, Trinity, Tyler, and Walker Counties), and prescribed fires account for just less than eleven percent of all $PM_{2.5}$ emissions in the area. Figure 3-2 shows all of the sources of fine particulate matter near the NFT and their emissions, as based on the 2008 NEI. Data are taken

from EPA's Technology Transfer Network Clearinghouse for Inventories and Emissions Factors (http://www.epa.gov/ttnchie1/net/2008inventory.html). Since the NAAQS are not being exceeded at the closest monitoring site to the NFT, and prescribed fire emissions account for only eleven percent of the total $PM_{2.5}$ emissions in the surrounding counties, it appears that prescribed burning activities have not caused or contributed to any exceedances of the $PM_{2.5}$ NAAQS near the NFT.

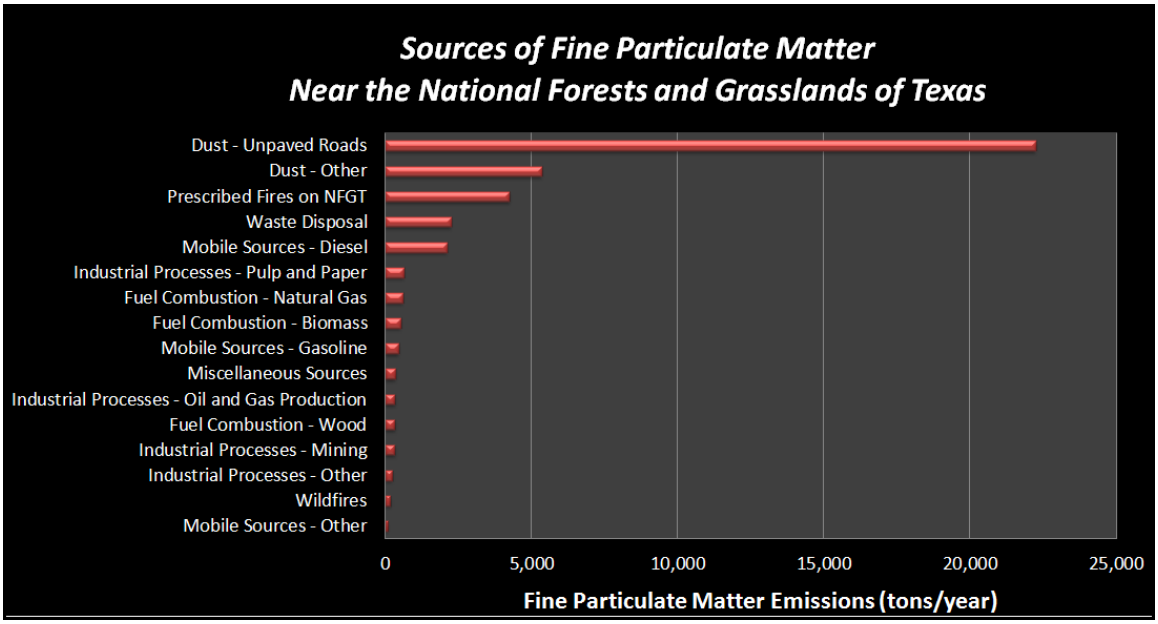


Figure 3-2. Sources of Fine Particulate Matter Near the National Forests and Grasslands in Texas.

Another way to assess fine particulate matter levels is to look at sources and emissions of the pollutant

Within the state of Texas, there are at least 30 air quality monitors that measure fine particulate matter in the air. There are no areas within the state which have been designated as nonattainment with either the 24-hour or annual average $PM_{2.5}$ air quality standard.

The NFT coordinated with TCEQ (Texas Commission on Environmental Quality) on air quality monitoring issues. This is an ongoing process. Air quality is addressed during prescribed burning by operating within the burn plan perimeters for smoke dispersion.

Alternative 1 – No Action

Without treatment, increased loadings of fine surface fuels, downed woody material and dense flammable shrub thickets are likely to result in wildfires of uncharacteristically high flame lengths and fireline intensities. Fire behavior analysis indicates that fireline intensities in areas of moderate to extensive damage could be two to twenty times more than FM2 with normal fuel loadings. Even in some lightly damaged areas, fireline intensities may approach eight times more than what was expected prior to storm damage. These large wildfires would increase emissions and could cause exceedances of the $PM_{2.5}$.

Alternative 2 – Proposed Action

Emissions from heavy equipment and vehicles used in the proposed action and action alternatives would be negligible regarding the NAAQS for ozone or particulate matter. Large fuels would be removed and would not be available to burn during wildfire conditions. Cumulatively, there would be a reduction in the potential for emissions.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres. Without treatment in most of the MAs, increased loadings of fine surface fuels, downed woody material and dense flammable shrub thickets are likely to result in wildfires of uncharacteristically high flame lengths and fireline intensities. Fire behavior analysis indicates that fireline intensities in areas of moderate to extensive damage could be two to twenty times more than FM2 with normal fuel loadings. Even in some lightly damaged areas, fireline intensities may approach eight times more than what was expected prior to storm damage. These large wildfires would increase emissions and could cause exceedances of the $PM_{2.5}$.

Alternative 4 - Modified Alternative 3
Buildup of fuels in MA 4, MA 5 and MA 8 could cause smoke management issues within these MAs. The buildup of fuels could cause exceedances of the $PM_{2.5}$. This would primarily be an issue on the SHNF where there are more smoke sensitive areas.

3.8 Public Health and Safety

Affected Environment
Immediately after a wind event, there are a number of public health and safety issues to be addressed including downed trees across roads and in recreation areas or administrative sites. After these initial safety issues have been taken care of, the Forest can then focus on the issue of reducing hazardous fuels that threaten the public and firefighters.

Alternative 1 – No Action
As stated in Section 3.4, under no action, large diameter fuels would contribute to more intense wildfires creating hazards for firefighters. A flammable shrub layer would develop, which would increase fire intensity in the event of a wildfire. Large fuels on the ground would impede the construction of control lines. These conditions would worsen as time passes. No action also increases the risk of smoke affecting nearby residences and settling along highways or bridges for long time periods. Falling trees and limbs resulting from a wind event could be a safety hazard for the public recreating on the Forest. Downed trees would block access to the Forest and to private residences surrounded by National Forest lands.

Alternative 2 – Proposed Action
The proposed action would improve the safety of surrounding private residences, other structures, and forest land. Reducing large fuels would change fire behavior enough to allow direct suppression tactics by local firefighting resources, which would increase the chance of suppressing the fire before it reaches the adjacent privately-owned structures. The cumulative

effect would be an increase in the level of public safety should wildfires occur on adjacent national forest land. There would also be a reduction in the amount of smoke emissions, which would reduce the potential for effects on public health.
Falling trees and limbs that are a safety hazard for the public would be removed. Downed trees would no longer block access to the Forest or to private residences surrounded by National Forest lands.

Alternative 3 - High Priority Areas Only
This alternative would remove the initial safety hazards along roads and in recreation areas and administrative sites. Hazardous fuels in MAs 1 and 2 would not be reduced under this alternative thereby creating unsafe conditions for firefighters and the public on the majority of the Forest – MA 1 and MA 2 (468,000 acres).

Alternative 4 - Modified Alternative 3
Buildup of fuels in MA 4, MA 5 and MA 8 could cause smoke management issues within these MAs and have a negative impact on public health.

3.9 Threatened and Endangered Species

An assessment of the direct, indirect, and cumulative effects of the various alternatives on selected species is presented in the following sections (See Chapter 2 for a description of the alternatives). The treatment area is defined as land on which management actions would take place, while the cumulative effects analysis area includes all areas where direct and indirect effects may occur, not merely those areas in which actions would take place. The cumulative effects analysis area, unless otherwise noted, consists of national forest in or near the various treatment areas and/or adjacent private land. The effects described in this report incorporate the analyses from other specialist reports included in the project file.

The species addressed in this section are categorized into three groups: those listed under the Endangered Species Act as threatened or endangered, those listed by the Forest Service as Sensitive (Southern Region (R-8) Regional Forester's Sensitive Species List (8-7-01)), and those listed as Management Indicator species (MIS). There are some overlaps between these groups.

Most of the species addressed tend to be habitat specialists, closely linked with specific habitat types, with an uneven distribution across the landscape. Individual species' habitat associations and the effects of the proposed alternatives are described in the following sections.

The following species or their habitat occur within the vicinity of the project area and are further analyzed in this document**.**

Table 3-8. Federally Listed Threatened and Endangered Species
Birds
Red-cockaded woodpecker *(Picoides borealis)*
Reptiles
Louisiana Pine Snake *(Pituophis ruthveni)*
Plants
Navasota ladies'-tresses (*Spiranthes parksii*)

Table 3-9. Forest Service Sensitive Species
Mammals
Rafinesque's big-eared bat *(Corynorhinus rafinesquii)*
Southeastern myotis (*Myotis autroriparious*)
Birds
Bachman's sparrow *(Aimophila aestivalis)*
Bald eagle *(Haliaeetus leucocephalus)*
Fish
Sabine shiner *(Notropis sabinae)*
Insects
Texas emerald dragonfly *(Somatochlora margarita)*
Crayfish
Sabine fencing crayfish *(Faxonella beyeri)*
Neches crayfish *(Procambarus nechesae)*
Blackbelted crayfish *(Procambarus nigrocinctus)*
Sabine Burrowing Crayfish (*Fallicambarus wallsi*)
Mollusks
Ouachita Rock Pocketbook (*Arkansia wheeleri*)
Texas Pigtoe (*Fusconaia askewi*)
Triangle Pigtoe (*Fusconaia lananensis*)
Louisiana Pigtoe (*Pleurobema riddellii*)
Sandbank Pocketbook (*Lampsilis satura*)
Southern Hickorynut (*Obovaria jacksoniana*)
Texas Heelsplitter (*Potamilus amphichaenus*)
Plants
Panicled indigobush (*Amorpha paniculata*)
Incised agrimony (*Agrimonia incisa*)
Texas bartonia (*Bartonia texana*)
Warner's hawthorn (*Crataegus warneri*)
Mohlenbrock's umbrella sedge (*Cyperus grayioides*)
Southern ladies'-slipper (*Cypripedium kentuckiense*)
Neches river rose mallow (*Hibiscus dasycalyx*)
Pineland bogbutton (*Lachnocaulon digynum*)
Slender gayfeather (*Liatris tenuis*)
Yellow fringeless orchid (*Platanthera integra*)
Barbed rattlesnake root (*Prenanthes barbata*)
Large beakrush (*Rhynchospora macra*)
Sabine coneflower (*Rudbeckia scabrifolia*)
Texas sunnybells (*Schoenolirion wrightii*)
Scarlet catchfly (*Silene subciliata*)
Clasping twistflower (*Streptanthus maculatus*)
Texas trillium (*Trillium texanum*)
Drummond's yellow-eyed grass (*Xyris drummondii*)
Harper's yellow-eyed grass (*Xyris scabrifolia*)

Table 3-9. Forest Service Sensitive Species

Threatened and Endangered Species (TES)

A. Birds - Affected Environment and Environmental Consequences

1. Red-cockaded woodpecker

The federally endangered red-cockaded woodpecker (*Picoides borealis;* RCW) has a high potential to occur on drier ridge tops in open-canopy, fire-maintained, mature pine stands with forb and/or grass dominated ground cover and a midstory relatively devoid of hardwoods (Jackson 1994; Conner et al. 2001a; USDI 2003). The RCW excavates cavities in live pine trees, using old trees infected with red heart fungus (*Phellinus pini*), thin sapwood, and a large diameter of heartwood (Conner et al. 1994; Conner et al. 2001b). Generally, pine trees ≥60 years old are needed for cavity excavation (Rudolph and Conner 1991; USDI 2003). Threats to this species include conversion of mature forest to short-rotation plantations or non-forested areas, hardwood proliferation resulting from fire exclusion, lack of forest management to develop and maintain open stand conditions, and habitat fragmentation that affects population demographics.

On the NFT, the red-cockaded woodpecker is distributed within three populations: (1) Sam Houston, (2) Davy Crockett, and (3) Angelina/Sabine National Forests. These RCW populations are identified in recovery criteria as important to conserving this species in varied habitats and geographic regions, reducing threats of extinction, and delisting (USDI 2003).

The RCW populations in Texas are located within Habitat Management Areas (HMA), delineated around known occupied and potential RCW habitat, managed for the productivity and recovery of this species, and identified in the Plan as MA 2 and MA 6.

Annual survey data shows that over the last ten years, RCW populations appear to be increasing. Available inventory information is adequate because inventories of high potential habitat areas are current enough to guide project design, support determination of effects, and meet requirements for conservation of this species.

Alternative 1: No Action

Management of RCW habitat would be more difficult because the downed timber would impede access to areas. Bark beetles (e.g. *Ips* beetle) could also become a problem if excessive numbers of snags are left. Bark beetles could attack and kill cavity trees.

Cumulative Effects: Without the removal of down and damaged trees within RCW clusters, the fuels would cause prescribed fires or even wildfires to burn much more intensely and over longer durations. There would be a strong possibility that some trees within clusters would be killed, including cavity trees. The heavy fuels within RCW foraging habitat would have similar results.

Alternative 2 - Proposed Action.

This alternative would have positive indirect effects because the removal of down and damaged trees serves the dual purpose of protecting RCW habitat from wildfire and restoring habitat to resemble pre-wind event conditions. The desired RCW habitat supports a fire regime consisting of frequent, low-intensity ground fires. These frequent fires promote a groundcover of grasses and forbs by reducing woody understory and midstory vegetation. By removing downed trees, fuel loading would be reduced, which would allow for the continued application of frequent low-

intensity prescribed fires. Reducing fuel loads would also protect emerging natural regeneration, soil productivity, and remaining trees that serve as potential foraging and nesting habitat. This alternative would help ensure the replacement of pine trees that were lost in the blowdown and facilitate the establishment and persistence of trees that may serve as foraging and nesting habitat as the trees age.

Direct effects are not expected because no living cavity tree would be removed, and no removal, mulching, or lop and scatter would occur in active RCW clusters during nesting season (April 1-July 31), unless the cluster is confirmed to have fledged young or does not have a potential breeding pair. Active cavity trees would be monitored within 200 feet of previously closed Forest Service roads being used as haul roads during breading season (April 1 – July 31). If adults are being flushed from cavity trees due to timber removal activities then restrict traffic until clusters confirmed to have fledged young. Use of open and closed roads will be evaluated on a case-by-case basis, through consultation with USFWS, to determine if specific open roads can be used during nesting season without causing incidental take.

No activities would occur in active clusters or use of roads thru clusters prior to one hour after sunrise and ceasing one hour prior to sunset. This restriction would not apply to yearlong open public roads. These design criteria would only allow activities within active clusters when no nesting is occurring or the activities are sufficiently far enough away to prevent any harassment and should assure no adverse impacts occur to this species.

Although a wind event could affect foraging habitat for a number of clusters and recruitment stands, no foraging habitat analysis would be completed for this project unless the treatment activities could result in limited foraging acres for one or more clusters. The proposed action would remove only downed trees and those that are not expected to survive (i.e. severely damaged, leaning, or root sprung). These trees would have already been removed from the foraging base by natural forces and the proposed activities would thus not further reduce foraging. Thus, evaluation of the effects of foraging is likely not needed.

Cumulative Effects: The cumulative effects analysis area and timeframe would be the project area and adjacent Forest Service and private lands over a three year period. The land around the project area is Forest Service and private lands. The private lands are generally managed for short rotation timber harvest or for residential uses. Prescribed burning with fire breaks, midstory mulching, thinning, and oil and gas exploration are the other known actions occurring near the area. Control of NNIPS would occur, but should not affect the RCW because suitable habitat would not be treated. Control of NNIPS is limited to utility rights-of-way, special use sites, recreation sites, and road rights-of-way.

A blowdown of mature pine stands resulted in a loss of foraging and nesting habitat that cannot be replaced in the short-term. Although habitat quality in some areas has been reduced, these areas may be improved by fuel reduction treatments. The proposed project would have beneficial cumulative effects for the RCW. Removal of the downed and damaged trees in and near RCW clusters and recruitment stands would reduce fuel loads, making prescribed fire more effective than if the many downed trees were left untreated. The removal of the downed and damaged trees would also reduce the potential for prescribed burns or wildfires to burn intensely enough to kill cavity trees and/or overstory trees in the foraging habitat. Overall, the proposed

treatments would facilitate continued management and maintenance of existing high potential habitat, and would facilitate the development of marginal habitat into high potential habitat.

Maintaining and improving RCW habitat on national forest land is important due to limited opportunities for habitat development on adjacent private lands. Forested areas exist on private lands near the proposed project area; however, management practices on these lands typically emphasize short-rotation timber production (i.e. 20-40 years). Pines younger than 50 years old are primarily composed of sapwood, which is unsuitable for cavity excavation (Conner and O'Halloran 1987, p.405). Because the rotation age on these lands is not expected to increase, these areas would remain unsuitable.

Alternative 3 - High Priority Areas Only
Not treating in MA 2 would have a negative impact on RCW habitat similar to impacts discussed in Alternative 1**.** Dropping areas with less than 30% damage would have minimal effect on RCW because prescribed burning would still be a treatment option in MA 2.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on the RCW.

B. Reptiles – Affected Environment and Environmental Consequences

1. Louisiana Pine Snake

The Louisiana pine snake *(Pituophis ruthveni)* is a Forest Service Sensitive species and a candidate species for federal listing. Louisiana pine snakes inhabit areas with sandy, well-drained soils in open, pine forests with minimal midstory and a well-developed grassy understory (Rudolph and Burgdorf 1997). A primary component of the pine snake's habitat is the presence of Baird's pocket gophers (*Geomys breviceps*). Pocket gophers serve an essential role in pine snake ecology by serving as the primary source of food and by supplying shelter. Studies have shown that pine snakes utilize pocket gopher burrow systems for escape cover, nest sites, and hibernation sites (Rudolph et al 1998, Rudolph and Burgdorf 1997). Pocket gopher abundance is directly related to the presence of extensive herbaceous ground cover, which is in turn related to the amount of sunlight able to reach the forest floor. Frequent low intensity fires are also responsible for maintaining the grassy, herbaceous understory required by both gophers and pine snakes. In the absence of fire, a woody midstory quickly develops, greatly reducing the habitat effectiveness of the area (Rudolph and Burgdorf 1997). No pine snakes have been documented or captured in areas where fire has been effectively suppressed. Because of this association, absence of fire has been proposed as the greatest current threat to Louisiana pine snake populations, by decreasing both habitat quality and quantity (Rudolph and Burgdorf 1997).

Available Inventories: The U.S. Forest Service's Southeastern Research Station (SRS) traps the Louisiana pine snake annually in the south SNF and south ANF. They also keep records of any other Louisiana pine snake sightings including road killed individuals. The last documented Louisiana pine snake on the SNF was captured in Fox Hunter's Hill in 1993. A Louisiana pine

snake was captured on the south ANF in 2012; however, this snake was a recapture originally caught in 2007 and released in 2008. Prior to 2012, no snakes had been captured or sighted since 2009. Prior to project implementation, surveys would be conducted by district personnel to look for TES plants and animal species. If pocket gopher mounds are observed, they would be avoided whenever possible.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Cumulative Effects: Due to the fact that there would be no direct or indirect effects as no action is being taken, there would also be no cumulative effects.

Alternative 2 - Proposed Action
The increased traffic during project activities could put individual snakes and/or their eggs at risk for mortality through direct contact with machinery and vehicles. Disturbance during forest management activities may force individual snakes into other areas of the forest or deeper underground. Additional protective measures include contractual requirements that prohibit any forest workers from killing, harming, or capturing any snake found within the project area.

Prescribed burning would have beneficial indirect effects by reducing midstory vegetation which would provide better habitat preferred by the pocket gopher, a diet mainstay for the snake. An increase in pocket gophers increases the density of their burrowing systems, which provides an increase in shelter, foraging, and snake hibernation areas. Salvage and other proposed fuels reduction treatments would reduce the potential for catastrophic wild fires that would destroy overstory pine forest stands. This would help ensure protection of Louisiana pine snake habitat from catastrophic wild fires.

Although some mortality may occur, the overall indirect effect of implementing these management actions would benefit the species in the long run.

Cumulative Effects: The cumulative effects analysis area and timeframe would be the project area and adjacent Forest Service and private lands over a three year period. The land around the project area is Forest Service and private lands. The private lands are generally managed for short rotation timber harvest or for residential uses. Prescribed burning with fire breaks, midstory mulching, thinning, and oil and gas exploration are the other known actions that could occur near treatment areas. Control of NNIPS would occur, but should not affect the Louisiana pine snake since suitable habitat would not be treated. Control of NNIPS is limited to utility rights-of-way, special use sites, recreation sites, and road rights-of-way.

A blowdown of mature pine stands resulted in a loss of habitat that cannot be replaced in the short-term. Although habitat quality may be reduced do to wind damage, these areas may be improved by fuel reduction treatments. The proposed project would have beneficial *cumulative effects* for Louisiana pine snakes. Overall, the proposed work would facilitate continued management and maintenance of existing high potential habitat, and would facilitate development of marginal habitat into high potential habitat.

Alternative 3 - High Priority Areas Only
Not treating in MA 2 would have a negative impact on Louisiana pine snake habitat similar to impacts discussed in Alternative 1. Dropping areas with less than 30% damage would have minimal effect on the Louisiana pine snake because prescribed burning would still be a treatment option.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on the Louisiana pine snake.

C. Plants – Affected Environment and Environmental Consequences

1. Navasota Ladies'-Tresses

This plant species is a Texas endemic primarily known from two river drainages in east-central Texas and a separate disjunct location in east Texas on the ANF. Although approximately 100 occurrences with a total of about 10,000 plants are known, many of the sites are threatened by strip mining and rapid urban encroachment on suitable habitat. This federal and state listed endangered species is endemic to the Post Oak Region of East Central Texas. Navasota Ladies'-Tresses were federally listed as endangered on May 6, 1982. The Global Status of the Navasota Ladies'-Tresses is classified as G3-Vulnerable, and S3-Vulnerable for the state of Texas (NatureServe 2012).

Reported occurrences for Navasota Ladies'-tresses are limited to areas of Catahoula pine barrens in Compartment 84, Black Branch Barrens, on the Angelina NF. Surveys performed in Compartments 76 and 86, which also contain Catahoula Pine Barrens, have not detected the species. Orzell (1990) reported that the species was found in Compartment 84 on Catahoula formation barrens. This occurrence was not relocated in the MacRoberts 1996 survey, although they reported finding a new occurrence. Surveys were conducted for Spiranthes parksii in suitable habitat on the Angelina NF on October 24-25, 29, and November 7, 2005. No new occurrences for this species were found. Surveys conducted by Philipps in 2006 again failed to locate any representatives of this species. A survey conducted by Philipps, Singhurst, Walker, Loos, and Rudolph in the fall of 2007 again failed to relocate the species. There have been two element occurrence records for this species recorded, in 1986 and 1996. Both occurrences were located on the Angelina NF in Black Branch Barrens; however, all recent attempts to relocate this species have failed. Personal communications with several biologists indicate the species has been found on a barren(s) on Campbell Group forest properties between Compartments 84 and 86.

Various botanists searched for Navasota ladies'-tresses in surveys of suitable habitat in 2005, 2006, 2007, 2009, and 2010. The two known occurrences were not relocated during these surveys, nor were any new occurrences discovered. In 2011, areas of Black Branch Barrens were surveyed by Philipps and Loos following a wildfire. No individuals were noted. Currently there are no known extant occurrences of this plant on the Angelina NF. No sightings of this species in Compartment 84 have been made since the 1996 MacRoberts survey. It must be noted that *Spiranthes parksii* is very difficult to distinguish from *Spiranthes cernua*. No photographs,

reports, or voucher specimens exist for any of the reported sightings of this species in Compartment 84. As a result, it is possible that the 1990 and 1996 sightings could have been *Spiranthes cernua*, which is documented in the area. Since a "reported" occurrence for this species has not been made since 1996, it is possible that this species may no longer exist on the District.

Alternative 1 - No Action
There would be no direct or indirect effects as a result of this alternative.

Cumulative effects: Because this alternative would have no direct or indirect effects, it would also have no cumulative effects.

Alternative 2 - Proposed Action.
Mechanical equipment activites would be restricted from operating within the Black Branch Barren area. Prescribed fire activities would also be excluded in areas where the endangered plant Navasota Ladies'-Tresses, *Spiranthes parksii*, has been reported to occur. Site specific surveys would be conducted in any potentially suitable habtitat. Therefore, there is very low probability for any direct effects.

Cumulative Effects: The cumulative effects area is within the administrative boundaries of each of the units of the NFT and includes all MAs. This boundary was chosen, because the administrative boundary of the NFT includes all possible treatment sites in the case of a wind event. The time span for the cumulative effects analysis to TES species is three years after an event occurs. The private lands are generally managed for short rotation timber harvest or for residential uses. Prescribed burning with fire breaks, midstory mulching, thinning, and oil and gas exploration are the other known actions occurring near the area. Control of NNIPS would occur, but should not affect Navasota ladies'-tresses since suitable habitat would not be treated.

There would be no cumulative effects to this plant species over time as a result of implementing Alternative 2. Standards in the Forest Plan and Design Criteria associated with this proposal are designed to minimize or eliminate the potential for impacts to TES plants

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on Navasota Ladies'-Tresses.

3.10 Forest Service Sensitive Species

Sensitive species are taken from the Southern Region (R-8) Regional Forester's Sensitive Species List (8-7-01) and are listed earlier in this chapter. Species are addressed as a group if effects from the proposed alternative are expected to be similar due to the species similar life histories and habitat requirements.

A. Mammals – Affected Environment and Environmental Consequences

1. Rafinesque's Big-eared Bat (Corynorhinus rafinesquii) and Southeastern Myotis (*Myotis autroriparious*)

Rafinesque's big-eared bat reaches the western limit of its range in east Texas. Rafinesque's big-eared bat has been recorded from 16 counties in eastern Texas (Mirowsky et al. 2004). This species are experiencing population declines because of the loss of adequate roosting habitat. In east Texas, this bat roost in a variety of places that may include; crevices behind loose bark, hollow trees, under dry leaves, caves, wells, old mine shafts, buildings and cisterns, or other protected cavities or structures (Harvey 1999, Mirowsky et al. 2004). Preliminary research on habitat associations for the Rafinesque's big-eared bat in eastern Texas indicates a strong preference for roosting within bottomland hardwood communities (Mirowsky et al. 2004).

The Southeastern myotis inhabits mature bottomland hardwood forests, associated with areas of slow moving rivers and creeks or reservoirs and lakes. In East Texas this species typically roosts in hollow gum trees, but is also found in water tupelo, sweetgum, and human-made structures such as buildings and highway culverts (Mirowsky et al. 2004).

Alternative 1 - No Action

There would be no direct or indirect effects resulting from the No Action Alternative.

Cumulative Effects: Due to the fact that there would be no direct or indirect effects as no action is being taken, there would also be no cumulative effects.

Alternative 2 - Proposed Action.

There may be some direct effects to these species. Research on habitat associations for these species in eastern Texas indicates a preference for roosting within bottomland hardwood communities. Bottomland hardwood communities are typically found in MA 4, which are included in the proposed treatment areas. Therefore the proposed project could cause impact to these species.

There may be minimal indirect effects since tree removal activities may destroy some snags or hollow trees that may serve as roosting habitat for these species. However, these effects should be minor because of the abundance of snags across the NFT. The effects of prescribed burning on bat roosting habitat would be both harmful and beneficial. At a landscape level, suitable roost sites would be burned-up while at the same time some live trees would be killed, creating new snags available for roosting. This destruction and creation of snags across the landscape occur at a slower rate within the mesic habitats preferred by these bats because of the low intensity fires within these areas.

Cumulative Effects*:* The cumulative effects analysis area and timeframe would be the project area and adjacent Forest Service and private lands over a three year period. The land around the proposed project area is Forest Service and private lands. The private lands are generally

managed for short rotation timber harvest or for residential uses. Prescribed burning with fire breaks, midstory mulching, thinning, and oil and gas exploration are the other known actions occurring near the area. Control of NNIPS would occur, but should not affect these species since suitable habitat would not be treated.

Conditions on adjacent private lands provide little opportunity for the development of roosting habitat for these species. Pine on these lands is being managed for short rotations (approximately 30 years). Lands managed intensively for wood production generally have lower densities of snags than national forests (Van Lear 1993). With management practices unlikely to change on private land in the foreseeable future, habitat for these species would remain limited on adjacent lands.

Alternative 3 - High Priority Areas Only
There would be no direct effects on these species. High quality potential habitat for these species does not occur in any of the treatment areas and they do not have high potential to occur in the treatment areas. The day roost sites most often used by these bats in eastern Texas are large diameter hardwoods (often black gum, genus *Nyssa*), that are heavily buttressed, hollow, and have a large triangular basal entrance (Mirowsky and Horner 1997). Such trees are restricted to mature bottomland hardwood forest, where no tree removal would occur.

Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because no treatments would occur in MA 4, MA 5, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1.

B. Birds – Affected Environment and Environmental Consequences
1. Bachman's Sparrow
The Bachman's sparrow (*Aimophila aestivalis*), a sensitive species, is an inhabitant of open pine forests with grassy understories or other open areas with thick grassy cover (Hamel 1992). This species is a permanent resident of the NFT in areas that are frequently burned and maintained in an open condition. It is regularly reported during annual bird point surveys. Foraging occurs on the ground; therefore an herbaceous cover is necessary. Nesting occurs from mid-April to late May in areas with a high density of herbaceous cover and a low density of midstory and overstory (Dunning 2006). Decline of this species is attributed to the loss of pine forest containing a grassy understory.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Cumulative Effects: Due to the fact that there would be no direct or indirect effects as no action is being taken, there would also be no cumulative effects.

Alternative 2 - Proposed Action.
Effects to Bachman's sparrow are expected to be similar to those discussed for the RCW. Quality habitat supports frequent, low-intensity ground fires. These frequent fires promote a groundcover of grasses and forbs by reducing woody understory and midstory vegetation. By removing down trees, fuel loading would be reduced, which should allow for the continued application of frequent low-intensity prescribed fires. Timber removal could destroy some nests of this species if conducted during the nesting season, but overall habitat would be improved for subsequent breeding attempts and foraging opportunities. Similarly, tree removal conducted during the non-nesting season may temporarily displace some individuals. Prescribed burning would have beneficial indirect effects. Prescribed burning on much of the NFT has been effective in improving habitat conditions.

Cumulative Effects: The cumulative effects analysis area and timeframe would be the project area and adjacent Forest Service and private lands over a three year period. The land around the proposed project area is Forest Service and private lands. The private lands are generally managed for short rotation timber harvest or for residential uses. Prescribed burning with fire breaks, midstory mulching, thinning, and oil and gas exploration are the other known actions occurring near the area. Control of NNIPS would occur, but should not affect the Bachman's sparrow since suitable habitat would not be treated. Control of NNIPS is limited to utility rights-of-way, special use sites, recreation sites, and road rights-of-way.

Habitat for Bachman's sparrow on some portions of the national forest and most private land in the project vicinity is in poor condition. This is due to the lack of frequent fires within forested areas and the resulting lack of the grassy understory preferred by this species. Private forests in the vicinity would probably continue to provide poor habitat. The cumulative effects would be beneficial. Prescribed burns on much of the national forest have been effective in improving habitat conditions. Removal of the downed and damaged trees would reduce fuel loads, making prescribed fire in these areas more effective than would be the case if the many downed trees were left in place. This project would also help to alleviate potential smoke management problems from extended burning and smoldering of large fuels for several days after a prescribed burn, allowing continuation of large prescribed burns. Overall, the proposed work would facilitate continued management and maintenance of existing high potential habitat, and would facilitate development of marginal habitat into high potential habitat.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on Bachman's sparrow.

2. Bald Eagle

The bald eagle has high potential to occur in coastal areas and within two miles of large bodies of water such as reservoirs, lakes, and rivers (USDI 1995). In eastern Texas, this high potential habitat contains mature pines with an unobstructed line of sight and flight path, which the eagles select for nest trees. In the southeast, the nesting period usually occurs from October to May (USDI 1995). Bald eagles primarily forage on fish, but their diet also includes waterfowl, rodents, reptiles, and carrion (USDI 1989). After decades of decline, eagle populations have recovered steadily in recent years. The primary threats facing the species today are the loss of habitat to alteration and development, and disturbance at existing nest sites (USDI 1989).

Bald eagles have been sited at Toledo Bend Reservoir, Sam Rayburn Reservoir, Lake Conroe, and Ratcliff Lake. Multiple nests are found along the shorelines of Sam Rayburn and Toledo Bend Reservoirs.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Cumulative Effects: Due to the fact that there would be no direct or indirect effects and no action taken, there would also be no cumulative effects.

Alternative 2 - Proposed Action

Direct effects are possible, since noise disturbance from forest management activities may temporarily force unknown individual eagles into other areas of the forest. Field surveys would be done in and around the treatment areas. If any eagle nests are found, a 660 ft. buffer would be established around all active bald eagle nests to preclude equipment and timber harvest activities near nests during nesting season (October to May). If an unknown nest is found while treating the project area, the operation would be temporarily halted, the district biologist would be notified, the nest tree would be protected and a buffer would be established around its perimeter. There project would have beneficial indirect effects because the treatments would lessen the potential for catastrophic wildfires, thus protecting nest trees and associated shoreline forested habitat.

Cumulative Effects: The cumulative effects analysis area and timeframe would be the project area and adjacent Forest Service and private lands over a three year period. The land around the proposed project includes Forest Service and private lands. The private lands are generally managed for short rotation timber harvest or for residential uses. Prescribed burning with fire breaks, midstory mulching, thinning, and oil and gas exploration are the other known actions occurring near the area. Control of NNIPS would occur, but should not affect the bald eagle since suitable habitat would not be treated.

The proposed removal of downed and damaged trees from high potential eagle habitat would reduce the potential for prescribed fires or wildfires to burn intensely, which could damage or kill habitat. Removal of the downed and damaged trees would reduce fuel loads in the treatment areas, which would increase the effectiveness of prescribed burning. Prescribed fire is important in keeping fuel loads low, so that the potential for wildfires remains low.

Nearby private lands provide limited habitat for bald eagles. Failing to remove downed and damaged trees from the treatment areas would potentially reduce the value of those areas to

eagles in the long term. If any bald eagle nests are found during project implementation, they would be appropriately protected by following the National Bald Eagle Guidelines (USDI 2007).

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on the bald eagle.

C. Insects – Affected Environment and Environmental Consequences

1. Texas emerald dragonfly (*Somatochlora margarita*)
The Texas emerald dragonfly, also known as the Big Thicket emerald dragonfly, has been found in San Jacinto, Sabine, and San Augustine counties, but its potential range may exceed 10,000 square miles in southeast Texas, including all of the NFT. Habitat requirements are poorly understood, especially for the larvae which seem to be associated with small, clear, sandy-bottomed streams and boggy seeps within loblolly and longleaf pine stands (NatureServe 2012). Larval characteristics are largely unknown, but members of the genus generally disappear when forests are cleared along with associated activities (Price et al. 1989). Adults have been observed foraging over forest openings, such as roads.

This species *does not* have high potential to occupy proposed treatment areas because these areas *do not* include high potential habitat as described above for larvae. Treatment areas have been delineated to exclude streams (perennial and intermittent) and their associated protection zones (MA-4). However, because of the small potential for indirect effects to aquatic habitat, this species is included in the detailed analysis. Site specific surveys are not feasible and would not improve effects analyses or allow improved project design.

Alternative 1 - No Action
Direct/Indirect: There would be no *direct* or *indirect effects* resulting from the No Action Alternative.

Cumulative Effects: Due to the fact that there would be no direct or indirect effects, there would also be no *cumulative effects*.

Alternative 2 - Proposed Action
Direct and Indirect Effects: Given that the adult Texas emerald dragonfly is highly mobile and forages at canopy level most of the time, above the actual treatment areas for this project, negative direct effects to adults are not anticipated. The proposed tree removal actions could potentially result in temporary increases in sediment delivery to high potential habitats for larvae, all of which lie outside the proposed treatment areas. However, adherence to *Plan* S&Gs and

project design criteria for protecting stream courses would minimize the magnitude of this occurrence, and adverse indirect effects to streams are not anticipated.

Scientific literature and monitoring results in the south demonstrate that appropriate Best Management Practices (BMPs), fully implemented as designed and adapted to a site, effectively protect water chemistry, aquatic habitat, and aquatic biota (Prud'homme and Greis 2002). Plan measures and project design criteria are employed for protecting stream courses (the *Plan*, p.82-83, 153-154, and 158-159).

Cumulative Effects: The cumulative effects analysis area and timeframe would be the project area and adjacent Forest Service and private lands over a three year period. The land around the proposed project area is Forest Service and private lands. The private lands are generally managed for short rotation timber harvest or for residential uses. Prescribed burning with fire breaks, midstory mulching, thinning, and oil and gas exploration are the other known actions occurring near the area. Control of NNIPS would occur, but should not affect the Texas emerald dragonfly since suitable habitat would not be treated.

Several of the streams that could run through treatment areas either originate or terminate on private lands. Activities on these private lands could affect larval habitat. However, the proposed treatment activities would not adversely impact water quality or larval habitat over the long term. Other activities on National Forest land in and near the treatment areas, such as prescribed burning, also follow Forest Plan design criteria to similarly protect stream courses. Because there would be no reduction in the number of forested acres, there would be no cumulative effects on foraging habitat for adult dragonflies.

National forest lands provide the best opportunity for the protection or maintenance of habitat for this species in the long-term. Management practices near streams are generally more restrictive than on adjacent private lands, in which employing protection measures for streams is voluntary.

Alternative 3- High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on the Texas emerald dragonfly.

D. Aquatic Species – Affected Environment and Environmental Consequences

1 Lotic Species (Moving Water)

Fish: The Sabine shiner (*Notropis sabinae*) lives in creeks and small to medium sized rivers with sandy bottoms. Its range extends from east Texas to the Mississippi river drainage, and north to

Missouri. Spawning takes place April through September in Texas and Louisiana, and multiple clutches are likely (NatureServe 2012). It is probable that the Sabine shiner may tolerate higher turbidity waters, precluding the need for silt free sand substrates. Threats to this species include alterations to stream flow, such as culverts that block fish passage, fragmentation, and siltation.

Habitat for the Sabine shiner is available in several creeks on the NFT. However, this species does not have high potential to occupy proposed treatment areas because these areas do not include high potential habitat as described above. Sabine shiners are difficult to survey for, and site specific surveys are not feasible and would not improve effects analyses or allow improved project design.

Lotic Crayfish: Blackbelted crayfish (*Procambarus nigrocinctus*) is a lotic stream inhabiting crayfish known to occur among debris in streams with sandy bottoms. Little is known about this species. NatureServe (2012) lists land development and habitat draining or surfacing as possible threats. Generally, crayfish are most closely associated with small stream riparian habitats generally associated with intermittent streams and small perennial streams with narrow floodplains.

Mussels: Texas Pigtoe (*Fusconaia askewi*), triangle pigtoe (*Fusconaia lananensis*), Louisiana pigtoe (*Pleurobema riddellii*), Texas heelsplitter (*Potamilus amphiachaenus*), sandbank pocketbook (*Lampsilis satura*), and southern hickorynut (*Obovaria jacksoniana*) are freshwater mussels that may inhabit a variety of water-body types including large and small rivers and streams, lakes, ponds, canals, and reservoirs (Howells et al. 1996). The Ouachita rock pocketbook (*Arkansia wheeleri*) inhabits backwater tributaries of the Red River near Lamar County with clean or vegetated sand/gravel/cobble bars, and shallow waters/pools on sand or mud with little or no current (NatureServe 2012). These seven sensitive mussel species have high potential to occur in mud, sand, or gravel substrates in streams and small rivers. They do not occur in deep shifting sands or deep soft silt (Howells et al. 1996), which can contribute to smothering. Mussels filter feed on algae, detritus, and small particles in the water, and may be able to absorb some organic material in solution (Howells et al. 1996).

Impoundment of river systems is believed to be the most significant threat facing freshwater bivalves. Impoundment alters flow regimes, increases sediment accumulation, and may impede movement of fish hosts. Impoundments of streams, such as dams, alter flow and temperature regimes; disrupt the timing of reproduction and associated behavior of fish and mussels. Pollution, over harvest, reduced spring and river flows, introduction of exotic species, and sedimentation are other probable causes of decline (Williams 1993, Howells et al. 1996, Watters 2000). In addition, any impacts to fish may negatively affect mussels, which use certain fish as hosts for larval development (Howells et al. 1996).

Alternative 1- No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Cumulative Effects: Due to the fact that there would be no direct or indirect effects, there would also be no cumulative effects.

Alternative 2 - Proposed Action

Implementing the proposed management actions may result in increased sediment delivery to aquatic habitats. However, adherence to *Plan* measures and design criteria for protecting stream courses would minimize the magnitude of this occurrence. Adverse direct and indirect effects to streams from this project are not anticipated. Scientific literature and monitoring results in the south, demonstrate that appropriate Best Management Practices (BMPs) fully implemented as designed and adapted to a site, effectively protect water chemistry, aquatic habitat, and aquatic biota (Prud'homme and Greis 2002, p.524). The Plan measures and project design criteria are employed for protecting stream courses (the Plan, p.82-83, 153-154, and 158-159). These practices limit sediment delivery to streams, and are consistent with, or more restrictive than, state BMPs for protecting aquatic habitats from sedimentation. Impacts to fish from increased sediments are secondary to increasing migration obstructions.

The greatest potential impacts are to mussels since they are sedentary and unable to escape influxes of silt from increased ground disturbing activities. Given the extensive road system on the Forest, road ditch drainage would result in some increase in sediment and siltation.

The Plan standards and guidelines limit or prevent the use of equipment during wet ground conditions or in streamside zones (the Plan, p.82, p.158). During extended dry periods, roadside pools or other wet areas are likely to become completely dry. However, during these events, crayfish burrow into the soil up to depths of three feet. This behavior would allow these species to avoid direct surface disturbances from the proposed management actions. Silt runoff from ground disturbance may impact some lotic species.

Saa, et al (1994) found that particularly hot fires precipitate phosphorous from burnt soils, resulting in stream pollution. However, most prescribed burns do not get hot enough to affect soil chemistry. There is little possibility for *indirect effects* that could result from hot prescribed fires.

Cumulative effects*:* The cumulative effects analysis area and timeframe would be the project area and adjacent Forest Service and private lands over three year period. The land around the proposed project area is Forest Service and private lands. The private lands are generally managed for short rotation timber harvest or for residential uses. Prescribed burning with fire breaks, midstory mulching, thinning, and oil and gas exploration are the other known actions occurring near the area. Control of NNIPS would occur, but should not affect any aquatic species since suitable habitat would not be treated.

The watersheds for most streams in the project vicinity are located on both private and Forest Service lands. There are no expected changes in management activities on adjacent private lands. High potential habitat is likely scarce on private lands since protective measures for streams are less stringent and are optional for landowners. Other planned Forest Service activities, such as prescribed burning thinning, fire breaks, thinning, mulching and timber thinning would have little effect on aquatic habitat as long as the Plan's BMPs are adhered to, since the Plan contains measures to reduce or prevent impacts to aquatic habitats. Ultimately, the cumulative effects of all these projects are almost totally dependent on maintaining MA 4 integrity (including avoiding temporary crossings), maintaining/restoring fish passage, and preventing sedimentation and erosion from road runoff. Road improvements, such wing ditches

and water bars, would reduce road runoff. Overall, activities associated with this project are not expected to cause any deterioration of habitat quality, thus no measurable cumulative effects are anticipated.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Only MA 4 near private boundaries would be treated and no treatments would occur in MA 5. This alternative would have less potential direct, indirect, and cumulative effects compared to Alternative 2 since not treating in MA 4 or MA 5 provides additional protections for aquatic species.

2. Lentic Species (Still Water)

Sabine fencing crayfish and Neches crayfish live primarily in lentic habitats (still water). These crayfish occurs in temporary and permanent pools or roadside ditches and in individual burrows. Limiting factors for these crayfish include land development, agricultural runoff, and competition with other crayfish (NatureServe 2012). Creeks and drainages throughout the project area experience pooling during periods of low water flow. Temporary pooling of water outside creek channels occurs when rainfall is higher. The Sabine fencing crayfish is associated with the Neches River Basin (Hobbs 1990, p.595) on the ANF and DCNF. The Neches crayfish has been found on the ANF and DCNF.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Cumulative Effects: Due to the fact that there would be no direct or indirect effects, there would also be no cumulative effects.

Alternative 2 - Proposed Action
Crayfish that inhabit roadside pools could be directly affected (injured or killed) from a temporary increase in traffic on the roads and created temporary roads during project implementation. Long-term negative indirect effects to these species or its population are unknown but would be minimal as the work would occur during dry periods. Disturbance in one particular area of the forest during project implementation may temporarily displace individuals into other areas of suitable habitat.

Cumulative Effects: The cumulative effects analysis area and timeframe would be the project area and adjacent Forest Service and private lands over three year period. The land around the proposed project area is Forest Service and private lands. The private lands are generally managed for short rotation timber harvest or for residential uses. Prescribed burning with fire breaks, midstory mulching, thinning, and oil and gas exploration are the other known actions

occurring near the area. Control of NNIPS would occur, but should not affect any aquatic species since suitable habitat would not be treated

High potential habitat is likely scarce on private lands, since protective measures are less stringent, and are optional for landowners. Other planned Forest Service activities, such as prescribed burning, thinning, and fire breaks would have little effect on aquatic habitat, since the Plan contains measures to reduce or prevent impacts to aquatic habitats. Activities associated with this project would not cause any deterioration of habitat quality, thus minimal cumulative effects would be anticipated.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Only MA 4 near private boundaries would be treated and no treatments would occur in MA 5. This alternative would have less potential direct, indirect, and cumulative effects compared to Alternative 2 since not treating in MA 4 or MA 5 provides additional protections for aquatic species.

E. Plants – Affected Environment and Environmental Consequences

Records of past species occurrence reports and aerial photography was reviewed in order to determine presence/absence or areas of potential suitable habitat for these species. Sensitive plant species listed in Table 3-10 that either are known to occur or have suitable habitat in the project area have been identified and would be incorporated in further effects analysis. The other species do not have affinities to project area habitats, do not have distributional ranges that overlap the project area, and would not be affected by the proposed action. The proposed action would have no impacts on these plant species and they are dropped from further consideration herein.

Table 3-10: R8 Sensitive plant species known to occur and/or having suitable habitat on various units of the NFT.

Common name	Scientific name	NFT distribution and habitat	Individual NFT Units	
			Species known to occur	Is suitable habitat present?
Panicled indigobush	*Amorpha paniculata*	Angelina NF in bogs and baygalls	Yes	Yes
Incised agrimony	*Agrimonia incisa*	Angelina NF in sandy longleaf savanna	Yes	Yes
Texas bartonia	*Bartonia texana*	Angelina and Sam Houston NF in baygalls	Yes	Yes
Warner's hawthorn	*Crataegus warneri*	Davy Crockett NF in deep sandy soils	Yes	Yes
Mohlenbrock's umbrella sedge	*Cyperus grayoides*	Angelina and Sabine NF in xeric sandylands	Yes	Yes
Southern ladies'-slipper	*Cypripedium kentuckiense*	Angelina and Sabine NF in beech-white oak ravines	Yes	Yes
Neches river rose mallow	*Hibiscus dasycalyx*	Davy Crockett NF in sloughs and marshes	Yes	Yes
Pineland bogbutton	*Lachnocaulon digynum*	Angelina and Sabine NF in hillside seepage slope bogs	Yes	Yes
Slender gayfeather	*Liatris tenuis*	Angelina and Sabine NF in sandy longleaf pine savanna	Yes	Yes
Yellow fringeless orchid	*Platanthera integra*	Angelina NF in hillside seepage slope bogs	Yes	Yes
Barbed rattlesnake root	*Prenanthes barbata*	Angelina and Sabine NF in beech-white oak ravines	Yes	Yes
Large beakrush	*Rhynchospora macra*	Angelina NF in hillside seepage slope bogs	Yes	Yes
Sabine coneflower	*Rudbeckia scabrifolia*	Angelina and Sabine NF in hillside seepage slope bogs and baygalls	Yes	Yes
Texas sunnybells	*Schoenolirion wrightii*	Angelina NF in Catahoula pine barrens	Yes	Yes

Table 3-10: R8 Sensitive plant species known to occur and/or having suitable habitat on various units of the NFT.

Common name	Scientific name	NFT distribution and habitat	Individual NFT Units	
			Species known to occur	Is suitable habitat present?
Scarlet catchfly	*Silene subciliata*	Sabine NF on sandy post oak hillsides	Yes	Yes
Clasping twistflower	*Streptanthus maculatus*	Sabine NF where glauconite is present	Yes	Yes
Texas trillium	*Trillium texanum*	Angelina NF in baygall ecotones	Yes	Yes
Drummond's yellow-eyed grass	*Xyris drummondii*	Angelina NF in hillside seepage slope bogs	Yes	Yes
Harper's yellow-eyed grass	*Xyris scabrifolia*	Angelina and Sabine NF in hillside seepage slope bogs	Yes	Yes

MI = May impact individuals but not likely to cause a trend toward federal listing or a loss of viability; NI = No impact BI-Beneficial Impacts; NE-No Effect

1. *Amorpha paniculata* (Panicled False Indigo)

Amorpha paniculata is assigned a rounded global rank of G2 (imperiled) and a Texas state rank of S2 (imperiled). It has a limited range in the south-central U.S. and is considered rare in most if not all of that range. It occurs in deep acid woodlands and bogs over Letney (Arenic Paleudults) soils within the Catahoula Formation. *Amorpha paniculata* is a stout shrub that grows in deep acid woodlands and bogs in East Texas. Most habitat occurs within streamside management zones. It is distinguished from other Amorpha species by its fuzzy leaflets with prominent raised veins underneath, and the flower panicles, which are 8 to 16 inches long and slender, held above the foliage. It flowers between May and June. Threats include shading and overstocking of pines. Also, lack of fire is a major threat but some sites are being managed with fire. Many sites are on roadsides at stream crossings.

Surveys in areas of suitable habitat were conducted for this species by Philipps in 2005 and by Bridges, Singhurst, Nilles, and Philipps in 2006. This species is known to occur within Compartments 72, 85, 87, 90 and 92 in the ANF and Compartment 139 in the SNF. Recently, this species was found by Walker and Philipps in Compartment 18 on the DCNF, again at a stream crossing. Additional occurrences are expected with more survey work.

Alternative 1 - No Action

There would be no direct or indirect effects resulting from the No Action Alternative.

Cumulative Effects for Sensitive Plants

Due to the fact that there would be no direct or indirect effects, there would also be no cumulative effects.

Alternative 2 - Proposed Action

Existing population inventory information across the project area is not thorough for this species. However, resource protection measures that require adherence to MA-4 guidelines, site-specific surveys prior to implementing treatments, and other project design criteria aimed at eliminating soil disturbing activities where this species may occur, and other restrictions related to work in wet areas would allow this project to be implemented without negatively impacting this species and would result in no direct effects. This is a fire dependent species. The application of prescribed fire as a management tool in the project area would have beneficial indirect effects to this species since prescribed fire would reduce woody competition by top-killing shrubs, reduce shading by non-selective mid-story reduction, and reduce overstocking thereby allowing more sunlight to reach the lower mid-story/herbaceous layer of the forest.

Cumulative Effects for Sensitive Plants

Cumulative effects would be the same for all action alternatives (Alternatives 2 – 4). The cumulative effects area is within the administrative boundaries of each of the units of the NFT and includes all management areas (MAs). This boundary was chosen, because the administrative boundary of the NFT includes all possible treatment sites in the case of a wind event. The time span for the cumulative effects analysis to TES species is three years. The rational for this time span includes several considerations involving the current list of scheduled projects on the NFT. These include:

- Prescribed burning of approximately 100,000 acres per year Forest wide.
- Current and future projects involving accepted silviculture practices that promote forest health and species diversity of approximately 3,200 acres per year.
- Oil and gas development (well pads and pipelines).
- Special uses authorizations of approximately 900 per year.
- Non-native invasive species treatments of 250 acres per year.

Personnel considerations also drive the ability to treat areas impacted by wind events as these activities are also driven by available qualified personnel.

Adaptive management would also drive implementation of any wind event associated recovery/restoration efforts and new events on the NFT would set back the cumulative effects timeline. Following NEPA procedures, the decision would be reviewed at 5-year intervals to assure that effects analyses are consistent with current conditions and that any new information is incorporated. This is in addition to the continual information feedback to the decision making process associated with adaptive management.

Cumulative impacts include those impacts resultant from treatment from wind events on both Forest Service system lands and non-Forest Service system lands located within the administrative boundary of each unit in the NFT. Cumulative effects may arise from all treatment methods proposed in the proposed alternatives. Past, current, and reasonably foreseeable treatments on lands within the NFT administrative boundary include:

- Clearing of fallen trees/debris on highways and rights of ways by Texas Department of Transportation (TXDOT).

- Clearing of fallen trees/debris around equipment on well pads and the maintenance of vegetation in utility corridors.

- Clearing of fallen trees/debris and other treatments on private lands held by private timber companies, and others.

- Clearing of fallen trees/debris and other treatments by state agencies such as the Sabine River Authority and Texas Parks and Wildlife Department (TPWD) on state lands.

- Ongoing FS projects.

There are likely to be few cumulative effects to TES plants over time as a result of implementing the proposed alternatives. Standards in both the Forest Plan and those associated with this proposal are designed to minimize or eliminate the potential for impacts to TES plants. Areas treated over the course of three years, if any, would undergo a single recovery project (salvage sale or other accepted silviculture practice) followed by a successive number of prescribed burns.

Cumulative impacts of prescribed burning on the NFT include a continued restoration of the fire regime in a fire maintained ecosystem and thus a long-term (years) increase in quality of wildlife habitat. The direct effects to TES plants described previously are of short duration (days to months) and as such would not add cumulatively to effects to suitable TES plant habitats from other activities in areas where recovery efforts from a wind event would occur. For example, disturbance to TES plants related to these treatments ceases once treatment is complete (days to months) and vegetation would return to their normal patterns. Thus this direct effect does not add to cumulative effects due to its duration.

Given mitigation associated with this proposal in proximity to TES plants and wetland habitats (as described below), and implementation of other measures for protecting TES plants from negative impacts there would be no adverse cumulative effects. The use of prescribed fire is likely to have beneficial cumulative effects on TES plants associated with these communities. Pine and pine/hardwood forests and early successional habitats are commonly managed with fire resulting in improvement in the quality of habitats in a fire dependent ecosystem and would be within the scope of this proposal. There are likely to be few cumulative effects to plant species in wetland habitats over time as a result of implementing the proposed alternatives given that the proper mitigations are followed. Forest management in bottomland hardwood and wetland habitats would be limited to the application of prescribed fire. Efforts to increase fire frequency to burn away fallen debris and woody shrubs would likely have beneficial cumulative effects to fire dependent wetland habitats, whereas any fire can be expected to extinguish in the wetter wetland habitats that are fire intolerant, resulting in no adverse cumulative effects.

Alternative 3 - High Priority Areas Only

Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have a beneficial effect on *Amorpha paniculata* since this species occurs in bogs which are a part of MA 4.

2. *Agrimonia incisa* (Incised Agrimony)
This species has high potential to occur in fire-maintained, open-canopied longleaf pine savanna, on well-drained but not xeric sandy soils (Orzell 1990). Threats to this species include the exclusion of fire (which allows woody shrubs to invade its habitat), intensive site preparation, and conversion of open, mature longleaf pine forests to short rotation pine plantations (NatureServe 2012). This species is known in several compartments on the southern Angelina in primarily longleaf pine-dominated areas.

Incised agrimony is known from about 50 different sites on the Angelina National Forest, straddling the Jasper-Angelina County line south of Sam Rayburn Reservoir, centered on N31 04, W94 11 (MacRoberts and MacRoberts 1997), an area of approximately 4 km x 11 km. This area corresponds roughly to the area represented by compartments 73-87 of the ANF. Outside the ANF, the species is known from several sites farther east, including three sites on private land in northern Newton County. The species is seems to be "recovering nicely," most probably due to the National Forest's aggressive fire program (pers. communications T. Philipps 2004).

Bridges and Orzell (1989) – Recorded two occurrences in the Trout Creek area (compts. 77 and 80). J. Singhurst (1996) – Reported the species from eight sites on the ANF in compts. 73,75, 78-81, and 83. MacRoberts and MacRoberts (1995) – Reported 17 occurrences in nine compts. (75-79, 81, 83, 85, and 87. MacRoberts and MacRoberts (1997) – Documented eight additional occurrences in compts. 75-78,81,83,85, and 87. Surveys did not find this species in high potential habitat west of these compartments in Upland Island Wilderness (compts 68-70 and 94-99), Boykin Springs area (compt. 92), north of Sam Rayburn Reservoir. Various botanists (1998) surveyed high potential habitats in 11 compartments (comp. 1-7, 11, and 13-15) on the north side of Sam Rayburn Reservoir for Forest Service sensitive species, and this species was not found.

A hillside seepage slope bog floristic survey conducted between 8/8/06-8/11/06 resulted in the inadvertent documentation of one additional population of *Agrimonia incisa* in C-77 of the ANF. Another survey specifically designed to relocate known occurrences of this species was conducted between 9/21/2006 and 9/24/2006. A total of 15 historical occurrences were visited resulting in the relocation of 9 extant occurrences. Additional surveys conducted in 2007 have resulted in the documentation of this species in three more areas on the Angelina NF, all within the Trout Creek area. In 2010, Philipps and Elliott documented this species once again in C-77. In 2011, Philipps and Elliott discovered two new occurrences for this species in Compartments

78 and 85 while surveying the Sandy Creek area. *Agrimonia incisa* is a localized species restricted to a small area on the ANF. It does appear under favorable habitat and management conditions (longleaf pine savanna with a frequent fire return interval). It is unknown why this species has not been documented in other areas of the District that share those same attributes.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information is adequate because surveys have identified sufficient numbers of occurrences within the National Forests. Project activities could have direct effects on this species by damaging or destroying individual plants with equipment usage in high potential habitat. This is a fire dependent species. The application of prescribed fire as a management tool in the project area would have beneficial indirect effects for this species. Prescribed fire would reduce woody competition by top-killing shrubs, reduce shading by non-selective mid-story reduction, and reduce overstocking thereby allowing more sunlight to reach the lower mid-story/herbaceous layer of the forest.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on *Agrimonia incisa*.

3. *Bartonia texana* (Texas Bartonia)
This species is a Texas endemic, and has been documented in eight counties in southeastern Texas and is found in Jasper and Nacogdoches counties on the ANF. It is known within compartments 76, 86, and 112. It occurs in wet seepage areas, streams edges, and other mesic to wet sites such as sphagnum bogs.

MacRoberts and MacRoberts surveyed high potential habitats for Forest Service sensitive plant species in many compartments on the Angelina in the 1990's. They found the species in Compartments 76 and 86. Plants found in Compartment 76 were in a baygall; and the plants in Compartment 86 were found upslope from a baygall in a sand/baygall ecotone. Robert Evans, then Forest Botanist, and David Peterson, Fisheries Biologist, located Texas Bartonia in Compartment 76 in September 1994 in a baygall. This may be the same population reported by the MacRoberts. A large area known to occupy Texas bartonia occurs on the SFA Experimental Forest, Compartment 112 of the ANF. This information is from district records (occurrence map) of unknown origin. The species was not found during an inventory performed by Forest Botanist, Tom Philipps, in 2005. Surveys conducted on September 23-24, 2006 could not relocate the two occurrences reported by MacRoberts in 1997, but another survey conducted in

late September 2006 on the SHNF relocated the C-98 population. Loos reported a suspected, but not confirmed, occurrence for this species within a baygall in C-75 of the ANF. The specimen was not in good condition and could not be differentiated between *B. texana* and *B. paniculata*, which occur in similar habitats. *Bartonia texana* appears to be truly rare. The continuing drought in 2011 made conditions for this species in its habitat very unfavorable. Nevertheless, Loos conducted surveys for this species in Compartment 71 and in suitable habitat within Upland Island Wilderness without success. Likewise, a survey by Philipps and Marr in Compartment 76 in a previously documented location returned negative results.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information across the project area is not thorough for this species. However, resource protection measures that require adherence to MA 4 guidelines, site-specific surveys prior to implementing treatments, and other project design criteria aimed at eliminating soil disturbing activities where this species may occur, and other restrictions related to work in wet areas would allow this project to be implemented without negatively impacting this species. Fire would not be directly applied to riparian areas; rather, low intensity fire would be allowed to back into streamside vegetation (the Plan, p. 155) where it generally goes out naturally. The application of prescribed fire as a management tool in the project area would have no direct or indirect effects to this species since any prescribed fire applied would extinguish naturally upon reaching the wet sphagnum substrate where this species occurs.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have a beneficial effect on *Bartonia texana* since this species occurs in bogs which are a part of MA 4.

4. *Cyperus grayioides* (Mohlenbrock's Umbrella Sedge)
This sedge has been recorded in several Midwestern and southern states, including Texas, where it has been found in 20 eastern counties (Orzell 1990). *Cyperus grayioides* occurs on dry, sandy barren openings in upland longleaf pine savannahs on xeric stream terrace Pleistocene sand ridges and on the Willis (Quaternary) and Catahoula (Miocene) Formations. The plant forms open colonies around the rims of blowdowns (wind formed depressions), on active dunes, and rarely in disturbed roadsides associated with dry sand prairies (Bowles et al. 1986). This species is also found in open well-drained sandy soils with little or no other vegetation present. Most sites are full sun with little shade. Suitable habitat includes early successional stages of sand prairies, and sandy barrens of xeric forests (upland longleaf pine and post oak forests).

This species declines as herbs and young hardwoods invade the habitat over time. The habitat is maintained by disturbances such as grazing and fire that suppress invasion of other vegetation. Habitats may be recreated by simulating disturbances (with fire or bull-dozing small areas to disturb the seed bank and clear vegetation) where it once occurred. The lack of fire to maintain its habitat is a limiting factor for the species.

MacRoberts and MacRoberts surveyed high potential habitats for Forest Service sensitive plant species in many compartments on the ANF in the 1990's. They found the species in Compartments 74, 76, and 87 (Sherwood Creek). Plants were found in two locations in Compartment 76 on deep sandy hilltops. An additional three sites are located on the SNF. Numerous surveys on the south ANF by various forest botanists and other botanists/biologists have not recorded additional occurrences of the species until 2011 when Philipps documented this species in Compartment 74 in the ANF.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information is adequate because surveys have identified sufficient numbers of occurrences within the National Forests. Project activities may have direct effects on this species by damaging or destroying individual plants, but would not cause a trend toward listing or a loss of viability. However, this is a fire dependent species. The application of prescribed fire as a management tool in the project area would have indirect effects to this species since prescribed fire would reduce woody competition by top-killing shrubs, reduce shading by non-selective mid-story reduction, and reduce overstocking thereby allowing more sunlight to reach the lower mid-story/herbaceous layer of the forest. In addition, since this species commonly forms open colonies around the edges of wind formed depressions, any root sprung tree could potentially provide additional suitable habitat.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on *Cyperus grayioides*.

5. *Lachnocaulon digynum* (Pineland Bogbutton)
Lachnocaulon digynum is restricted to seasonally or semi permanently saturated substrates, usually with little or no shrub or tree cover, within hillside seepage slope bogs in the West Gulf Coastal Plain. It has a rounded global conservation rank of G3 and is ranked S1 (critically imperiled) in Texas. *Lachnocaulon digynum* requires active management, most importantly the

maintenance of its habitat through prescribed burning. In addition to prescribed burning, it is also necessary to prevent drainage of the habitat by adjacent or upslope ditching. No grazing should be allowed in the habitat, and no major disturbances of the soil surface within the population. Minor surface disturbances, however, could provide sites for establishment of new colonies.

Numerous surveys have been conducted within areas of suitable habitat in the NFT for this species. Surveys have been conducted by Bridges and Orzell in the late 1980's, the MacRoberts in the mid-1990's, Singhurst in the late 1990's and in early 2000's, and Philipps in the mid 2000's for this species without a single confirmed occurrence record. However, a survey by Walker and Philipps in 2010 documented this species in a bog in Compartment 92 in the ANF.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information across the project area is not thorough for this species. Resource protection measures that require adherence to MA 4 guidelines, site-specific surveys prior to implementing treatments, other project design criteria aimed at eliminating soil disturbing activities where this species may occur, and other restrictions related to work in wet areas would allow this project to be implemented without having negative direct effects on this species. This is a fire dependent species. The application of prescribed fire as a management tool in the project area would have beneficial indirect effects to this species since prescribed fire would reduce woody competition by top-killing shrubs, reduce shading by non-selective mid-story reduction, and reduce overstocking thereby allowing more sunlight to reach the lower mid-story/herbaceous layer of the forest.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have a beneficial effect on *Lachnocaulon digynum* since this species occurs in bogs which are a part of MA 4.

6. *Liatris tenuis* (Slender Gayfeather)
This species has high potential to occur in open, fire-maintained, dry upland longleaf pine savannas on the Catahoula Formation (Orzell 1990). The species is known from over 40 locations on the ANF in the longleaf ridge area and from several locations in the southern SNF, including C-139 and C-142. The distribution of locations indicates that the species is widespread on the Forest. Threats to these species include conversion of high potential habitat to dense young pine plantations, severe soil disturbance such as from intense site preparation, and the invasion of woody understory species as a result of fire exclusion.

Orzell (1990) conducted extensive surveys for sensitive plants throughout much of the ANF, focusing on habitats most likely to contain rare and sensitive species, including well-burned upland longleaf forest. He found this species in compartments 73, 84, 86, 88, 92, and in Upland Island Wilderness on the ANF. MacRoberts and MacRoberts surveyed high potential habitats for sensitive plant species, which included *Liatris tenuis*, in the following 11 compartments: 31, 32, 33, 34, 60, 61, 62, 74, 75, 76, and 77 at various times during the 1990s. The species was found in compartments 61 and 76. Various botanists (1998) surveyed high potential habitats in 11 compartments on the north side of Sam Rayburn Reservoir for sensitive species, which included *Liatris tenuis*. The compartments surveyed were 1-7, 11, and 13-15. A survey was conducted on October 26-27, 2004 in Compartment 139 on the SNF for unrecorded occurrences of Liatris tenuis. One new population was documented in this area. No other surveys were conducted in FY 2005 specifically for this species; however, other botanical surveys in longleaf pine habitat were conducted in 2005 with no new occurrences noted. A hillside seepage slope bog floristic survey conducted between 8/8/06-8/11/06 resulted in the documentation/association of *Liatris tenuis* in three locations in Boykin Springs on the ANF and one location on the Stark Tract on the SNF. In addition, a project survey conducted in C-139 on the SNF following a prescribed burn revealed literally thousands of *Liatris tenuis* in flower across the landscape.

Additional surveys done on the ANF in 2006 and 2007 resulted in the discovery of six more occurrences. Also, another hillside seepage slope bog floristic survey completed in July 2007 resulted in the documentation/association of this species occurring at the lower edges of these communities in another three locations within the Boykin Springs area of the ANF. In 2009, Walker documented this species on the ANF scattered across Compartments 91 and 92. In addition, Loos documented this species on the north end of the ANF in Compartment 1 and a new location in Compartment 14, all within areas of sandy soils. Surveys by Loos in 2010 within Compartments 81, 82, and 94 did not result in finding any specimens.

2011 surveys by Elliott, Philipps, and Loos found new individuals in C-85 while surveying the Sandy Creek area. This species was also found by Philipps in Compartments 64, 73, and along a right of way within the Turkey Hill Wilderness Area while conducting project surveys. Later surveys by Philipps and Loos in Upland Island Wilderness revealed several more occurrences. It appears that this species can be found in those areas exhibiting sandy soil and are either maintained regularly by prescribed fire or found within open rights of ways that are free of competing brush and can be locally abundant in those areas.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information is adequate because surveys have identified sufficient numbers of occurrences within the National Forests. Project activities may have direct effects by damaging or destroying individual plants, but would not cause a trend toward listing or a loss of viability. This is a fire dependent species. The application of prescribed fire as a management tool in the project area would have beneficial indirect effects to this species since prescribed fire would reduce woody competition by top-killing shrubs, reduce shading by non-selective mid-

story reduction, and reduce overstocking thereby allowing more sunlight to reach the lower mid-story/herbaceous layer of the forest.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on *Liatris tenuis*.

7. *Platanthera integra* (Yellow Fringeless Orchid)
This orchid can be found in low, wet pine savannas, sphagnum seeps, and bogs in the southeastern United States from New Jersey, south to north-central Florida, and west to Tennessee and southeast Texas. The 1990 TNHP Report documented two small occurrences, both in bogs on the southern ANF. These two sites were examined in 1998 and both were still extant. The 1996 baseline is one population. Seasonal flooding and periodic burning are the key components to the communities where this orchid is found. The Global Status of the Yellow Fringeless Orchid is classified as G3-Vulnerable, and S1-Critically Imperiled for the state of Texas (NatureServe 2012).

Surveys for this species were conducted on August 24-25, September 19-21, 2005 and the following year on August 7-11 and September 5, 2006 in suitable habitat on the ANF. The two known extant occurrences were not relocated nor were any new occurrences documented during any of these surveys. However, a survey conducted on August 21, 2007 following the application of a prescribed burn the preceding spring resulted in the relocation of this species once again in one of the sites documented in 1998. Philipps' 2008 surveys of a number of Angelina bogs, the suitable habitat for this plant, did not result in finding any new occurrences of yellow fringeless orchid. . In surveys conducted in 2009 by Loos and subsequently Walker on the ANF did not relocate a single specimen of this species in any of the previously documented locations. No new locations were found.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information across the project area is not thorough for this species. Resource protection measures that require adherence to MA 4 guidelines, site-specific surveys prior to implementing treatments, other project design criteria aimed at eliminating soil disturbing activities where this species may occur, and other restrictions related to work in wet areas would allow this project to be implemented without having negative direct effects on this species. This is a fire dependent species. The application of prescribed fire as a management tool in the project area would have beneficial indirect effects to this species since prescribed fire

would reduce woody competition by top-killing shrubs, reduce shading by non-selective mid-story reduction, and reduce overstocking thereby allowing more sunlight to reach the lower mid-story/herbaceous layer of the forest.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have a beneficial effect on *Platanthera integra* since this species occurs in bogs which are a part of MA 4.

8. *Rhynchospora macra* (Large Beakrush)
This species is found within the Coastal Plain in hillside seepage slope bogs and pocosins from North Carolina to Texas. It is considered rare within its range and has a global conservation ranking of G3 and is ranked S1 (critically imperiled) in Texas. It is highly threatened by land-use conversion, habitat fragmentation, and forest management practices and is especially vulnerable to succession resulting from fire exclusion.

This species is known from several hillside seepage slope bogs within the ANF. A hillside seepage slope bog floristic survey conducted 8 August 2006 to 11 August 2006 resulted in the documentation/association of *Rhynchospora macra* in two locations in Boykin Springs on the ANF. An additional survey conducted by Philipps in 2007 resulted in the documentation of additional occurrences in C-76 and C-87 of the ANF. To date, there are five known element occurrence records for this species within the NFT.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information across the project area is adequate for this species. Resource protection measures that require adherence to MA 4 guidelines, site-specific surveys prior to implementing treatments, other project design criteria aimed at eliminating soil disturbing activities where this species may occur, and other restrictions related to work in wet areas would allow this project to be implemented without having negative direct effects on this species. This is a fire dependent species. The application of prescribed fire as a management tool in the project area would have beneficial indirect effects to this species since prescribed fire would reduce woody competition by top-killing shrubs, reduce shading by non-selective mid-story reduction, and reduce overstocking thereby allowing more sunlight to reach the lower mid-story/herbaceous layer of the forest.

Alternative 3 - High Priority Areas Only

Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have a beneficial effect on *Rhynchospora macra* since this species occurs in bogs which are a part of MA 4.

9. *Rudbeckia scabrifolia* (Sabine Coneflower)
Rudbeckia scabrifolia is a narrow endemic currently known from four southeast Texas counties and 2 Louisiana parishes. All of the Texas locations are from the Catahoula Formation or near the contact of the Catahoula and Willis Formations. It is restricted to hillside seepage slope bogs and associated broadleaf semi-evergreen acid-seep forests. It is threatened by fire suppression, which causes the bogs to become shrub-invaded, and by alteration of the local hydrology by roads and fire lanes, which can cause the bogs to dry out. Other threats may include logging, and hog browsing and rooting. However, many sites are well-managed and viable. It has a global conservation rank of G3G4 and a Texas state conservation rank of G3 (vulnerable).

There are over 80 occurrences of this species documented across its range. Bridges and Orzell documented 26 occurrences of this species on both the ANF and SNF during the 1989 surveys. Additional surveys conducted by other botanists since the 1989 baseline survey, including MacRoberts, Singhurst, and Philipps have documented additional occurrences in the majority of hillside seepage slope bogs and acid seep forests that occur within the Longleaf Ridge and Mayflower Uplands LTA. It appears to be relatively abundant within suitable habitat and is relatively secure where it exists.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information across the project area is adequate for this species. Resource protection measures that require adherence to MA 4 guidelines, site-specific surveys prior to implementing treatments, other project design criteria aimed at eliminating soil disturbing activities where this species may occur, and other restrictions related to work in wet areas would allow this project to be implemented without having negative direct effects on this species. This is a fire dependent species. The application of prescribed fire as a management tool in the project area would have beneficial indirect effects to this species since prescribed fire would reduce woody competition by top-killing shrubs, reduce shading by non-selective mid-story reduction, and reduce overstocking thereby allowing more sunlight to reach the lower mid-story/herbaceous layer of the forest.

Alternative 3 - High Priority Areas Only

Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have a beneficial effect on *Rudbeckia scabrifolia* since this species occurs in bogs which are a part of MA 4.

10. *Trillium texanum* (Texas Trillium)
This species is extremely rare in low moist woods, bogs and stream banks (Correll and Johnston 1970) and in low, boggy hardwood bottoms; seep borders of ravine streams. Often in sphagnum mats (NatureServe 2012). It is known only in Compartment 76, 77, and 86 of the ANF. MacRoberts and MacRoberts found the species in deep sandy soil on the ecotone between baygall/stream and upland pine/hardwoods.

Orzell (1990) conducted extensive surveys for sensitive plants throughout much of the ANF, focusing on habitats most likely to contain rare and sensitive species, including well-burned upland longleaf forest. He reported no occurrences of Trillium texanum on the ANF. MacRoberts and MacRoberts surveyed high potential habitats for Forest Service sensitive plant species, which included Trillium texanum, at various times during the 1990s. Their surveys in 1995-96 revealed 5 occurrences (sites) *of Trillium texanum* according to ANF records. All locations were in Compartment 76 of this project. Various botanists (1998) surveyed high potential habitats in 11 compartments (comp. 1-7, 11, and 13-15) on the north side of Sam Rayburn Reservoir for Forest Service sensitive species, and *Trillium texanum* was not found. Numerous other botanical surveys by Forest Botanists and other botanist have been conducted in the 1990's to the present on the ANF. In 2007, *Trillium texanum* occurrences were relocated in Compartments 76, 77, and 86 of the ANF. In 2009, Philipps and Singhurst revisited the 5 known sites. These sites are generally monitored on a yearly basis.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information across the project area is adequate for this species. Resource protection measures that require adherence to MA 4 guidelines, site-specific surveys prior to implementing treatments, other project design criteria aimed at eliminating soil disturbing activities where this species may occur, and other restrictions related to work in wet areas would allow this project to be implemented without negatively impacting this species. Fire would not be directly applied to riparian areas; rather, low intensity fire would be allowed to back into streamside vegetation (the Plan, p. 155) where it generally goes out naturally. The application of prescribed fire as a management tool in the project area would have no direct effects on this species since any prescribed fire applied would extinguish naturally upon reaching the wet sphagnum substrate where this species occurs. Additionally, there may be indirect

beneficial indirect effects to this species from the reduction of woody competition through the application of prescribed fire.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have a beneficial effect on *Trillium texanum* since this species occurs in bogs which are a part of MA 4.

11. *Xyris drummondii* (Drummond's Yellow-eyed Grass)
Xyris drummondii occurs in the Coastal Plain from southeast Georgia westward through northwestern Florida and south Alabama to southern Mississippi, Louisiana, and Texas. It is usually found in hillside seepage bogs where seepage has created exposures of wet fine sand or peaty sand. The Texas sites are exclusively on the Catahoula formation where groundwater emerges from a sandy residuum at its contact with an impervious layer of tuffaceous sandstone. It has a global conservation rank of G3 and is ranked S2 (Imperiled) in Texas.

Xyris is a difficult genus and usually requires an expert to identify. Bridges and Orzell documented nine occurrences on the Angelina NF during their 1989 baseline survey. The MacRoberts located an additional population in C-77 during a 1995 survey. Another survey conducted by Singhurst, Bridges, Nilles, and Philipps in 2006 resulted in the documentation of two more occurrences, all on the ANF. Several other occurrences have been documented by Philipps between 2007 and 2011. To date, there are 14 documented sites where this species is known to occur, all of them on the ANF.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information across the project area is adequate for this species. Resource protection measures that require adherence to MA 4 guidelines, site-specific surveys prior to implementing treatments, other project design criteria aimed at eliminating soil disturbing activities where this species may occur, and other restrictions related to work in wet areas would allow this project to be implemented without having negative direct effects on this species. This is a fire dependent species. The application of prescribed fire as a management tool in the project area would have beneficial indirect effects to this species since prescribed fire would reduce woody competition by top-killing shrubs, reduce shading by non-selective mid-story reduction, and reduce overstocking thereby allowing more sunlight to reach the lower mid-story/herbaceous layer of the forest.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have a beneficial effect on *Xyris drummondii* since this species occurs in bogs which are a part of MA 4.

12. *Xyris scabrifolia* (Harper's Yellow-eyed Grass)
Xyris scabrifolia occurs in the Southeastern Coastal Plain from North Carolina to Texas. In Texas, it is frequent in hillside seepage bogs on the Catahoula Formation. Within these seepage bogs, X. scabrifolia is found within open boggy areas and in partial shade of evergreen shrub thickets. The greatest threats to the Xyris scabrifolia suboccurrences include (1) habitat destruction by conversion to urban, suburban, agricultural, silvicultural, or military use, (2) alteration of hydrology as a result of habitat fragmentation, and (3) loss of herb diversity due to fire suppression. It has a rounded global conservation rank of G3. In Texas the conservation ranking is currently under review.

There are currently an estimated 144 element occurrence records for this species across its range, with 27 occurrence records located on the ANF and SNF. Bridges and Orzell had documented 19 locations during the 1989 baseline survey, the MacRoberts documented an incidental occurrence in C-76 of the ANF in 1995 while conducting a survey for another species, and Bridges, Singhurst, Nilles, and Philipps documented an additional 7 occurrences during the 2006 bog floristic inventory on the NFT. The species appears to be relatively abundant where suitable habitat exists and seems to be secure within the NFT.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information across the project area is adequate for this species. Resource protection measures that require adherence to MA 4 guidelines, site-specific surveys prior to implementing treatments, other project design criteria aimed at eliminating soil disturbing activities where this species may occur, and other restrictions related to work in wet areas would allow this project to be implemented without negatively impacting this species and would result in no direct effects. This is a fire dependent species. The application of prescribed fire as a management tool in the project area would have beneficial indirect effects to this species since prescribed fire would reduce woody competition by top-killing shrubs, reduce shading by non-selective mid-story reduction, and reduce overstocking thereby allowing more sunlight to reach the lower mid-story/herbaceous layer of the forest.

Alternative 3 - High Priority Areas Only

Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have a beneficial effect on *Xyris scabrifolia* since this species occurs in bogs which are a part of MA 4.

13. *Crataegus warneri* (Warner's Hawthorn)
Crataegus warneri is a Texas endemic found in four counties in East Texas: Anderson, Houston, Morris, and Walker. It occurs on the margins of upland oak-hickory and oak-hickory-pine woodlands or forests, mostly on deep sandy soils, and in deep xeric Blackjack oak sandhill communities on ridgetops, and sideslopes, often in bare sandy soil with little to no competition. The threat of habitat destruction is high in this region due to silvicultural and agricultural expansion, fire suppression, and urban and suburban development. It has a global conservation rank of G3 and a Texas conservation rank of S3 (vulnerable).

A baseline population survey conducted by Singhurst in 1994 resulted in the documentation of three occurrence records, all within the DCNF. Another survey conducted in association with a land exchange in the late 1990s resulted in the documentation of two more populations, again on deep sands within the DCNF. There are currently seven known populations of this species on the NFT, all within the DCNF.

This species is most often found in deep loose sands on hilltops and stream terraces with little to none vegetative competition. This suggests that *Crataegus warneri* prefers frequent fires or other disturbances that would minimize the amount of shrub encroachment on sites and thus allow for less competition. These disturbances (mowing, wind, fire etc.) are needed to maintain open habitat. Hurricane Ike caused large areas of downed trees thereby reducing competition for this species.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
There are some possible negative direct effects associated with the proposed action as there is a chance for the species to be damaged or destroyed from logging equipment through soil compaction if activities occur where the species is actually present. However, there would be beneficial indirect effects for this species in the short-term, as additional suitable habitat would be created by the removal of competing vegetation. The benefits from the creation of suitable habitat outweigh these risks. In the long term, without additional disturbances (like prescribed fire) to maintain the open non-competitive habitat conditions that this species prefers, population decline may follow.

The open conditions necessary for this species to exist and thrive need to be maintained through additional disturbances. Periodic wind events would reduce woody competition if *Crataegus warneri* can also survive the event. Since this species is fire dependent and tolerates fire events well, the application of prescribed fire is the most important tool to maintain suitable habitat for the species. Prescribed fire events are commonly used where this species exists on USFS lands as a management tool and that in itself should preserve species viability. However, mulching, chipping, or other mechanical methods of vegetation controls used as a management tool where this species exists would be avoided. Because this species occurs in other locations on the DCNF where project activities other than prescribed fire are not likely to occur, species populations should remain constant.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on *Crataegus warneri*.

14. *Hibiscus dasycalyx* (Neches River Rose Mallow)
Neches River Rose Mallow is a Texas endemic that was federally declared a Candidate species on May 4, 2004. The known range of this species is limited to the DCNF on the NFT, but suitable habitat may occur elsewhere. It is generally found to occur within openings in shrub swamps or along the margins of riparian woodlands in seasonally wet soils (often found near standing water). Sites are typically flooded during late winter and early spring, but the surface soils are often quite dry by late summer. In 2004, it was known from only six sites in three east Texas counties. All of the occurrences are subject to genetic swamping by more common Hibiscus species that are perhaps better adapted to human-disturbed conditions. The Global Status of this species is classified as G1-Critically Imperiled, and S1-Critically Imperiled for the state of Texas (NatureServe 2012). The viability of this species is considered to be at high risk of failing.

All known occurrences of Neches River Rose Mallow on the NFT are located on the DCNF. Records of surveys are somewhat spotty, but four occurrences had been documented by the early 2000's. These four occurrences were relocated by Philipps in 2005, and have been subsequently monitored in 2006 and 2007. An expedition by Loos down the Neches River from Neches Bluff past the Big Slough Wilderness area in 2010 and 2012 resulted in the documentation of four locations for this species, however two of the occurrences appeared to be hybrids and the one seemingly genetically pure occurrence occurred within a private inholding.

All four known sites were visited in 2011 by a group including Singhurst, Poole, Philipps, Loos, and several representatives from U.S. Fish and Wildlife Service as part of an evaluation process for possible listing of this species under the Endangered Species Act. Viable plants were found at

all four sites. Occurrences seemed healthy despite being somewhat stunted due to the drought and visible predation from animals and insects. Past flowering with seed production was observed in all sites. Chinese tallow was observed in all locations. Philipps and Loos also surveyed several other areas of suitable habitat within Compartments 54 and 49 without success. Later, Loos surveyed areas around Slay Creek and Barton Branch within Compartments 118, 120, and 121 again without success.

This species does not generally occur in bottomland streamside habitat but rather on or near the edges of small lakes, sloughs, and seasonally wet buttonbush swamps. It does tend to hybridize with other members of this genus, thereby making identification sometimes difficult. It has limited distribution on the NFT. Past re-stocking efforts have proven to have mixed results. A re-introduction program should be initiated to supplement past efforts. The Chinese tallow needs to be eradicated from all known sites.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information across the project area is adequate for this species. Resource protection measures that require adherence to MA 4 guidelines, site-specific surveys prior to implementing treatments, other project design criteria aimed at eliminating soil disturbing activities where this species may occur, and other restrictions related to work in wet areas would allow this project to be implemented without having negative direct and indirect effects on this species. Fire would not be directly applied to riparian areas; rather, low intensity fire would be allowed to back into streamside vegetation (the Plan, p. 155) where it generally goes out naturally. The application of prescribed fire as a management tool in the project area would have no direct or indirect effects on this species since any prescribed fire applied would extinguish naturally upon reaching the wet substrate where this species occurs.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have a beneficial effect on *Hibiscus dasycalyx* since this species occurs in areas which are a part of MA 4.

15. *Silene subciliata* (Scarlet Catchfly)
Scarlet catchfly grows within the ecotone between upland longleaf pine savannas and forested ravines, and is maintained by low-intensity ground fires. The 1990 TNHP Report noted the occurrence of this endemic species only in southwest Louisiana and southeast Texas, including five Texas counties. NatureServe (2012) has locations known in eight Texas counties. The

Global Status of the scarlet catchfly is classified as G3-Vulnerable, and S3- Vulnerable for the state of Texas (NatureServe 2012).

The known occurrences of scarlet catchfly were all found on the SNF. The 1990 TNHP report documented one occurrence located within the Stark Tract. Surveys done by Carr in 1990 failed to relocated this occurrence. However, the 1991 surveys by Carr and Evans resulted in finding two new occurrences—one at Fox Hunters Hill and a new occurrence at the Stark Tract. Ferguson relocated the Fox Hunters Hill occurrence in a 2000 survey. In 2005, Philipps relocated both of the occurrences found by Carr and Evans. A new occurrence was found in 2006 by Loos in the Stark Tract area. One of the occurrences found by Carr and Evans was relocated in 2007. Surveys on the SNF in 2009 by Loos and the MacRoberts did not result in locating this species. Surveys by Loos and Philipps in 2010 have resulted in the successful relocation of an occurrence reported by Ferguson in 2000 and a new occurrence in Compartment 140. 2011 surveys by Loos revealed no further new locations. Currently there are four known occurrences on the SNF.

This species does respond well to prescribed fire, after which an increase of flowering stems would be seen followed by a gradual reduction of individuals until the next fire event. This species is more common in Jasper and Newton counties which are further south of the District. The fact that scarlet catchfly has only been found in the far southeast corner of the District may be an indicator that it has reached the edge of its range.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information is adequate because surveys have identified sufficient numbers of occurrences within the National Forests. Project activities may have direct effects by damaging or destroying individual plants, but would not cause a trend toward listing or a loss of viability. Site-specific surveys prior to implementing treatments would mitigate many of the potential affects from project treatments. This is a fire dependent species. The application of prescribed fire as a management tool in the project area would have beneficial indirect effects to this species since prescribed fire would reduce woody competition by top-killing shrubs, reduce shading by non-selective mid-story reduction, and reduce overstocking thereby allowing more sunlight to reach the lower mid-story/herbaceous layer of the forest.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on *Silene subciliata*.

16. *Cypripedium kentuckiense* (Kentucky Lady's Slipper)
This species occurs on mesic beech-white oak forested slopes in east Texas. These slopes are generally only impacted by prescribed fire on a rare basis. It is distributed from the Ouachita Mountains in Arkansas east to the Cumberland Plateau in Kentucky and Tennessee, south to the east gulf coastal plain in Alabama and Mississippi, and west to Louisiana, southeastern Oklahoma and eastern Texas. The TNHP Report noted occurrences in seven counties in east Texas, including three occurrences on the Sabine NF and one on the ANF. The Global Status of the Kentucky Lady' Slipper is classified as G3-Vulnerable, and S1-Critically Imperiled for the state of Texas (NatureServe 2012).

Nine extant occurrences of Kentucky ladies slipper are currently known to be present on the SNF. The 1990 TNHP report documented three occurrences of this orchid on the SNF. Walker relocated one of these occurrences in 1990. Singhurst found three more occurrences and relocated three (1996). The MacRoberts found a new occurrence of the orchid in 1996. Evans and other biologists found two new occurrences in 1998. Ferguson relocated these occurrences in 2000 and 2001. Philipps relocated five occurrences in 2005. Surveys in 2006 by the Forest Service, TPWD, Azimuth Forestry, and the Pineywoods Chapter of the Texas Native Plant Society resulted in relocating several occurrences and one new occurrence. Philipps and Loos relocated five occurrences in 2007. Philipps surveyed for new occurrences in 2008. He did not find any new occurrences, but relocated two known occurrences. In 2009, Philipps and Loos again surveyed for this species. No new occurrences were discovered but all known locations were revisited and are extant. Surveys by Philipps and Loos in 2010 resulted in the relocation and of many of the known locations and the inadvertent discovery of a new occurrence totaling four plants on lands managed by the Campbell Group in the Matlock Hills area of the SNF.

2011 surveys by Singhurst and Loos in and around Compartments 2-4 failed to find this species, although suitable habitat was present. Other known sites in Matlock Hills, Height Hill, Indian Mounds Wilderness, Cypress Creek, Boat Ramp, and Bourghs Creek were revisited by Loos and appeared to be stable but exhibited very few flowering specimens as compared to past years.

Occurrences of this species have been stable for more than 15 years. They are not declining but neither are they expanding. It has been suggested that the Texas individuals are part of a relict population, outliers of a much more numerically abundant group. Habitat is limited in Texas however; individuals do not seem to have been negatively impacted from hurricanes, poaching, and feral hogs.

Alternative 1 - No Action
Direct and Indirect Effects: There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information across the Forest is not thorough for this species. However, specific resource protection measures that require site-specific surveys prior to implementing treatments and other restrictions related to work in these areas would allow this project to be implemented and avoid a trend toward listing or a loss of viability despite potential

impacts from falling trees. In addition, as most, if not all occurrences occur in MA-7 and MA 8 (Beech Ravines) where no project activities are expected to be implemented, there should be no direct or indirect effects.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on *Cypripedium kentuckiense*.

17. *Streptanthus maculatus* (Clasping Twistflower)
Streptanthus maculatus is known from Anderson, Nacogdoches, Sabine, and San Augustine in east Texas. It occurs primarily on seasonally moist barrens on the Weches Formation in Nacogdoches and San Augustine counties. However, there are recent reports from other sandy forested habitats in Anderson and Sabine counties. It currently has a global conservation rank of G3 and is ranked S2 (Imperiled) in Texas.

Steptanthus maculatus is an annual species and can be quite variable in size and flowering period. Mature individuals have been seen ranging from a height of 1.5 meters to 5 centimeters. For this reason, the species is extremely difficult to survey for. Most areas of suitable habitat for this species are not present within the NFT. Incidental occurrences have been documented on roadsides. It is theorized that seeds may have been deposited as part of road bed material (glauconite) that is mined from areas where this species is present. Only two documented populations for this species is known, both on roadsides. One is located in C-71 on the SNF. The other is located along a forest road on private land just south of C-70 on the SNF.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information across the Forest is not thorough for this species. Resource protection measures that require site specific surveys prior to implementing treatments and other restrictions related to work in areas would allow this project to be implemented and avoid a trend toward listing or a loss of viability despite potential negative direct or indirect effects.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on *Streptanthus maculatus*.

18. *Prenanthes barbata* (Barbed Rattlesnake Root)
Barbed rattlesnake root (*Prenanthes barbata*) has a Global Status of G3-Vulnerable and S3-Vulnerable for the state of Texas (NatureServe 2012). It has been found in eight states of the southeastern US—Kentucky, Tennessee, Georgia, Alabama, Mississippi, Arkansas, Louisiana, and Texas. In Texas, this plant has been documented in fifteen counties, mostly in East Texas. This species has been found on the ANF, the SNF, and most recently on the Caddo Grasslands. Barbed rattlesnake root is found in rich, mesic hardwood forests near rivers and streams. In Texas, it has been found in beech-white oak plant communities.

Prior to 1993, four populations of barbed rattlesnake root were recorded as occurring in East Texas, one on the SNF. Singhurst's 1993 surveys for this plant resulted in relocating the SNF population and finding six additional populations on the Forest, as well as another population on the ANF. Surveys of NFT sites with suitable habitat for this plant have been conducted by several botanists in the 1990's and in the past decade. Several sites have been relocated and new sites have been discovered, mostly on the Sabine.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information across the project area should be adequate for barbed rattlesnake root. Sufficient numbers of occurrences have been discovered on the forest so that the proposed project would not significantly affect its population. More importantly, suitable habitat for this plant is near streams. Resource protection measures that require adherence to MA 4 guidelines, site specific surveys prior to implementing treatments, other project design criteria aimed at eliminating soil disturbing activities where this species may occur, and other restrictions related to work in wet areas would allow this project to be implemented without negatively impacting this species. There should be no direct or indirect effects if the proposed project is implemented.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on *Prenanthes barbata*.

19. *Schoenolirion wrightii* (Texas Sunnybells)
This sun-loving, bulbous, rhizomatous perennial bulb species is known from only two compartments on the ANF: the Black Branch Barrens in Compartment 84, and recently found in the Rocky Branch Barrens in Compartment 86 (email communication from Forest Botanist, Tom Philipps, 17 March 2006). This species is found on shallow nutrient-poor, acid soils where woody vegetation is generally prevented from perpetuating (Grace 1993). Orzell (1990) described the Angelina sites stating sunnybells grow in forb dominated barrens, on shallow, nutrient-poor soils weathered from the Catahoula Formation. Fire is thought to be an important component of the habitat where the species is found as frequent fires may maintain the open savanna community and reduce encroachment of woody vegetation (Grace 1993).

Orzell (1990) conducted extensive surveys for sensitive plants throughout much of the ANF, focusing on habitats most likely to contain rare and sensitive species and found the species only in the Black Branch barrens in compartment 84.
MacRoberts and MacRoberts surveyed high potential habitats for Forest Service sensitive plant species over large areas of the District in the 1990s. Numerous Forest Botanists and others (e.g., Jason Singhurst with Texas Parks & Wildlife Department) have conducted inventories for TES plants. Texas sunnybells was found in two new locations in two of the Rocky Branch Barrens in compartment 86 by Singhurst and Philipps in March 2006. Also, this species is present in five distinct barrens in compartment 84. Surveys for this species are generally conducted annually in the spring.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Alternative 2 - Proposed Action
Existing population inventory information is adequate because extensive surveys of high potential habitat on the forest have resulted in this species being found in every compartment that contains Catahoula barrens communities. There would be no direct effects to this species. Resource protection measures that require site specific surveys prior to implementing treatments and other restrictions related to work in areas where this species may be found would allow this project to be implemented and avoid a trend toward listing or a loss of viability despite potential impacts from this project. The use of prescribed fire would be beneficial indirect effects, because it would reduce woody encroachment and improve barren habitat.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on *Schoenolirion wrightii*.

3.11 Management Indicator Species

A management indicator (MIS) is a species selected by the Forest Service to be used as a tool in forest planning, to help set management objectives, analyze effects of alternatives, and monitor the effects of plan implementation (36 CFR 219.19(a)(1)). Management indicators are selected to represent populations of other species which have similar habitat needs. A species may be identified as an MIS for various reasons including: 1) a species listed as threatened or endangered under the Endangered Species Act; 2) a species with special habitat needs; 3) a species that is commonly hunted, fished, or trapped; 4) a non-game species of special interest; 5) a species whose population changes are believed to indicate the effects of management on other species.

This MIS effects analysis is tiered to the Plan's Final Environmental Impact Statement (FEIS) discussion of effects on wildlife and fisheries (FEIS: Appendix F, 87-110 pgs.).

Appendix D provides a complete list of MIS and it includes reasoning for excluding or including MIS for further analysis in this document, based upon known occurrences, species range, and/or habitat present within the project area. For this project, the following subset of the forest-wide management indicators was selected (Table 3-11).

Table 3-11. Habitat type with Representing Species

Species	Habitat Type
Red-cockaded Woodpecker ***(Picoides borealis)***	**Dry-Xeric-Oak Pine forests**
Louisiana Squarehead **(*Tetragonotheca ludoviciana*)**	**Dry-xeric Oak pine forest**
Shortleaf – Oak forest	**Dry-xeric oak pine forest**
Longleaf – Bluestem series	**Longleaf pine woodland/savannah**
Loblolly - Oak forest	**Mesic oak-pine forest**
Navasota Ladies Tresses	**Longleaf pine barrens**
Little Bluestem –Rayless Goldenrod series	**Longleaf pine barrens**
Yellow Fringeless Orchid	**Herbaceous wetlands**
Sphagnum – Beakrush series	**Herbaceous wetlands**

Species	Habitat Type
Southern Ladyslipper	**Mesic hardwood forest**
Eastern wild turkey (*Meleagris gallopavo*)	**Forest/Grassland:** **Early-succession (0-20 yrs)** **Mid-succession (20-50 yrs)** **Late-succession (50-90 yrs)** **Old growth (90+ yrs)**
White-tailed deer (*Meleagris gallopavo*)	**Forest/Grassland:** **Early-succession (0-20 yrs)** **Mid-succession (20-50 yrs)** **Late-succession (50-90 yrs)** **Old growth (90+ yrs)**
Yellow-breasted chat (*Icteria virens*)	**Forest/Grassland:** **Early-succession (0-20 yrs)** **Mid-succession (20-50 yrs)** **Late-succession (50-90 yrs)** **Old growth (90+ yrs)**
Pileated woodpecker (Dryocopus pileatus)	**Forest/Grassland:** **Mid-succession (20-50 yrs)** **Late-succession (50-90 yrs)** **Old growth (90+ yrs)**
Gray and Fox Squirrels (Sciurus carolinensis and Sciurus niger)	**Forest/Grassland:** **Early-succession (0-20 yrs)** **Mid-succession (20-50 yrs)** **Late-succession (50-90 yrs)**

Species	Habitat Type
	Old growth (90+ yrs)
Snags	**Forest/Grassland:** **Mid-succession (20-50 yrs)** **Late-succession (50-90 yrs)** **Old growth (90+ yrs)**

The effects of the alternatives on MIS and their habitats would be addressed. These project-level effects should not be used to infer effects to MIS populations. Population and habitat trends of MIS on National Forest lands are best monitored and addressed at the landscape level.

A. Red-cockaded Woodpecker (*Picoides borealis*)
The effects of the two alternatives on the red-cockaded woodpecker (*Picoides borealis*) have been discussed previously under Birds - Affected Environment and Environmental Consequences - Red-cockaded woodpecker. No changes in trends are expected as a result of the proposed project.

B. Louisiana Squarehead (*Tetragonotheca ludoviciana)*
Environmental Baseline: Known also as the Sawtooth Nerveray, this species has been recorded in 19 east Texas counties as well as in western Louisiana and extreme southwest Arkansas. Louisiana squarehead is restricted to sandy soils in sandhill woods and xeric sandhills in longleaf pine savannas. Known populations are small in number of individuals (Rob Evans personal communication), and are known to occur on DCNF and ANF. Frequent fires should help maintain this species. Periodic prescribed burning would retard woody invasion, thereby maintaining open sandy areas with little competition. It is a fire-adapted species and appears to respond well to any fire intensity, as has been documented following the wildfire in C-77 of the Angelina National Forest where this species was seen to flourish as the result of that very intense fire. Also, the numbers of individuals found within road ROWs suggests that this species does well when there is a lack of woody competition. The Global Status of the Louisiana Squarehead is classified as G4-Apparently Secure, and S3-Vulnerable for the state of Texas (NatureServe 2012).

Surveys conducted by MacRoberts in 1995 resulted in the documentation of 5 populations on the ANF. Inventories and monitoring following the February 10, 1998 windstorm blowdown, found an additional population on the northern ANF and one population on the SNF. More surveys conducted in 2005 by Forest Botanist Tom Philipps resulted in the relocation of several populations on the DCNF and two new populations on the ANF. The current known populations are estimated at 20. The short-term objective in the *Plan* is 20 populations and the long-term objective is 25. A hillside seepage slope bog floristic survey conducted between 8/8/06-8/11/06 resulted in the inadvertent documentation of one additional population of this species in C-92 of the Angelina NF. In 2007, surveys conducted on the ANF in the Upland Island Wilderness

located one new population. As more southern pine habitat is managed with fire and overall fire frequency is increased, potential increases in sites with this fire-dependent plant may be possible.

Alternative 1 - No Action
There would be no direct or indirect effects resulting from the No Action Alternative.

Cumulative Effects: Due to the fact that there would be no direct or indirect effects, there would also be no cumulative effects.

Alternative 2 - Proposed Action
This species is most often found in deep loose sands on xeric blackjack, bluejack, or post oak hilltops. It is also often found on frequently maintained roadsides. This suggests that *Tetragonotheca ludoviciana* prefers frequent fires or other disturbances, such as mowing, that would minimize the amount of shrub encroachment on sites and thus allow for less competition. Hurricane Ike caused large areas of downed trees thereby reducing competition for this species. The activities under the proposed action would be beneficial for this species in the short-term, as additional suitable habitat would be created by the removal of competing vegetation. There is some potential for detrimental effects associated with the proposed action, as there is a chance for the species to be damaged or destroyed from logging equipment through soil compaction if activities occur where the species is actually present. However, the benefits from the creation of suitable habitat outweigh these risks.

Cumulative Effects: The open conditions necessary for this species to exist and thrive need to be maintained through additional disturbances. Periodic wind events would reduce woody competition for *Tetragonotheca ludoviciana*. This species can survive most disturbances at the surface and resprout. Since this species is fire dependent and tolerates fire events well, the application of prescribed fire would be an important tool to maintain suitable habitat for the species. Prescribed burning combined with the proposed reduction of heavy fuels and vegetative competition would have beneficial cumulative effects. Because this species occurs on the DCNF and the ANF, the population should remain constant. No changes in trends are expected as a result of the proposed project.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have no effect on *Tetragonotheca ludoviciana*.

C. Shortleaf – Oak forest
Shortleaf – oak forest is common throughout the NFT, and they occur in the project area. This forest type is used as an indicator for dry xeric oak-pine forest.

Alternative 1 - No Action
There would be no direct effects resulting from the No Action Alternative. Indirectly, effects would be negative because the downed timber has caused increased fuels. The excessive fuels after a wind event could cause fires to burn much more intensive, which could cause tree mortality.

Cumulative Effects: Prescribe fires and wildfires could burn much more intense and over longer durations with the heavy fuels from downed timber. If heavy fuels are not reduced, excessive tree mortality could occur when the upland xeric areas are burned.

Alternative 2 - Proposed Action
The proposed action would remove some upland shortleaf pines that have been damaged by a wind event. There may be a loss of some overstory leaning or rootsprung trees, but these trees would be expected to die anyway. The proposed action would reduce the number of future snags by removing these damaged standing trees. Overall, the project would have beneficial indirect effects by reducing fire hazards associated with heavy fuels.

Cumulative Effects**:** The cumulative effects should be beneficial as a result of reduced heavy fuels. No changes in trends are expected as a result of the proposed project.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have a beneficial effect on the shortleaf – oak forest since this habitat type occurs in both MAs.

D. Longleaf – Bluestem series
The longleaf- bluestem series is common on the southern Angelina and Sabine National Forests and could occur in the project area. This forest type is as an indicator for Longleaf pine woodland/savannah.

Alternative 1 - No Action
There would be no direct effects resulting from the No Action Alternative. Indirectly, effects would be the negative because of the downed timber has caused increased fuels. The excessive fuels could cause fires to burn much more intensive, which could cause tree mortality.

Cumulative Effects: Prescribe fires and wildfires could burn much more intense and over longer durations with the heavy fuels from downed timber. If heavy fuels are not reduced, excessive tree mortality may occur when these areas are burned.

Alternative 2 - Proposed Action
The proposed action would remove some longleaf pines that have been damaged by a wind event. There could be loss of some overstory leaning or rootsprung trees, but these trees would be expected to die anyway. The proposed action would reduce the number of future snags by removing these damaged standing trees. Overall, the project would have beneficial indirect effects by reducing fire hazards associated with heavy fuels.

Cumulative Effects**:** The cumulative effects should be beneficial as a result of reduced heavy fuels. No changes in trends are expected as a result of the proposed project.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same.

E. Loblolly - Oak forest
Loblolly-oak forests are common on the NFT and they occur in the project area. This forest type is as an indicator for mesic oak pine forest.

Alternative 1 - No Action
There would be no direct effects resulting from the No Action Alternative. There would be negative indirect effects because the downed timber has increased fuel loads. The heavier fuel load could cause fires to burn much more intensely causing tree mortality.

Cumulative Effects: Prescribe fires and wildfires could burn much more intense and over longer durations with the heavy fuels from downed timber. If heavy fuels are not reduced, excessive tree mortality could occur when these areas are burned.

Alternative 2 - Proposed Action
The proposed action would remove some loblolly pines that have been damaged by a wind event. There may be loss of some overstory leaning or rootsprung trees, but these trees would be expected to die anyway. The proposed action would reduce the number of future snags by removing these damaged standing trees. Overall, the project would have beneficial indirect effects by reducing fire hazards associated with heavy fuels.

Cumulative Effects**:** The cumulative effects should be beneficial as a result of reduced heavy fuels. No changes in trends are expected as a result of the proposed project.

Alternative 3 - High Priority Areas Only

Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have a beneficial effect on the loblolly-oak forest since this habitat type occurs in both MAs.

F. Navasota Ladies Tresses
The effects of the each alternative on the Navasota ladies tresses have been discussed previously under Plants - Affected Environment and Environmental Consequences. No changes in trends are expected as a result of the proposed project.

G. Little Bluestem –Rayless Goldenrod series
The little bluestem – rayless goldenrod series is primarily associated with the longleaf pine barren plant community. Some of these communities could occur in and near the treatment areas. The Black Branch barrens are found throughout the Longleaf Ridge Catahoula formation in MA 6.

Alternative 1 - No Action
There would be no direct or indirect effects as a result of this alternative.

Cumulative effects: Because this alternative would have no direct or indirect effects, it would also have no cumulative effects.

Alternative 2 - Proposed Action.
Most equipment activites would be restricted from operating within the Black Branch Barren area. Also, sight specific surveys would be conducted in any potentially suitable habtitat. Therefore, there is very low probability for any direct effects. There may be some benificial indirect effects associated with prescribed burning, which would improve the barrens habitat.

Cumulative Effects: The cumulative effects area is within the administrative boundaries of each of the units of the NFT and includes all MAs. This boundary was chosen, because the administrative boundary of the NFT includes all possible treatment sites in the case of a wind event. The time span for the cumulative effects analysis to TES species is three years. The private lands are generally managed for short rotation timber harvest or for residential uses. Prescribed burning with fire breaks, midstory mulching, thinning, and oil and gas exploration are the other known actions occurring near the area. Within the foreseeable future, control of NNIPS would occur but should not affect this species.

There would be no cumulative effects to this series over time as a result of implementing Alternative 2. Forest Plan standards and guidelines would eliminate the potential for impacts to TES plants. Given mitigation associated with this proposal in proximity to TES plants and

habitats, and implementation of other measures for protecting TES plants from negative impacts there would be no adverse cumulative effects.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

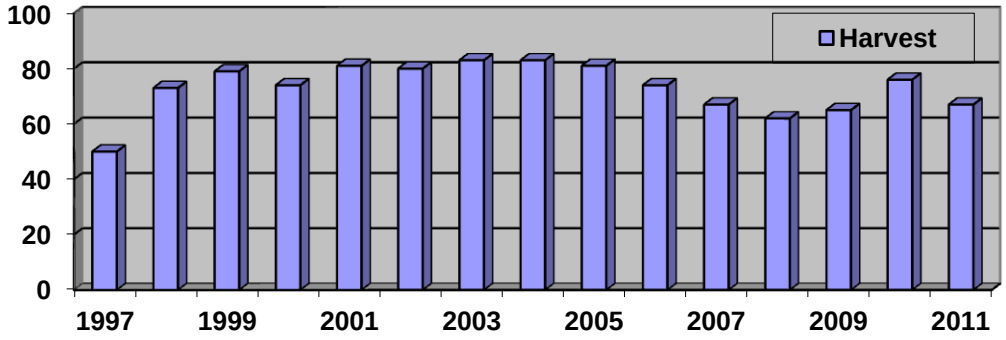
Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same.

H. Yellow Fringeless Orchid
The effects of the each alternative on the yellow fringeless orchid have been discussed previously under Plants - Affected Environment and Environmental Consequences. No changes in trends are expected as a result of the proposed project.

I. Southern Ladyslipper - Mesic hardwood forest
The effects of the each alternative on the southern landyslipper have been discussed previously under Plants - Affected Environment and Environmental Consequences. No changes in trends are expected as a result of the proposed project.

J. Eastern Wild Turkey (*Meleagris gallopavo*)
This bird historically occupied 30 million acres in eastern Texas. As a result of unregulated hunting and the loss of habitat, this species was virtually eliminated by 1900. Restocking efforts of Rio Grande, Florida, and pen-raised turkeys from 1924-1978 were unsuccessful. Restocking of Eastern wild turkeys began in 1979, but most restocking efforts have occurred since 1987. Rangewide this species is considered secure with a Global Status of G5-Secure. In the state of Texas, the wild turkey has a rank of S5-Secure (NatureServe, 2012). Eastern wild turkey was selected as a management indicator species because it is a demand/game species of high economic importance. This species utilizes a wide range of habitat types, including grass/forb-dominated openings interspersed with mast producing hardwoods or open pine woodlands making it suitable as a management indicator species associated with early, mid and late-successional forests, as well as old growth. This species has been and continues to be monitored through combinations of survey techniques, including gobbler call counts and gathering harvest levels data. Surveys are conducted by both Texas Parks and Wildlife Department (TPWD) and USFS personnel and are analyzed by TPWD. Annual surveys and harvest data (Table 3-12) suggest that Eastern wild turkey populations are stable and that viability is not an issue on NFT.

Table 3-12. Spring Turkey Harvest in Angelina, Houston, Jasper, Nacogdoches, Newton, Sabine, San Augustine, Shelby, San Jacinto, Trinity, Montgomery and Walker Counties (National Forest Counties) from 1997-2011.



Alternative 1 - No Action
Because no activities would occur under this alternative, there would be no direct or indirect effects on the wild turkey.

Cumulative Effects*:* Because no actions are being proposed in this alternative, there would be no direct or indirect effects. Therefore, there should be no cumulative effects with other actions going on in this area.

Alternative 2 - Proposed Action
The proposed project would have minimal direct effects to wild turkey other than that some birds may be disturbed during logging operations, including nesting hens. However, hens often renest and this would have minimal effects on the nest success for wild turkey populations. Indirect effects would be beneficial because of the reduced heavy fuels, which would allow for cooler less intense prescribed burning.

Cumulative Effects*:* Prescribed burning would be much more effective at improving turkey habitat when fuels are light. By maintaining lower intensity fires the overstory would not be affected and some areas would remain unburned to provide nesting cover. No changes in trends are expected as a result of the proposed project.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same.

K. White-tailed deer (*Odocoileus virginianus*)
Historically, the white-tailed deer populations have expanded and been reduced due to the influences of human intervention. Current annual harvest in this region exceeds two million animals. Historical restocking programs and state agency population management efforts, including appropriate hunting regulations, ensure that population viability for this species is no

longer an issue, in east Texas or on the NFT. Rangewide, this species is considered secure with a Global Status of G5 (NatureServe 2012). The white-tailed deer was selected as a management indicator species in the Plan as a demand species associated with grass/forb and brushy habitats, interspersed hardwoods, and associated edges which covers the four forest/grassland seral stage habitats listed in the Plan: early, mid, and late succession and old growth. Deer populations are monitored using annual deer spot-light surveys and a more recent method known as distance sampling (TPWD, 2011). Both methods are actual counts of deer along established routes. In addition, harvest data are provided by the TPWD. Figure 3-3 shows trends of estimated white-tailed deer population size in specific ecological regions (ecoregions) and resource management units (RMUs) which sit within ecoregions. The information used is extrapolated by TPWD to develop annual harvest recommendations. Trends for all RMUs surrounding the NFT indicate a stable to increasing population. These estimates parallel hunter use and harvest information on the NFT units.

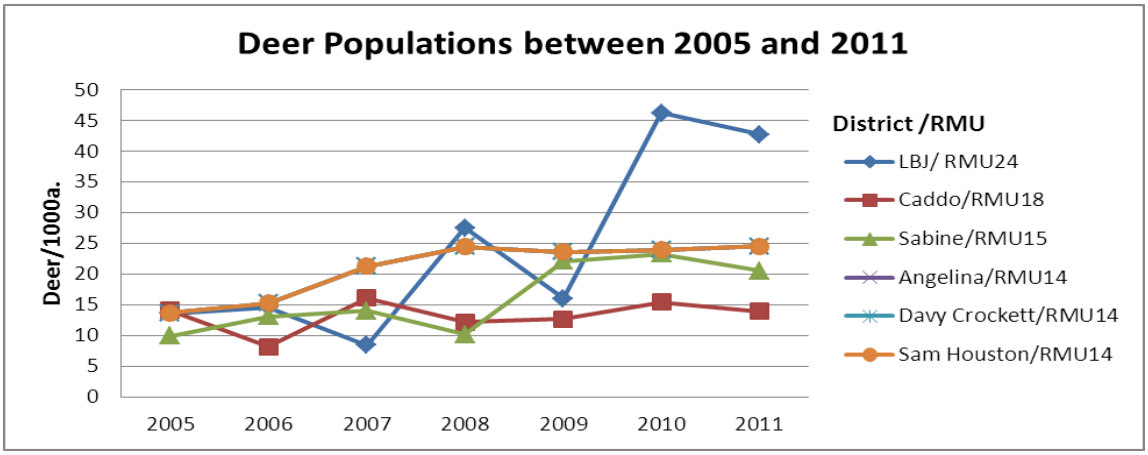


Figure 3-3. White-tailed deer population trends in three eastern Texas Ecological regions.

Carrying capacity for mixed hardwood-pine forests is listed as one deer per 20-40 acres and one deer per 30-50 acres for loblolly-shortleaf pine habitats (Halls 1984). Carrying capacity of homogenous pine habitats is lower than that of mixed pine-hardwood or bottomland hardwoods and streamside areas, as soil nutrients, mast, and available browse are higher in the more mesic areas (Halls 1984).

Alternative 1 - No Action

Because no activities would occur under this alternative, there would be no direct or indirect effects on the white-tailed deer.

Cumulative Effects*:* Because no actions are being proposed in this alternative, there would be no direct or indirect effects. Therefore, there should be no cumulative effects with other actions going on in this area.

Alternative 2 - Proposed Action

The proposed project would have minimal direct effects to white-tailed deer other than some deer could be disturbed during logging operations. There would be beneficial indirect effects since the reduced fuel loads would allow for cooler, less intense prescribe burns.

Cumulative Effects*:* Prescribe burning would be more effective at improving deer habitat when fuels are light. By maintaining lower intensity fire, the overstory would not be affected and some areas would remain unburned to provide cover. No changes in trends are expected as a result of the proposed project.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same.

L. Yellow-breasted Chat (*Icteria virens*)
The yellow-breasted chat ranges from southern Canada and British Columbia east to southern New Hampshire and south to northern Florida, the Gulf Coast and Baja, California. The species winters from southern Texas and central Mexico south through the Yucatan to western Panama. The NFT is used by this species primarily as breeding habitat, and is seldom seen during the winter seasons. This species was selected in the *Plan* as a management indicator for the brushy, scrub habitat available in early, mid and late seral stage habitats. Acres of habitat in 1996 were estimated to total 174,000 acres, and the *Plan's* short-term objective is to have 140,000 acres. The *Plan* projected that habitat acreage reductions would occur in the early and late succession stages, and increases would occur in the mid succession stages, with overall reductions exceeding increases by 34,000 acres. The NFT have annually conducted breeding bird point surveys since 1998. The NFT, through neo-tropical bird point-counts, assesses population trends of yellow-breasted chats annually in various forest types and age classes. National forest trend estimates are evaluated in part by comparison with trends estimated from annual Breeding Bird Survey (BBS) data from surveys across the larger regions in which national forests in Texas occur. Figure 3-4 reflects a stable trend in this species with secure viability over all four national forests. Though early succession habitat is decreasing, the use of yellow breasted chats of this seral stage continues to show wide-spread occurrence on the NFT. Throughout the southeast, this species is considered secure with a Global Status of G5-Secure. In the state of Texas, the yellow-breasted chat has a rank of S5-Secure (NatureServe, 2012).

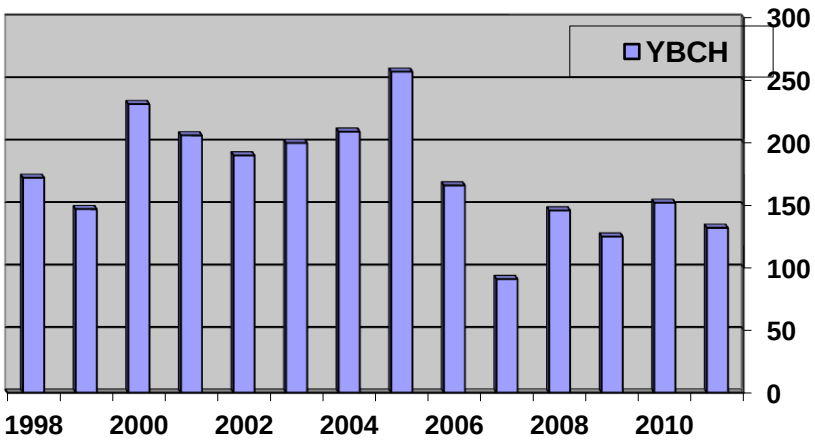


Figure 3-4. Yellow-breasted chat numbers across the four National Forests (2011 M&E report).

Alternative 1 - No Action
Because no activities would occur under this alternative, there would be no direct or indirect effects on the yellow-breasted chat.

Cumulative Effects*:* Because no actions are being proposed in this alternative, there would be no direct or indirect effects. Therefore, there should be no cumulative effects with other actions occurring on the forest

Alternative 2 - Proposed Action
The proposed project would have minimal direct effects to chats other than some chats may be disturbed during logging operations. There would be beneficial indirect effects since the reduced fuel loads would allow for cooler, less intense prescribe burns.

Cumulative Effects*:* Prescribed burning would be much more effective at improving yellow-breasted chat habitat when fuels are light. By maintaining lower intensity fires the overstory would not be affected and some areas would remain unburned to provide nesting cover. No changes in trends are expected as a result of the proposed project.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same.

M. Pileated Woodpecker (*Dryocopus pileatus*)
Pileated woodpeckers are birds of the forest, preferring large diameter snags/trees, and needing up to 200 acres of foraging habitat per nesting pair. Pileated woodpeckers have demonstrated the ability to adapt to human habitation and are common in managed forests, as well as rural,

suburban, and urban park-like settings (Conner 1978: Hamel 1992). Widely distributed in wooded areas of North America; populations have been stable or increasing in recent decades. Rangewide this species is considered secure with a Global Status of G5-Secure and S5-Secure (NatureServe 2012). The pileated woodpecker was identified as a management indicator for the NFT because of its specific habitat requirements needing large snags (Hamel 1992, Dickson 2001). This species was also selected in the *Plan* as an indicator for three forest or grassland seral stage habitats: mid and late succession and old growth. Acres of habitat in 1996 were estimated to total 280,000 acres, and the *Plan's* short-term objective is to have 372,000 acres. The *Plan* projected that habitat acreage reductions would occur in the late succession stage, and increases would occur in the mid-succession and old- growth stages, with overall increases exceeding reductions by 92,000 acres. Pileated woodpecker populations have been monitored annually through bird point counts on the NFT since 1998. National forest trend estimates are evaluated in part by comparison with trends estimated from annual Breeding Bird Survey (BBS) data from surveys across the larger regions in which national forests in Texas occur. Data from point counts suggest a stable trend (Figure 3-5). Pileated Woodpecker numbers appear to be stable. The following data showing the increases in the number of snags on the NFT should help to increase Pileated Woodpecker numbers.

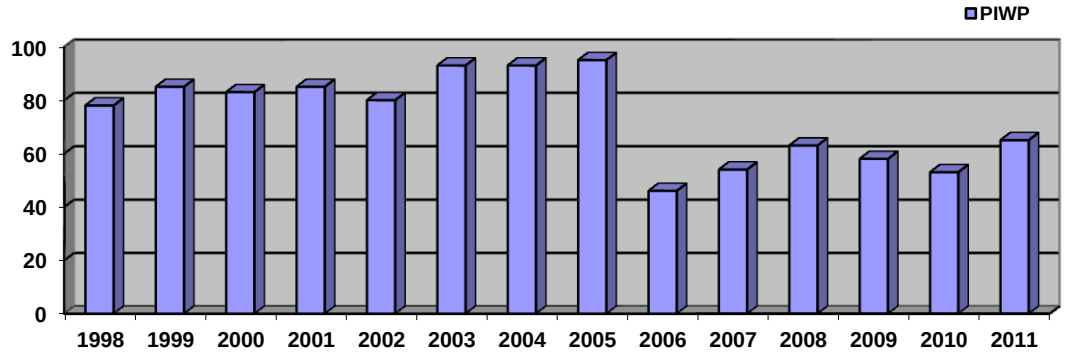


Figure 3-5. Pileated Woodpecker Occurrences - All Forest Stands.

Alternative 1 - No Action

Because no activities would occur under this alternative, there would be no direct or indirect effects on the pileated woodpeckers.

Cumulative Effects*:* Because no actions are being proposed in this alternative, there would be no direct or indirect effects. Therefore, there should be no cumulative effects with other actions going on in this area.

Alternative 2 - Proposed Action

There would be no direct effect because the proposed treatments woujld not injure or kill pileated woodpeckers. There would be a negative indirect effect since standing damaged trees that are removed would not be available as future snags. There would be no change in this species population trend as a result of the proposed action.

Cumulative Effects*:* Pileated woodpeckers have abundant snags throughout the National Forest, and their population numbers have been stable, except for 2006. No changes in trends are expected as a result of the proposed project.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. Not treating in MA 4 or MA 5 would have a beneficial effect on the Pileated woodpecker since this species occurs in both MAs.

N. Snags
Snags are a habitat component of virtually all seral stages, and the lack of snags can be a limiting factor in maintaining or increasing populations of some species. Numerous factors influence the creation and longevity of snags (Dickson 2001). Prescribed burns, wildfires, weather events, insects, disease, and decay are some of the factors that influence the numbers and distribution of snags across the landscape. For example, the prescribed burning program on the NFT influences snag distribution by both creating and removing snags from the forest. Any prescribed burn would burn with varying intensity as a result of many factors including: the amount, type, and distribution of fuels, weather conditions, and topographical features. These factors combine to result in a mosaic effect in which some areas burn intensely, while other portions burn with little intensity, or fail to burn at all. The results are that some single trees or pockets of live trees may be killed, creating new snags, while some existing snags are consumed. This creation and consumption of snags results in an uneven distribution of snags across the landscape. When combined with the other factors influencing snag creation and retention, it is obvious that snag numbers and distribution would be very dynamic across the NFT. Snags were selected as a management indicator because they are used by and are important to a wide variety of wildlife species for nesting, roosting, foraging, perching, and other uses in all four successional stages—early, mid, late seral and old growth. Woodpeckers are primary cavity nesters that rely heavily on snags for nest sites (Conner 1978). Snags are important habitat components throughout the forest; therefore it is used as a management indicator in early, mid, late seral, as well as old growth habitat. Snag data is gathered as part of the vegetation sampling portion of the R8 Bird protocol. Data on snag numbers has been collected at approximately 700 survey points. A sample of approximately 93 survey points is surveyed annually. Snags are recorded based on their diameter, and grouped into two size categories: 1) 12" – 20" dbh (blue bars) and 2) larger than 20" dbh (red bars). Figure 3-6 displays average number of snags per acre from the habitat data collected in the R8 bird point count effort; this combines all seral stages, indicating all areas have from 1 to 2 snags per acre.

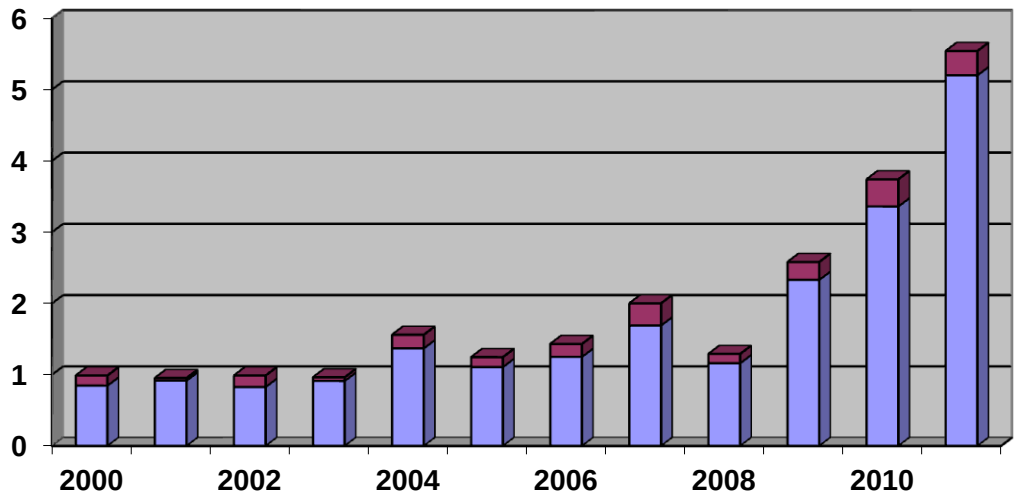


Figure 3-6. Average number of snags at each sample point (USDA 2011).

As described in Chapter V of the Forest Plan, the objective for snags increases as forest stands mature. Management activities, such as prescribed burning, wildfires and natural tree mortality are maintaining a fair number of snags per acre.

Alternative 1 - No Action
Because no activities would occur under this alternative, there would be no direct effects on snags. However, an indirect beneficial effect would be that the numerous damaged trees remaining in the forest would eventually become snags.

Cumulative Effects*:* The combined effects of regular planned prescribed burning with leaving damaged trees after a wind event would result in additional snags throughout the forest. The number of snags per acre would probably show a measurable increasing trend on the NFT as result of no action and planned prescribed burning.

Alternative 2 - Proposed Action
There would be no direct effects because no snags would be removed during any treatments. Not all of the wind damaged areas would be treated; therefore, many damaged trees would be left. The NFT should have abundant snags after the proposed project.

Cumulative Effects*:* There are abundant snags throughout the NFT and previous hurricanes, tornados, and the recent drought have created many more that would not be removed. No changes in trends are expected as a result of the proposed project.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres. This would leave many snags throughout the Forest.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same. No treatments would occur in MA 4, MA 5, or MA 8 so snags would remain in these management areas.

O. Gray and Fox Squirrels (*Sciurus carolinensis* and *Sciurus niger*)
Gray and fox squirrels are popular small game throughout the southeastern U.S., and squirrel hunting is second only to white-tailed deer hunting in most forested areas. Together these species generate considerable revenue and sport, and serve as a noteworthy wildlife species providing the main source of mammalian wildlife viewing opportunities to many people. Optimum habitat for these species consists of mature deciduous and mixed forests with abundant supplies of mast (e.g., acorns, hickory nuts) with availability of permanent water. Streamside zones normally provide this optimum habitat. Range-wide these species are considered secure with a Global Status of G5 (NatureServe 2012). Currently, hunter harvest data and habitat trends are the primary means to assess squirrel populations on the NFT. To monitor actual trends in squirrel populations, hunter harvest and harvest per unit effort (hunter success rate) are recorded on NFT Wildlife Management Areas (WMA), some 249,000 acres. These WMAs include all of the Sam Houston National Forest and portions of all other Forests. This area covers approximately 40% of all habitat managed on NFT. Starting in 2007, TPWD discontinued the way that it has extrapolated squirrel harvest data. Since that time, harvest data information has come directly from survey forms filled out by hunters on a voluntary basis. The numbers reported have been and would be considerably different from the past data. This is no indication that squirrel populations or their habitat has declined in any way. Current trends verify an increase in mid and old-growth stages of suitable habitat for gray and fox squirrels.

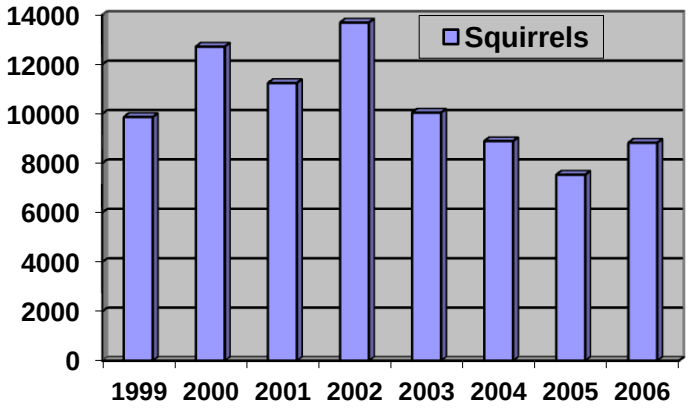


Figure 3-7. Squirrel Harvest Data on NFT WMAs

Alternative 1 - No Action
Because no activities would occur under this alternative, there would be no direct or indirect effects on the squirrels.

Cumulative Effects*:* Because no actions are being proposed in this alternative, there would be no direct or indirect effects. Therefore, there should be no cumulative effects with other actions going on in this area.

Alternative 2 - Proposed Action
The proposed project would have minimal direct effects to squirrels other than some squirrel may be disturbed during logging operations. There would be beneficial indirect effects because the reduced fuel loads would allow for cooler less intense prescribe burning.

Cumulative Effects*:* Prescribe burning would be much more effective at improving squirrel habitat when fuels are light. By maintaining lower intensity fires, the overstory would not be affected and some areas would remain unburned to provide cover. No changes in trends are expected as a result of the proposed project.

Alternative 3 - High Priority Areas Only
Because no treatments would occur in MA1, MA 2, MA 4, MA 5, MA 6, or MA 8 the direct, indirect, and cumulative effects would be similar to Alternative 1. Treatments would occur on no more than 16,490 acres in administrative and recreation sites, RCW clusters and recruitment stands which are approximately 2% of the total Forest acres.

Alternative 4 - Modified Alternative 3
Because the treatment acres that could be impacted under this alternative are close to alternative 2, the direct, indirect and cumulative effects would be the same.

3.12 Biological Diversity

Affected Environment

Special Management Areas MA 8 (SMAs) and MA 6 (Longleaf Ridge Special Area). These management areas contain lands requiring special management because of biologic, historic, or geologic values.

1. MA 6 Longleaf Ridge Special Area
   This management area is managed for maintenance of habitat component favorable to the development of longleaf pine communities and species of wildlife like the RCW. The longleaf ridge area is replete with many examples of significant natural heritage sites representative of the upland longleaf pine-little bluestem landscape.
2. MA 8a Research Natural Areas
   Research Natural Areas (RNA) are a part of a national network of ecological areas designated in perpetuity for research and education and/or to maintain biological diversity on National Forest System lands. The management area includes the 225 acre Mill Creek Cove on the SNF.
   MA-8a-111: The area is classified as unsuitable for timber production.
3. MA 8b Protected River and Stream Corridors
   These areas are two free-flowing rivers possessing at least one outstandingly remarkable characteristic. An inventory of rivers on the Forests found the Winters Bayou (SHNF) and segments of the Neches River (ANF and DCNF) to be eligible for inclusion in the Wild and Scenic River System as a recreational river.
   MA-8b-101: The area is classified as unsuitable for timber production. *Unregulated timber harvest may be utilized to accomplish non-timber related goals as determined through site-specific environmental analysis.*
4. MA 8c Scenic Areas

This management area includes Big Creek (SHNF), Winters Bayou (SHNF), Beech Ravines (SNF), and Upper Colorow Creek (SNF). These areas have an emphasis of protection, enhancement, or restoration of unique areas that are recognized as scenic, with outstanding visual quality.

MA-8c-123, MA-8d-23: Vegetation management activities can be used to restore or maintain the botanically significant character of the site. *Specific activities include fire, vegetation removal, planting, or other cultural techniques that are determined to be appropriate through a site-specific environmental analysis.*

5. MA 8d Natural Heritage Areas
   The management area consists of 27 sites (*Plan* pages 230-233), most of which have been identified within the Texas Natural Heritage Report (TNHR), or in subsequent inventory and monitoring since the report was published. These areas have an emphasis to protect, enhance, and promote sustainable population of unique plants or plant communities.
6. Ma 8e Special Bottomland Areas
   This management area retains its unique characteristic and is maintained in a natural to near-natural setting. These areas are established to provide a more restrictive management than is found in MA-4, which Streamside and Riparian Areas. A high emphasis is placed on improving and maintaining the riparian characteristics of the bottomland hardwood component for potential old-growth characteristics and wildlife habitat values associated with this ecosystem.
   MA-8e-81 The area is classified as unsuitable for timber production.
   Unregulated timber harvest may be utilized to accomplish non-timber related goals as determined through site-specific environmental analysis. No harvest shall occur within the primary zone unless for forest health, safety, or to provide habitat for threatened or endangered species. Harvest and silvicultural management may occur within the secondary zone to achieve the desired future condition.
7. MA 8f Cultural Heritage Areas
   A unit of land possessing features, sites or a concentration of sites, building, structures, or objects united historically or prehistorically by plan or physical development, and which have been determined to be significant to our understanding of the prehistoric and historic occupation and utilization of the lands in which they are located.
   MA-8f-101: These areas are classified as unsuitable for timber production.

Alternative 1 – No Action

No activities would occur under this alternative; therefore, there would be no direct, indirect, or cumulative effects to SMAs.

Alternative 2 – Proposed Action

Treatments are proposed in SMAs primarily to enhance the biologic, historic, or geologic values that the SMA was designated to protect. Treatments would be coordinated with resource specialists who would determine if the actions taken could be completed without further damaging sensitive resources. Acres of SMA that could potentially be impacted by the proposed action: MA 6: 37,585 acres, MA8a: 225 acres, MA8c: 1250 acres, MA8d: 2721 acres, MA8e: 11,475 acres, MA8f: 2380 acres.

The Texas Conservation Alliance (TCA) proposed additional areas for SMA designation to protect them from management activities. This would require a Forest Plan amendment. No additional SMAs would be designated through this project analysis.

Alternative 3 - High Priority Areas Only
No activities would occur within SMAs under this alternative; therefore, there would be no direct, indirect, or cumulative effects to SMAs. No treatments would occur in the RCW clusters within MA 6 (Longleaf Ridge - 32,000 acres) and MA 8d (Fox Hunter's Hill – 451 acres). Since nearly all the RCW clusters on the South Angelina NF are in MA 6 (Jason Engle, pers. comm.), not treating these clusters after a wind event could have a negative effect on the RCW similar to Alternative 1.

Alternative 4 - Modified Alternative 3
Treatments would be coordinated with resource specialists who would determine if the actions taken could be completed without further damaging sensitive resources. Red-cockaded Woodpecker (RCW) clusters within MA 6 (Longleaf Ridge - 32,000 acres) and MA 8d (Fox Hunter's Hill – 451 acres) could be impacted by the proposed treatments. The effects would be the same as those found for the RCW in Section 3.9.

3.13 Climate Change

Affected Environment
Most of the potentially damaging consequences relating to climate change are associated with extremes- the number of heat waves, floods, or severe storms (Climate Institute www.climate.org/topics/extreme-weather/index.html accessed 12/11/12). Disturbance events are becoming more frequent, widespread and intense (Lindenmayer et al. 2008). Since 1970, tropical cyclone activity has increased in the North Atlantic (Meehl et al. 2007). Activity is measured not only by the frequency and number of storms that develop, but also by their intensity and duration (collectively named the Power Dissipation Index). A marked increase in the PDI began around 1970, though a less-defined increase began in the early 1950's. While analyzing the number of tropical storms each year is a fairly simple way of noting changes over time, various studies have identified how the strength of the storms has changed as well. A 2005 study published in the journal Nature examined the duration and maximum wind speeds of each tropical cyclone that formed over the last 30 years and found that their destructive power has increased around 70 percent in both the Atlantic and Pacific oceans (Emanuel 2005). Another 2005 study, published in the journal of Science, revealed that the percentage of hurricanes classified as Category 4 or 5 (the two strongest categories on the Saffir-Simpson scale) has increased over the same period. (Webster et al. 2005). In the future, it is likely that tropical storm intensity would continue to strengthen. Model simulations suggest that wind speeds would increase by 1 to 8% and rainfall rates would increase by 6 to 18% for every 1^{o} rise in sea surface temperatures (NOAA 2008). Therefore, as climate change leads to progressively warmer ocean temperature, tropical storm intensity would increase as well.

Over the last 15 years, the NFT has experienced three major and several small wind events (hurricanes, tornados, and straight line winds). The NFT experienced a large blowdown in 1998, Hurricane Rita in 2005 and Hurricane Ike in 2008 (Table 3-13). These wind events impacted the

function, structure and composition of all four national forests. Salvage logging after these events removed some trees. Some remained to serve as carbon stocks and course woody debris.

Table 3-13. Wind Events on the NFT 1998-2012.

Wind Event	District	Year	Total Acres Impacted	Total Acres Treated*
1998 Blowdown	Angelina, Sabine, and Sam Houston	1998	103,000 acres	32,500 acres
Hurricane Rita	Angelina	2005	6,400 acres	7,088 acres
Hurricane Rita	Sabine	2005	11,000 acres	5,361 acres
Compartment 44 Blowdown	Sabine	2008	300 acres	75 acres
Hurricane Ike	Davy Crockett	2008	5,535 acres	5,068 acres
Hurricane Ike	Sam Houston	2008	2,540 acres	2,195 acres
Ratcliff Tornado	Davy Crockett	2011	539 acres	530 acres
Christmas Day Tornado	Davy Crockett	2012	223 acres	216 acres

* Acres are from previous wind event decision documents.

Carbon Stocks

Carbon stocks for the NFT are estimated to be at or near peak levels since the forest was established. Using FIA data, current stocks are estimated to be 47.5 million metric tons, including above and below ground live, dead wood, litter and soil carbon. Historic data on carbon stock trends over time were reviewed using FIA estimates of above ground live tree carbon on timberlands. Above ground live stocks are stocks that are most impacted by forest management. We estimate that the NFT has had a stable carbon stock sink for at least the past 30 years. This includes growth of the forest and reductions for harvest removals and mortality. The harvested wood carbon pool is not taken into account in this estimate, but would be expected to add to these totals.

Figure 3-8 reflects a change in the inventory protocols which may exaggerate the change in stocks between the 1992 and 2003 estimates. However the changes in stocks between 2003 and 2011 are based on consistent methods of measurement. Although estimates for these periods are within the sample errors (the error bars), they reflect that the change in stocks are generally positive and indicate that the forest is a carbon sink.

Recent impacts from drought have affected forest carbon stocks in east Texas. The Texas Forest Service (2011) estimated that the drought killed 6.5% of the trees in a nine county area that includes the Davy Crockett National Forest. This level of mortality would reduce the carbon stocks for a period of time, until forests regenerate and new growth recovers the carbon that is being lost as the dead wood decays.

Some of this loss may also be recovered and mitigated by harvesting the dead and dying trees. Converting these trees to durable products would recover some of the carbon. Based on regional estimates of the fate of harvested wood, more than 40% of the harvested carbon would remain in use the primary use the wood was converted to after 10 years (almost 30% after 50 years). Approximately half of the carbon emitted from these timber harvests is predicted to be for

energy use and would substitute for other fuels. The average total annual harvest from the NFT is estimated to emit 26,000 metric tons of carbon after 10 years, about 0.06% of the total current carbon stocks on the forest.

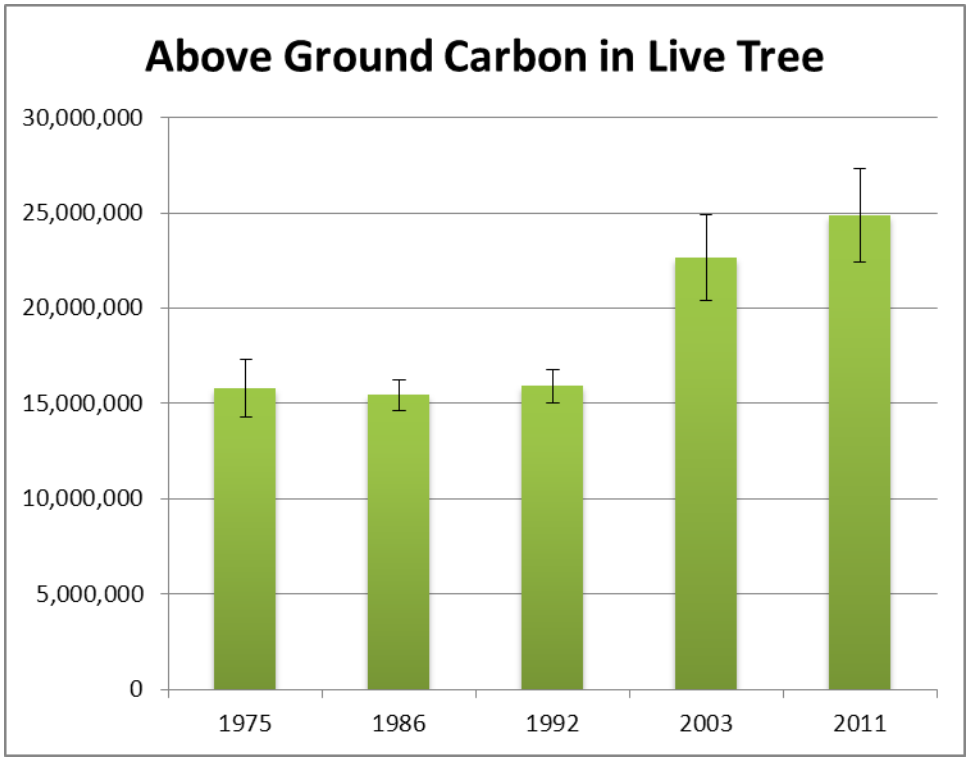


Figure 3-8. NFT carbon stocks 1975-2011

Alternative 1 – No Action

It is currently not possible to predict the actual effects of a project on global climate change, so a baseline comparison cannot be made using the no action alternative relative to climate change. Because fuel loads within the majority of the proposed project area would not be reduced, the potential for a severe wildfire would persist and would increase as fuels are added to the forest floor through natural processes. In such an event, the quantities of carbon dioxide and other greenhouse gas emissions released into the atmosphere would be expected to be greater than those that would have been released under the controlled conditions of a prescribed burn or in an area where fuel reduction treatments had been conducted. The actual quantity of emissions released would depend on the acreage burned, tons of fuel consumed and the amount of time required to suppress the wildfire.

Alternative 2 – Proposed Action

With this alternative, some of the carbon currently sequestered in vegetation and soils would be released back to the atmosphere. Greenhouse gas emissions and alteration to the carbon cycle would be caused by the proposed hazardous fuel reduction activities. Wildfires would still occur in the proposed project area; however, because fuel loads would have been reduced with this alternative, there would be a lower risk of a severe wildfire for the treated acres than the current

condition poses. The reduced risk has a two-fold effect on greenhouse gas emissions or the carbon cycle:

1. There is a direct beneficial effect on climate change of decreased greenhouse gas emissions from the treated acres because the risk of acres being burned by severe wildfires would be reduced.
2. There is an indirect beneficial effect because live stands of trees would retain higher capacity to sequester carbon dioxide compared to stands killed by severe wildfires, especially if not immediately reforested.

Technological knowledge to specifically link climate change to small-scale projects is currently lacking. Although the effects of greenhouse gas emissions in the global aggregate are well documented, it is currently not possible to determine what specific effect greenhouse gas emissions resulting from a particular activity might have on the environment.

Alternative 3 - High Priority Areas Only
This alternative would do very little to reduce carbon stocks since a small percentage of the total Forest acres would be treated. There would be little or no impact to climate change from the activities proposed under this alternative.

Alternative 4 - Modified Alternative 3
Because no treatments would occur in MA 4 or MA 5, there would be a greater opportunity to store carbon in these MAs. Streamside zones and major aquatic ecosystems do not receive any active management and would accumulate more downed and dead wood as carbon stocks than other MAs that are subject to active management.

3.14 Economics

The fraction of salvaged timber varies with the total amount destroyed, the timber value and access to salvageable lumber. Following a highly damaging storm such as Fran or Hugo, the timber market was glutted with up to 7 times the pre-hurricane average amount of salvaged timber available (Marsinko et al. 1996). Increased supply drives the price for timber down to approximately half of its pre-harvest value (Marsinko et al. 1996). If the salvaged timber is of marginal quality or difficult to remove, it is unlikely that the timber would be salvaged. For these reasons, only 13 % of timber was salvaged in the months following Hurricane Hugo (Miranda 1996). The 13% timber salvage rate represents only stem wood. Assuming that stem wood only represents 64% of the total tree biomass, carbon salvaged following Hurricane Hugo was less than 9%. Even the 9% recovery rate was only possible through a well-coordinated post-hurricane timber salvage effort (Miranda 1996). Therefore, the majority (>90%) of the wood was left to decompose within the forest (McNulty 2002).

Alternative 1 – No Action
No activities would occur under this alternative; therefore, there would be no direct, indirect, or cumulative effects. In addition, no revenue would be generated and no funds returned to the county for schools and roads.

Alternative 2 – Proposed Action
If the damaged areas can be treated with a salvage sale, a small amount of revenue can be generated for the products sold. These sales also generate funds that are returned to the local

counties for schools and roads. Removal and mulching are treatments that are contracted out to local businesses and would have a direct benefit to the economy. Otherwise, a mulching contract would expend funds from the Forest's operational budget to reduce fuel loads or improve RCW habitat. However, an indirect effect would be that in a large scale event like Hurricanes Rita and Ike the timber market could be flooded reducing the market value of the timber.

Alternative 3 - High Priority Areas Only
Because very few acres are proposed to be treated under this alternative, there would be little economic benefit derived. No revenue would be generated and no funds returned to the county for schools and roads. Funds would be expended for any restoration work that occurs.

Alternative 4 - Modified Alternative 3
The direct, indirect and cumulative effects would be the same as Alternative 2.

4.0 Agencies and Persons Consulted

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