IV. Comprehensive Evaluation

A. Ecological

1. Vegetative Communities

a. Existing Conditions and Trends

1. Landscape Communities

The National Forests and Grasslands in Texas (NFGT) is composed of four national forests that are located in eastern Texas (Angelina, Davy Crockett, Sabine, and Sam Houston), and two national grasslands located in northern Texas (Caddo and Lyndon B. Johnson). The landscape communities were classified into four major community types, plus three minor communities. The minor communities are smaller-scale plant communities surrounded by the larger pine forests, such as streamside communities, which were identified as important forest types in the *Plan.* The vegetative communities and inclusional series are displayed in Table 1 (series are based on nomenclature developed by Allard 1990). The inclusional series are small-scale plant communities, such as hillside bogs, that are embedded within the larger landscape communities. The major and minor community types are described briefly below.

Tallgrass Prairie

Both the Lyndon B. Johnson (LBJ) National Grassland and Caddo National Grassland (NG) lie within this community type. The surface geology of this environmental zone consists of weathered sandstones and shales. Differential erosion has produced rolling and hilly topography, and the landscape becomes more rugged and broken to the west. In many upland areas, overgrazing and cultivation prior to the Dust Bowl days of the 1930s have led to severe erosion and siltation. Accordingly, many portions of low lying floodplains also have a mantle of recent (post-1850) alluvium.

Savanna vegetation is more characteristic of the western area or LBJ, while a mixed savanna and forest are more characteristic of the Caddo NG further to the east. Woody species occupy approximately 30 to 45 percent of the area of the national grasslands. The composition of the woody vegetation of the tallgrass prairie communities, in general, consists of 63 percent post oak and 29 percent blackjack oak, with 8 percent consisting of ten other species (primarily cedar, elm, and hackberry).

Little bluestem (mid-grass) is the dominant grass in these communities, co-associated with big bluestem and Indiangrass (tall grasses). The Ladonia unit of the Caddo NG, as well as a small portion of the LBJ falls within the Blackland or true Tallgrass Prairie. The soils of the Blackland Prairie are mostly dark calcareous clays derived from the underlying clay, marl, shale, chalky limestone, and other bedrock. Low permeability of Blackland clay soils has inhibited tree growth, except along the many stream courses.

Table 1. Vegetative Communities.

Grassland Communities	Dominant Series	Inclusional Series
Tallgrass Prairie	Little Bluestem – Indiangrass	
		Post Oak - Blackjack Oak/Black Hickory
		Texas Oak
		Ashe's Juniper - Oak
Forest Communities	**Dominant Series**	**Inclusional Series**
Loblolly Pine	Loblolly Pine – Oak & Shortleaf Pine – Oak	
		Gammagrass - Switchgrass
		Sweetbay - Magnolia
		American Beech - White Oak
Shortleaf Pine	Shortleaf Pine – Oak	
		Bluejack Oak - Pine
		Sweetbay - Magnolia
		Loblolly Pine - Oak
Longleaf Pine	Longleaf Pine – Little Bluestem	
		Sphagnum - Beakrush
		Little Bluestem - Nuttall's Goldenrod
		Shortleaf Pine - Oak
		Loblolly Pine - Oak
Minor Community in Longleaf Pine		
Bay – Shrub Wetland		Sweetbay - Magnolia
Minor Communities in Forest Communities		
Mesic Hardwood	Beech – Magnolia/White Oak	

Table 1. Vegetative Communities (cont').		
		Loblolly - Oak
Botttomlands & Streamsides		
	Bald Cypress – Tupelo	
	Overcup Oak	
	Water Oak – Willow Oak	
	Swamp Chestnut Oak – Willow Oak	
	Pecan – Sugarberry	

Loblolly Pine

Loblolly pine is generally found in stands with various mixtures of hardwoods with thick understory growth; some areas have a significant component of shortleaf pine. Much of the historical loblolly pine region is associated with the traditional "Big Thicket" of east Texas. This broad, loblolly region is found in the southwestern Gulf Coastal Plain subsection. Loblolly pine trees can thrive on a variety of sites, but better growth is most often associated with better soils. Loblolly pine will frequently be found in both longleaf and shortleaf communities, but historically it was generally restricted to mesic sites, and slopes and terraces associated with streams.

Loblolly pine communities are less fire-adapted than the longleaf and shortleaf pine community types. Windstorms, including re-occurring hurricane events in the southwestern Gulf Coastal Plain subsection, and southern pine beetle (SPB) outbreaks are historical large-scale disturbances in the loblolly pine community.

Shortleaf Pine

This group was the largest natural timber belt in east Texas. It occurs north of both the longleaf and mixed hardwood-loblolly regions. Uplands in this area were typically open, scattered shortleaf pines, associated with both oaks and hickories. Various shrubs and regenerating overstory species may be located in the midstory and understory, especially in areas where fire has been suppressed. Herbaceous ground cover in upland sites has been reduced in some areas due to lack of fire. Natural herbaceous species will become more common when frequent burning regimes are applied. This community type also occurs as a shortleaf pine-oak-hickory inclusional community within the longleaf pine belt on finer textured soils.

The *Plan* directs that most forested stands on sandy soils in the Sparta Sandhills, Crockett Clay Hills, Redlands, and the Lignitic Uplands Landtype Associations (LTAs) on the northern Sabine and Davy Crockett NFs are to be restored to shortleaf pine. Generally, existing longleaf and shortleaf pine stands are to be maintained within these LTAs.

Longleaf Pine

Communities in this habitat group generally occur east of the Trinity River and extend eastward to the Sabine River and into Louisiana. Some isolated sites occur west of the Trinity River. The best examples of this group are typically found on deep, sandy soils.

Longleaf stands that have been burned frequently are characterized by an understory dominated by bluestem grasses and an overstory of longleaf pine. Unburned stands tend to lose the grassy herbaceous layer through shrub and hardwood invasion. Shortleaf and loblolly pine also tend to increase in these stands with a low fire frequency.

The *Plan* directs that most forest stands on deep sandy soils in the Mayflower Uplands, Deep Sandy Uplands, and Clayey Uplands Landtype Associations on the southern and central Angelina, Sabine, and Davy Crockett NFs are to be restored to longleaf pine. Existing longleaf pine stands are to be maintained wherever they occur.

Bay – Shrub Wetland

The bay-shrub wetland is considered an inclusion within the longleaf pine-little bluestem system. These wetlands or "baygalls" are generally identified as the Sweetbay-Magnolia series. These wet sites or wet lands will normally not be harvested. Some prescriptions require selective cutting to maintain the diversity of this community or allow development of the wetland into a hillside bog or Sphagnum-Beakrush series. The hillside bog, through natural succession (lack of fire or other disturbance) will develop the woody composition more typical of the bay-shrub wetland.

Mesic Hardwood

These forests occur primarily on slopes adjacent to stream bottoms or large river terraces. Although not always present, the most distinctive feature of the vegetation is the presence of American beech. This species reaches the western limits of its distribution near the Sam Houston National Forest (NF) and is limited or nonexistent on the Davy Crockett NF or western portion of the Sam Houston NF. This broad community seems to vary along an east-west gradient on national forest sites, with the most species-rich example found near the Sabine River in the Mill Creek Cove Research Natural Area.

These forests develop a closed canopy, with multiple canopies and open forest floor appearance. Communities with American beech (and southern magnolia) are often considered the classic "climax" plant community of the southeast. It has been suggested that these communities are relicts from Pleistocene glaciation.

Disturbance of late successional examples of this forest type tend to reiterate succession, while moderate disturbance of young stands may actually speed succession towards climax. Species found in this group are considered fire tender and it is unlikely that the community can develop under a prescribed fire program. Where these habitats occur adjacent to communities (like longleaf pine) an ecotone of variable width will occur.

Occasional fire episodes enter these habitats, but the landscape position and fuel composition suggest that few natural fires originate within these communities.

Bottomlands and Streamsides

These communities occur along streams ranging from constantly wet sloughs and backswamps to infrequently flooded storm-related floodplains. With the exception of bald cypress swamps, each community type is composed primarily of deciduous hardwoods. The particular species assemblage on a given site is highly dependent on local topographic factors, and even small-scale changes can produce important species changes.

Periodic flood events are probably the most important natural disturbance which operates in these communities, with heavy winds also playing an important role. Natural fires are of rare occurrence and generally play little role in community dynamics in these types. As in the mesic hardwood type (described above), occasional fires may enter these communities from more upland topographic positions, but moisture and fuel characteristics are typically sufficient to limit flame spread.

These streamside communities, though very different between the national grasslands and the four national forests, provide similar habitat, structure and riparian corridors for a myriad of other plant and animal species. Forest streamside communities have very different species composition as compared to those that occur on the national grasslands. The forest streamsides are commonly bottomland hardwood communities consisting of water oak, willow oak, swamp chestnut oak, and bald cypress, and have larger areas adjacent to the water.

The *Plan* designates certain riparian areas as Special Bottomland Areas (Management Area 8e*)* to greatly expand potential habitat for species like the Louisiana black bear and canebrake rattlesnake. The MA-8e areas are located on the Angelina and Sabine National Forests. The MA-8e riparian zones link the Angelina River and Neches River corridors with adjacent national forest lands and wilderness (such as Turkey Hill) through establishment of the Bear Creek, Ayish Bayou, Attoyac Bayou, and Upper Angelina River special management areas. The Longleaf Ridge Special Area *(*MA-6*)* provides for the development of a landscape with a number of special bottomland communities recognized as special management zones. The MA-6 riparian areas are designed to develop with structure and dead/down woody material not found within any other portions of the four national forests.

Very little understory will be present in the bottomland and streamside communities due to frequent flooding and shade.

Annual Monitoring and Evaluation Reports

Previous annual monitoring and evaluation reports discussed three key *Biodiversity* issues affecting vegetative communities under the topics: (1) regeneration of desired tree species (longleaf pine and shortleaf pine), (2) seral stage distribution (based on ten-year age classes), and (3) prescribed burning. In addition, the 2006 Annual Monitoring and

Evaluation (M&E) report contained trend information in *Biodiversity* on six forest community types: loblolly pine, shortleaf pine, longleaf pine, bay-shrub wetland, mesic hardwood, and bottomlands/streamsides. For consistency, these four areas are reported below.

Regeneration of Desired Tree Species

Table 2.
% survival of desired tree species

Regeneration	2003	2004	2005	2006	2007
First Year	---	93%	93%	56%	62%
Third Year	96%	78%	72%	53%	56%

Seral Stage Distribution

Table 3.

Successional Stage	Age Class	1992	2003	2004	2005*	2006	2007	Trend
Early	0-20 Years	22%	14%	13%	n.d.	11%	10%	- 12%
Mid	21-50 Years	11%	15%	15%	n.d.	17%	17%	+ 6%
Late	51-90 Years	61%	55%	53%	n.d.	50%	49%	- 12%
Very Late	> 91 Years	6%	16%	18%	n.d.	22%	24%	+18%

*n.d. – No data available for Fiscal Year 2005

Table 4. Prescribed Fire – Acres Burned Annually

FY	Fuel Reduction	Brownspot Control (Longleaf)	Site Prep for Regeneration	Control of Understory	Range Improvement	T&E*	Other Wildlife	Total
1997	38,454	397	196	4,353	883	5,501	21,583	71,367
1998	29,742	0	538	0	0	363	6,166	36,809
1999	52,937	667	174	2,681	500	5,531	24,640	87,130
2000	21,408	0	98	690	0	2,746	11,424	36,366
2001	40,656	80	92	563	0	3,535	14,230	59,156
2002	50,926	0	704	2,893	0	16,726	4,796	76,045
2003	23,750	0	1,472	0	0	4,360	1,400	30,982
2004	89,392	219	0	1477	0	31,722	4,401	127,211
2005	87,720	0	133	0	0	12,872	65	100,790
2006	95,770	0	479	0	0	435	0	96,684
2007	110,219	0	856	0	0	15,808	2,735	129,618

*Threatened and Endangered

Forest Community Types

Table 5.

Forest Community Type	1992	2003	2004	2005*	2006	2007	Trend
Loblolly Pine	58.6%	58.3%	58.4%	n.d.	58.6%	59.2%	+ 0.6%
Shortleaf Pine	25.8%	25.1%	25.1%	n.d.	25.2%	25.4%	- 0.4%
Longleaf Pine	5.6%	5.7%	5.7%	n.d.	5.2%	5.2%	- 0.4%
Bay-Shrub Wetland	0.4%	0.4%	0.4%	n.d.	0.4%	0.4%	No Change
Mesic Hardwood	2.9%	3.9%	3.9%	n.d.	3.9%	3.8%	+ 0.9%
Bottomland & Streamside	6.7%	6.6%	6.5 %	n.d.	6.7%	6.0%	- 0.7%

*n.d. – No data available for Fiscal Year 2005

b. Disturbances

1. Fire

Frequency and intensity of prescribed burning activities are slowly affecting changes in the vegetative communities found on the NFGT (Table 4). Burning, along with intermediate harvests (such as first thinning in 15-to-30 year old stands) have had significant influence on vegetative patterns and structure within the forested landscapes.

The trend in funding for prescribed fire activities in recent years (since 2000) has been to shift funding from wildlife and silvicultural sources to primarily hazardous fuels reduction funding. This reliance on hazardous fuels reduction funding is expected to continue for the near term.

Winter prescribed burning has long been an effective tool for controlling the hazardous buildup of fine forest fuels (leaves, pine needles, twigs, limbs, forbs, and grasses), for restoration of fire-dependent ecosystems (especially longleaf systems) and for wildlife, silviculture and range management. Today fire is also being used during the growing season to restore natural plant communities on the landscape, and to manipulate the floristic composition and structure of selected forest stands. Growing season burns are being used more often to manage certain fire-dependent forest communities such as longleaf pine, pitcher plant bogs, and RCW cluster sites. This has increased the flexibility and effectiveness of prescribed fire as a tool in the NFGT's many fire-dependent ecosystems, especially longleaf pine.

The primary natural factors influencing prescribe burn accomplishments are weather and fuels. Prescribed burning parameters such as relative humidity, fuel moisture, Keetch-Byram Drought Index(KBDI), Energy Release Component (ERC), Burning Index (BI), winds and smoke management conditions, are all influenced by short and long term weather patterns throughout the prescribed burning season. All burns are conducted within the established Regional/Forest Prescribe Burn parameters. During times of extended droughts and extreme fire behavior, no prescribe burns are implemented.

2. Regeneration

There is very limited regeneration harvesting being done at this time. An average of approximately 700 acres of regeneration is being added per year through current

management activities. Management and vegetative changes has been limited; most resulting from prescribed burning, wildfire, or storm-related disturbances.

If this trend continues, projected time frames for achieving forestwide and management area restoration objectives are not likely to occur. Either the *Plan* direction will need to be modified (less emphasis on restoration-by-regeneration of off-site species), or more future projects will need to include proposals for restoration harvests.

Table 6: Age Class Distribution

By Forest Type[1]

Forest Type	Age Class					
	0-10	11-30	31-70	71-90	90+	Total
Loblolly Pine	4,161	53,558	78,434	138,631	64,626	339,410
Shortleaf Pine	1,672	22,784	12,949	43,784	64,261	145,450
Longleaf Pine	1,151	1,382	6,672	15,472	456	25,133
Bay-Shrub Wetland	0	0	0	267	1,093	1,360
Mesic Hardwood	0	15	0	47	1,882	1,944
Bottomland & Streamside	172	1,182	10,938	9,940	16,489	38,721
Total	**7,156**	**78,921**	**108,993**	**208,141**	**148,807**	**552,018**
Percent	**< 1**	**14**	**20**	**38**	**27**	**100**

[1] Sources: June 12, 2009 GIS inventory data for the NFGT.

c. Projected Future Actions

Service-wide emphasis on restoration and integration should continue to increase and emphasize prescribed burning in the restoration of fire-dependent ecosystems, especially longleaf pine. In addition, the emphasis of prescribed burning in the wildland-urban interface (WUI) is expected to continue in the foreseeable future. These WUI lands are usually more challenging to burn due to risk management concerns. Increased use of mechanical fuel treatments and utilization of biomass in the WUI can be expected.

Funding for prescribed burning activities is expected to stay at current levels or increase in the future. The primary funding mechanism for prescribed burning should continue to be hazardous fuels reduction. The use of site preparation burning will stay at the current low levels due to a decrease in the amount of regeneration activities being conducted.

An increased emphasis on growing season burning may be expected. Increased reliance on growing season burning will aid in the restoration of fire-dependent ecosystems, improve habitat for rare and endangered wildlife species, and increase the window and total acres treated for hazardous fuels. This increased window is especially important in years where the dormant season weather is not conducive to accomplishment.

2. Animal/Plant Habitats

a. Existing Conditions and Trends

1. MIS

a. Plants

The botanical program on the National Forests and Grasslands in Texas (NFGT) chiefly revolves around the collection and assimilation of Proposed, Threatened and Endangered Species (PETS), Regional Forester's Sensitive Species (RFSS), and management indicator species (MIS) occurrence data from various field surveys into a database that can be accessed by project planners to adequately address potential impacts on these species as a direct result of planned forest activities. Surveys are generally conducted from March 1-November 15 (or later). These surveys are intended to document new occurrence records of TES and MIS, monitor existing known populations of these species, explore previously undocumented areas of the NFGT, and support district project plans when there is no botanical information for that particular project area on file.

An individual species' status, distribution, and subsequent designation are based upon occurrence records, information and knowledge of the Forest Service, U.S. Fish and Wildlife Service, the state Natural Heritage Program, and The Nature Conservancy. Species are listed and delisted as additional information becomes available, so periodic revisions to the lists (PETS, RFSS, and MIS) are necessary.

The NFGT tracks 28 rare plants. Each plant falls into 1 of 3 categories of rarity: federally listed threatened plants (4 species), sensitive plants (22 species), and two management indicator plants. Plant *management indicator species* (MIS) represent the issues, concerns, and opportunities relating to the diverse plant resources and habitats on the national grasslands and national forests. There are two MIS plants on the NFGT that are not represented in the Regional Foresters Sensitive Species (RFSS): nodding nixie (*Apteria aphylla)* and Louisiana nerveray *(Tetragonotheca ludoviciana)* (Table 7).

Table 7. MIS – Management Indicator Species

Management Indicator Species (MIS)	Species Present? (Y/N)	Habitat Represented	Habitat Present? (Y/N)
Apteria aphylla	Y	Baygalls and acidic woods	Y
Tetragonotheca ludoviciana	Y	Longleaf pine and/or bluejack oak sandhills	Y

b. Animal

Based on survey results of NFGT's point-count monitoring, increases in population density for the following management indicator species have occurred: Eastern Wild Turkey, Yellow-breasted Chat, Pileated Woodpecker, and Red-cockaded Woodpecker; stable population densities have been ascertained for the Northern Bobwhite Quail, Wood Thrush, Acadian Flycatcher, and Yellow-throated Vireo. None of the MIS animal species had deceasing populations (Table 8).

Table 8. Terrestrial MIS Status

MIS	Population Status	USFWS/USFS Status	Seral Stage Habitats
Northern Bobwhite	Stable	---	Tallgrass Prairie
Eastern Wild Turkey	Increasing	---	Forest Grassland Early, Mid, Late Succession and Old Growth
Red-Cockaded Woodpecker	Increasing	Endangered	Longleaf Pine (Longleaf Pine Woodlands and Savannahs) Shortleaf Pine (Dry-Xeric-Oak Pine Forest) Loblolly Pine (Mesic Oak-Pine Forest)
Pileated Woodpecker	Increasing		Forest Grassland Mid, Late Succession and Old Growth
Yellow-breasted Chat	Increasing	---	Forest Grassland Early, Mid, Late Succession
Yellow-throated Vireo	Stable	---	Bottomlands & Streamsides
Acadian Flycatcher	Stable	---	Bottomlands & Streamsides
Wood Thrush	Stable	---	Bottomlands & Streamsides
Whitetailed Deer	Stable	--	Forest Grassland Early, Mid, Late Succession and Old Growth
Gray/Fox Squirrel	Stable	--	Forest Grassland Mid, Late Succession and Old Growth

Game species population estimates are based on harvest data from Texas Parks and Wildlife Department (TPWD), habitat trends, and spotlight surveys for whitetailed deer.

Aquatic MIS were selected to represent the issues, concerns, and opportunities relating to aquatic resources on the NFGT. In measuring the biological integrity of the aquatic ecosystem, combinations of species were used to represent aquatic habitats and communities. Fish and macroinvertebrates were used as indicators to reflect the ability of aquatic organisms to move within and among stream reaches. A stream reach with high water quality, however, may contain no fish because of culvert impediments downstream, structural voids, seasonal flow changes, range limitations, or migration. Other fish were selected as management indicators of ponds and reservoirs. Table 9 displays the aquatic management indicators.

Table 9. Aquatic MIS Status

MIS	Population Status	Aquatic Habitat Category
Paddlefish	Stable	Large river systems
Sabine Shiner	Stable	Small streams and rivers having slight to moderate current
Dusky Darter	Stable	Medium to large streams of moderate to low gradients
Scaly Sand Darter	Stable	Large creeks to large rivers
Stonefly Guild	Stable	Flowing streams
Largemouth bass	Stable	Impoundments and ponds
Sunfish (RE & BG)	Stable	Impoundments and ponds
Channel Catfish	Stable	Impoundments and ponds

Largemouth Bass (*Micropterus salmoides*)

The largemouth bass the focal freshwater species in Texas and as the result of intensive TPWD stocking efforts, most native strains have been hybridized with the preferred Florida largemouth. This effort was strictly focused on growing larger game-fish and may have had the counter-effect of eliminating the native "northern" strain from most watersheds/water bodies. This species was selected for aquatic pond and reservoir habitats because of its focal status as a demand species.

All data and analyses are from NFGT electro-fishing reports, except for Coffeemill and Davy Crockett Lakes, which are monitored by TPWD out of the Texoma Fisheries Office. These sources also apply to sunfish and channel catfish summaries for these reservoirs.

In the *Plan*, the short-term objective was to have 40-90 bass per hour catch rate in all managed reservoirs. By 1998, this had been achieved in all but Ratcliff, Cottonwood and Clear Lakes (all of which developed weed problems, curtailing fertilizing and other management efforts). In 2001, Red Hills Lake yielded a 13.2 pound Florida hybrid female that was stocked as a fry in 1992. Black Creek Lake produced two fish over 10 pounds in 1999. Combined with the loss of federal hatchery fish and prevalent weed problems, management was curtailed on all but Crockett and Coffeemill Lakes.

Table 10. Largemouth Bass Survey Results From Specified Lakes During Fiscal Year. (Numbers indicate catch/hour via electro-fishing.).

Lake	2000	2003	2005	2006	2007
Black Creek	0	0	0	0	0
Coffeemill	90	0	100	0	0
Cottonwood	0	0	0	0	0
Clear	0	0	0	0	0
Crockett	165	108	82	118	0
Fannin	0	0	0	0	30
Ratcliff	0	0	0	0	0
Red Hills	40	0	0	0	0

Sunfish (*Lepomis species*)

This MI includes many common species such as bluegill, redear, green sunfish, warmouth and longear. Bluegills dominate most of the samples. Acting as a forage base or prey species for the largemouth bass, this group will not always exhibit concurrent trends.

The goal from the Plan was to maintain sunfish in the 40-250 per-hour catch-rate range in the short term. As evident below, this was achieved on all lakes that didn't have aquatic weed problems.

Table 11. Sunfish Survey Results From Specified Lakes During Fiscal Year. (Numbers indicate fish catch rate per hour via electro-fishing.).

Lake	1994	1995	1996	1997	1998	2000	2003	2005	2006
Black Creek	32	0	00	0	76	0	0	0	0
Coffeemill	78 (1992)	114	0	0	446	133	0	705	0
Cottonwood		5	0	0	0	0	0	0	0
Clear	0	29	0	0	24	0	0	0	0
Crockett	255	0	0	332	0	1967	108	696	0
Fannin	15	0	0	0	0	0	0	0	80
Ratcliff	0	0	39	0	0	0	0	0	0
Red Hills	0	97	0	0	0	126	0	0	0

Channel Catfish (*Ictalurus punctatus*)

This species was chosen as another sport fishing MI for aquatic ponds and reservoirs. It is a demand species and is highly sought by fisherman on public waters. As in many man-

made reservoirs, natural reproduction of channel catfish is low in NFGT lakes and ponds so this fish is stocked periodically.

Catfish monitoring is more difficult due to a slower electrical pulse required for electrofishing and their bottom-dwelling nature. Typically, we use indications of public success as a meter of abundance. Gill-net sampling leads to complete mortality, but body condition is a good indicator of population health. On the NFGT, monitoring is most successful through maintaining records on stocking (dates, times per year and rate) within individual water bodies.

Table 12. Channel Catfish Stockings.

Water-body	2003	2004	2005	2006	2007
Boykin	0	0	0	*830/8+”*	0
Bouton Lake	0	~2,000/5”	0	*1120/8+”*	0
Little Bouton	0	~700/5”	0	*0*	0
Sexton Pond	0	~700/5”	0	*0*	0
Double	0	4300/5”	2140/4	5255/3.2-5.8	0
Camp Letcher	0	0	0	0	0
Niederhofer	0	0	200/4	1375/3.2-5.8	1000/7.5
Office Pond C52	0	0	0	30,000 fry	0
Peden Tr. Ponds	0	0	0	390/3.2	0
Plantation Pond C76	0	0	0	30,000 fry	0
FS234B Pond C42	0	0	0	30,000 fry	0
SHNF Ponds	0	1,950/5”	0	0	0
Ratcliff	0	5000/5”	0	4000/4.8	2500/7.5
DCNF Ponds	0	1,950*/5”	0	375/4.8	500/7.5
Red Hill	0	3,400/5”	0	750/4.8	0
Lake Fannin	0	0	0	*1,100/6-8”*	0
Windmill Lake	0	0	0	*1,080/9”*	0

All entries in italics were stocked by Texas Parks and Wildlife Department
Fish totals are followed by size in inches (number stocked/size)
~ = approximation

Paddlefish (*Polydon spathula*)

This species, endemic to the Angelina, Neches and Sabine River systems, was extirpated years ago when reservoirs were constructed and gravel was dredged from the rivers. Native adults were still reported in the lower Neches around the Big Thicket during the 1980s. All natural reproduction has ceased. TPWD, in cooperation with the NFGT, made a concerted effort to restock the river systems with fingerlings. Paddlefish were stocked into the Neches from 1989 to 1998, the Angelina from 1989 to 1999 and in the upper Sabine River during the same time period. Subsequent habitat surveys (1996 - 1999) revealed that the preferred backwater spawning habitat with gravel substrates was completely gone from the Neches River. Without the habitat necessary to sustain reproduction, paddlefish stocking was curtailed.

During *Plan* development, specialists identified paddlefish as a MI for larger river systems because it was felt there was a potential to regain sustainable (reproducing) populations in NFGT rivers. Since 1996, specialists have realized this species is likely only a "put & take" member of the river systems, so its value as a management indicator has been re-evaluated.

Dusky Darter (*Percina sciera*)

This species was selected as an indicator for low gradient streams due to perceived prevalence in these habitats based on preliminary sampling. However, this species does not prefer highly turbid streams. Many NFGT streams become turbid during storm events. More intensive surveys did not reveal this species with the regularity that was expected.

Moye found this darter in Camp Creek on the Davy Crockett NF in 1995, yet Kelly did not find it in 1994-95. Kelly also found it in Cochino Bayou, but it was not found by Forest Service personnel in 1998 and 1999. Both Kelly and Forest Service personnel found the species in Piney Creek in 1994 and 1999, respectively.

The dusky was documented on the Sabine NF in 1994 by both Espey-Huston and Rogers at different locations of Big Sandy Creek. Forest Service personnel did not find it there in 1998, but the rare harlequin darter was present. Only one individual appeared in Bull Creek during an intensive 1996-97 survey of three creeks in the Indian Mounds Wilderness done by Claudia Ebeler. The dusky appeared in all three 1996-97 samples taken by LaMont, in a reference stream adjacent to the forest. The dusky was absent in all 20 samples taken by Forest Service personnel throughout the Sabine NF, even though other darter species were present.

Sabine Shiner (*Notropis sabinae*)

Selected as an indicator for rivers and streams, this Region 8 Sensitive species is found in clear, silt-free streams with sandy bottoms and once ranged throughout the Angelina and Neches River Watersheds. This species is very uncommon due

to reservoir construction and reduction in preferred stream habitat in perennial streams, which mostly occurred adjacent to inundated river systems (Sabine River, Angelina River & San Jacinto River). In 1972, Provine found the Sabine shiner in four different streams on the Sam Houston NF.

Scaly Sand Darter (*Ammocrypta vivax*)

Although an inhabitant of creeks and rivers of various sizes with sandy, silt, gravel or hard clay substrates (Kuehne and Barbour 1983), the NFGT has found it to be more typical of higher flow/gradient streams with clear water. As such, it was selected as our gradient stream indicator. However, according to Kuehne and Barbour, "it is unlikely to be thriving…and serious depletions may be occurring at the margins of the range," of which the NFGT would qualify.

Once common throughout the forest (Hubbs 1951, 1952, Provine 1972), this species has all but disappeared from the Sam Houston NF. Two intensive studies of many sites (Herbert 1999, Healy 2002) failed to turn up any scaly sand darters. Forest personnel picked them up on the East Fork of the San Jacinto in 1993, but they were missing in 1998. Being a silt-sensitive species, it is highly likely that the same sources of siltation that have eliminated most mussel species from the area streams (Howells 1994), have greatly impacted this darter.

The only record of this species on the Angelina NF was from Geeslin's baseline survey in 2001, where it occurred in Scott Creek.

Jess Kelly's 1995 baseline coverage turned up one individual on the Davy Crockett NF in Lynch Creek, which was dry the following quarter. No other record of the fish exists on the forest, despite numerous samples by agency personnel, although Lee et al (1980) show historic occurrence throughout the Neches River System.

The Sabine NF appears to be the best refuge for this species with ample 1994 (Espy-Huston) and 1995 (Rogers) records from Big Sandy, Conner, South Prong and McKim Creeks. They, however, did not appear in nearby Curry Creek (a tributary with lesser water quality and greater influences from private land). The fish was not found in any of the three Indian Mounds Wilderness streams to the immediate north (Ebeler 1998). Our most dated historic record for this species is in Boregas Creek (Hubbs 1949).

Stonefly Guild

The stonefly guild was chosen as an MI or index for rapid evaluation of stream quality and possible pollution problems. This guild includes all the macroinvertebrates as a group, rated by an established scoring system, such as the abbreviated EPA form used by the NFGTs or Hilsenhoff's Biotic Index (HBI), which is similar to an IBI. The NFGT uses the abbreviated EPA method, while the extensive Hilsenhoff procedure is usually requisite of surveys we have contractedthrough universities.

No macroinvertebrates were collected in 2006 other than crayfish from six streams on the Angelina. Crayfish can exist in a wide range of water quality conditions, but are not considered tolerant of pollution.

2. TES Species

a. Plants

There are four plants listed as *threatened* under the Endangered Species Act that are known to occur on or near the NFGT. The federally-listed plants are Navasota ladies'-tresses *(Spiranthes parksii),* earthfruit *(Geocarpon minimum),* white bladderpod *(Lesquerella pallida),* and Texas prairie dawn *(Hymenoxys texana).* Navasota ladies'-tresses is the only PETS plant known to occur on the NFGT (Table 13).

Table 13. Proposed, Threatened, and Endangered Species (PETS) Plants

Species	NFGT Distribution and Habitat	Individual NFGT Units	
		Species Known To Occur	Is Suitable Habitat Present
Lesquerella pallida	Weches formation	Not on any NFGT units	
Geocarpon minimum	Saline glades and barrens		
Hymenoxys texana			
Spiranthes parksii	Catahoula pine barrens	Angelina NF	Yes

Federally-listed plant species known to occur and/or adjacent to various units of the NFGT.

Activities that might threaten the continued existence of any plant species may be deferred or modified to provide adequate protection for the plants. Depending on the species, this may not require the protection of every individual plant or population.

The number of rare plants or their population structure is not completely known. Ongoing botanical surveys throughout the national grasslands and national forests are adding to the knowledge of abundance, distribution of rare plant species and, to a lesser extent, for all plant species found in the NFGT flora. A full understanding of rare plant habitat requirements remains inconclusive. Several factors are considered when choosing species for listing as sensitive or conservation species.

Regional Foresters Sensitive Species are generally plants that are rare throughout their range. The NFGT also tracks the 22 rare plants listed in Table 14.

Table 14. Regional Foresters Sensitive Species (RFSS) Plants.

Species	NFGT distribution and habitat	Individual NFGT units	
		Species known to occur	Is suitable habitat present?
Amorpha paniculata	Angelina NF in bogs and baygalls	Yes	
Agrimonia incisa	Angelina NF in sandy longleaf savanna	Yes	
Bartonia texana	Angelina and Sam Houston NF in baygalls	Yes	
Crataegus warneri	Davy Crockett NF in deep sandy soils	Yes	
Cyperus grayoides	Angelina and Sabine NF in xeric sandylands	Yes	
Cypripedium kentuckiense	Angelina and Sabine NF in beech-white oak ravines	Yes	
Dalea reverchonii	LBJ Grasslands on goodland limestone soils	Yes	
Hibiscus dasycalyx	Davy Crockett NF in sloughs and marshes	Yes	
Lachnocaulon digynum	Angelina and Sabine NF in hillside seepage slope bogs	No	Yes
Leavenworthia texana	Weches formation	No	
Liatris tenuis	Angelina and Sabine NF in sandy longleaf pine savanna	Yes	
Platanthera integra	Angelina NF in hillside seepage slope bogs	Yes	
Prenanthes barbata	Angelina and Sabine NF in beech-white oak ravines	Yes	
Rhynchospora macra	Angelina NF in hillside seepage slope bogs	Yes	
Rudbeckia scabrifolia	Angelina and Sabine NF in hillside seepage slope bogs and baygalls	Yes	
Schoenolirion wrightii	Angelina NF in catahoula pine barrens	Yes	
Silene subciliata	Sabine NF on sandy post oak hillsides	Yes	
Streptanthus maculatus	Sabine NF where glauconite is present	Yes	
Trillium texanum	Angelina NF in baygall ecotones	Yes	
Xyris drummondii	Angelina NF in hillside seepage slope bogs	Yes	
Xyris louisianica	Angelina NF in hillside seepage slope bogs	Yes	
Xyris scabrifolia	Angelina and Sabine NF in hillside seepage slope bogs	Yes	

Regional Forester sensitive plant species known to occur and/or having suitable habitat on various units of the NFGT.

b. Animal

Table 15. Animal PETS by Status and Rank

No.	Scientific Name	Common Name	Status		Status*/Rank
			USFWS	USFS	State
1	**Picoides borealis*	Red-cockaded Woodpecker	E	E	E
2	*Haliaeetus leucocephalus*	Bald Eagle	DM	S	S3
3	*Ursus americanus luteolus*	Louisiana black bear	T	T	--
4	**Corynorhinus rafinesquii*	Rafinesque's big-eared bat		S	S3
5	**Aimophila aestivalis*	Bachman's Sparrow		S	S3
6	**Pituophis ruthveni*	Louisiana pine snake	C	S	S2
7	*Notropis sabinae*	Sabine shiner		S	S3
8	*Somatochlora margarita*	Texas emerald dragonfly		S	S2
9	*Faxonella beyeri*	Sabine fencing crayfish		S	SNR
10	*Procambarus nechesae*	Neches crayfish		S	S1S2
11	*Procambarus nigrocinctus*	Blackbelted crayfish		S	S1
12	*Fusconaia askewi*	Texas pigtoe		S	S1S2
13	*Fusconaia lananensis*	Triangle pigtoe		S	S1
14	*Lampsilis satura*	Sandbank pocketbook		S	S1
15	*Obovaria jacksoniana*	Southern hickorynut		S	SNR
16	*Pleurobema riddellii*	Louisiana pigtoe mussel		S	S1
17	*Potamilus amphiachaenus*	Texas heelsplitter		S	S1

T = Federally threatened, E = Federally endangered, C = Candidate species, DM = Delisted and monitored, S = Federally sensitive; S1-S4 = State rankings and are as follows: S1= Critically imperiled in Texas because of extreme rarity; S2 = Imperiled in Texas because of rarity; S3 = Rare and uncommon in Texas; S4 = Apparently secure in the state; SNR-not ranked.

Sources: USDA Forest Service, 1996, revised 2007. **http://www.natureserve.org/**

b. Factors Influencing Existing Conditions and Trends

1. MIS

a. Plants

Current vegetative conditions on the NFGT are largely a function of past uses and management activities. Most of the native overstory was removed from the national forests during extensive logging that occurred in the late 1800s and early 1900s. A large portion of the area harvested during this period was succeeded by off-site tree species that had not historically occupied these landscape types. The fire regime that shaped the upland habitats of the earlier grasslands and forests was significantly altered as well. These factors have changed the character and pattern of forest vegetation on much of the NFGT.

b. Animals

All of the above-mentioned changes to the NFGT have altered the distribution, extent, and quality of vegetative communities and the associated habitats available to terrestrial wildlife.

The condition of aquatic species habitat is influenced by a number of factors including fishing pressure, invasive weeds, alkalinity, man-made reservoirs, culverts, and siltation from OHV use of unsurfaced trails.

Generally, the smaller lakes generally have a good Largemouth Bass population balance up to the 14 inch legal minimum, above which they fall off to few or none. It is difficult to break this trend on small lakes where fishing pressure is high. Brush structures and vegetation can be used to protect some age classes from predation and make fishing take more difficult, but still cannot buffer the effects of heavy fishing pressure on population structure.

Alkalinity measured in 2007 was 15 ppm as CaCO3 in Double Lake, 25 ppm in Ratcliff and 20 ppm in Red Hill, respectively. This measure of buffering capacity indicates how effective supplemental lake fertilization will be. A value less than 20 ppm indicates a need for liming as most fertilizer binds up with bottom sediments under these conditions. Ratcliff and Red Hill met the standard, while Double Lake did not. However, fertilization programs have been discontinued on all three lakes due to invasive weed problems or district priority.

With the availability of federal surplus fish in the last few years, we have succeeded in bolstering catfish age classes every year in order to provide a continuum of legal-sized fish. This species needs to be restocked in order to relieve the fishing pressure on the bass and sunfish populations.

Considering the inherited state of the habitat and the impact of man-made reservoirs and siltation from private lands, NFGT activities have not contributed to further decline of paddlefish populations. Unless TPWD determines conditions have changed and re-evaluate the restoration of paddlefish, the utility of this species as an MI is very low.

In 1999, Herbert found the dusky darter in six creeks on the Sam Houston NF. Only three (or 50 percent) of these same creeks contained dusky darters in 2000 (Healy). Despite an oil and brine spill and chronic brine leakage within the Clear Creek watershed, dusky darters appeared there in 1994, 1997 and 2000. Being silt-sensitive, recent absence of dusky darters from other creeks could correlate with published accounts of widespread mussel disappearance within the watershed. Probable siltation causes are motorized use of unsurfaced trails and gravel surfaced roads.

Intensive samples done on the Angelina NF in 1980 and 2000, revealed no dusky darters in Graham Creek, while a 1996 survey turned up one individual. The species was present in Boykin Creek in 1995, but gone in 2000. This could correlate with the heavy off-road vehicle (ORV) use in the area, which has since been curtailed. Forest personnel found the species in Trout Creek in 1995, yet it was absent in 1997 (Moye, 1998), which could also correspond with heavy ORV use in this watershed. In a 1991 study of three Nacogdoches streams by Ahle, the dusky was absent from only the most urban of the three, possibly indicating sensitivity as an indicator.

Another historic record was added to NFGT database from an area just north of the Angelina NF in Lavaca Creek near Etoile. Although the record is from 1950 (F.A. Dickins, SFA), it still has merit given that the Nacogdoches populations that range south

to the Angelina River are now known to be the most stable for the species. Of the streams sampled in FY05, no Sabine shiners were recorded. In streams where this fish has no barriers, it occurs fairly routinely (Lanana/Banita Creeks). However it is rare to find this shiner on the forest due primarily to impediments that keep them from migrating too far up smaller streams.

Despite surveys of over 50 sites by Texas A&M cooperators and 20 sites by Sam Houston personnel, this species only appeared in a Peach Creek pool in 1998 during extreme drought conditions. Siltation problems on the Sam Houston NF from ORVs, roads and private land activities may have impacted this species and its habitat. The major impact to streams in the San Jacinto River Watershed was construction of Lake Conroe in the 1970s; this reservoir eliminated many former habitats. In 1995, Stephen F. Austin State University cooperator, Jess Kelly, found a few individuals in Cochino Bayou on the Davy Crockett NF. Subsequent surveys in the area have been unsuccessful. This forest also has some erosion problems, primarily caused by roads and crossings (Peterson 2000). Much of the land in the Cochino watershed is also in private holding and heavily altered.

This shiner has not been found on any other forest, despite intensive surveys. It does exist with regularity in Lanana Creek, just north of the Angelina. Since this is an urban creek running through Nacogdoches, the survival of this population is not assured.

Considered as a guild with other MIs, the dusky darter and Sabine shiner both absent from McKim/East prong in 2006 seem to indicate that habitat has declined. It can probably be narrowed down to water quality or flow. 2006 was considered a drought year and adequate flows may have been lacking.

Ground-disturbing activity in and/or near streamside zones lowers habitat quality for many of the stonefly guild species monitored. The Plan objectives dictate that we move toward a “good to excellent” rating in the short term. At this point, most of our streams are still in the “good” range. It is difficult to determine if pollution and sediment related disturbance is caused by NFGT actions or actions on private lands interspersed within the NFGT administrative boundaries. Using the HBI technique is good for identifying the existence of population problems, but does not help personnel determine the cause of the problems.

2. TES Species

a. Plants

Many plants tolerate a wide range of conditions. They therefore occur commonly and cover wide areas. The plant communities of the national forests and grasslands change as environmental conditions vary. Changes in land uses, including fire exclusion, farming, livestock grazing, timbering, and other activities have most likely altered the abundance of many plant species on the NFGT. Changes in habitat conditions have caused some plants to become rare, while others have likely always been rare and limited to specialized habitats.

Species that survive in extreme habitats often become rare if habitat conditions change. Some tolerate life in habitats too harsh for common plants. Others have adapted to specific niches in specialized habitats. Species which grow only in calcareous prairies, for example, depend on specific soil types, fire regimes, and the absence of an overstory for their continued existence, and survive drought better than woodland herbaceous species. Some plants are adapted to life on rock outcrops, in riparian forests, or in sandy woodlands. Certain species have specific survival requirements that can be satisfied only by bogs with wetland soils.

While these plants survive under harsh conditions, they often cannot tolerate changes in their habitat. For example, if a road altered the water flow into a bog, causing the bog to dry out, the habitat could be changed to the extent that upland plants invade the bog, displacing the wetland species. When humans modify these habitats over wide areas, such plants become even scarcer.

In order to thrive, some rare plant species may depend on the disturbance created by fire. Fire reduces competition because it kills some species. To effectively seed-in and grow, many herbaceous plants native to the longleaf pine ecosystem need fire-created open spaces that have been bared to mineral soil. Decades of effective fire suppression have limited the open spaces these plants need, thereby causing them to drift toward rarity.

b. Animals

Disturbances can adversely affect rare species (PETS and Conservation species) more so than non-rare species (most of the NFGT's MIS, non-game species, and game species) because of rare species' narrower ecological niches; rare species do not adapt as well as more common species with broader ecological niches. Humans are the primary disturbers of terrestrial wildlife on the NFGT: cross-country 4-wheeler riders, trail riders on designated trails, year-round recreationists (including hunters) throughout the Forest, USFS personnel and contractors conducting timber management, fire management, recreation management, and wildlife management activities can have an adverse impact on terrestrial species. Adherence to NFGT's Revised Forest Plan negates the adverse impacts of disturbances to wildlife to an acceptable level.

c. Projected Future Actions

1. MIS

a. Plants

A large portion of the forest communities will likely continue to transition into the later successional classes. A significant prescribed burning program is expected to continue to burn over 100,000 acres per year to reduce hazardous fuels and improve habitat for wildlife, including the endangered red-cockaded woodpecker.

b. Animals

Prescribed burning is required to meet the Revised Forest Plan objectives of restoration of forest types historically occurring on the Forest and maintaining conditions suitable for many native plants and wildlife. MIS populations will be monitored, but the majority of species are not expected to significantly change in abundance on the NFGT in response to increased prescribed fire. Many species that are restricted to fire-maintained landscapes will potentially benefit from increased burning frequency. The range of some shrub and midstory nesting species using overgrown fire-maintained habitats will be reduced, but ample suitable habitat for those species will be available on the NFGT in infrequently and/or unburned forest types (MIS Report 2006).

With a public demand species, the need for change would be based on public input. The NFGT has been able to provide great opportunities for a fortunate few in the bass fishing realm, with two 13+ lb. bass taken from Ratcliff Lake in this reporting period. In Texas, fish of this size can be turned in under a state trophy program for angler prizes and recognition. These successes are likely based on past intensive management efforts in Ratcliff Lake, which have been curtailed in recent years in order to control aquatic weeds. We are able to still provide fishing success with other species, but bass emphasis is totally dictated by public demand and priorities of the particular Ranger District, not biological indices, so need for change is relative. Also, the "need" for the Forest Service to provide trophy bass fishing on lakes, that are too small to sustain such performance while in the proximity of huge state-managed trophy bass reservoirs, is of questionable necessity. This becomes especially apparent when the intensive labor and cost is considered. We have logically evolved into providing recreation area campers with a quality fishing experience, but not necessarily trophy bass angling.

The 32.8 catch rate in Coffeemill was said to be the highest ever, yielding healthy fish of legal size and larger. Conversely, populations have declined in Lake Davy Crockett since fish in the 11-12" size were not present, so there was no size class to provide the minimum 12" legal fish. Those present were healthy with excellent growth. Stocking was recommended in 2007 and 2008 to augment missing size classes.

Although the paddlefish is a protected species, one criterion for MIS designation, it does not aptly fit the other criteria. It is not easy to monitor and is not a good indicator of river habitats due to its rare and nomadic nature. An Index of Biotic Integrity (IBI) guild system would be much more useful in riverine systems.

The Dusky Darter has been absent from quality habitats for no apparent reason. It has also been present and missing in back-to-back intensive studies. There almost appears to be a geographic trend, with the occurrence fading as you go north and west on the NFGT. If stream gradient is a factor, this should only apply to the north Sabine, where streams have higher gradients. Dusky darters are rare on the Angelina, but then occur immediately north around Nacogdoches. The recommendation is to drop the dusky darter as an exclusive "low gradient" indicator during the next Forest Plan Revision process and add a cadre consisting of the bluntnose darter/slough darter/redfin darter/and dusky darter. Bluntnose and slough darters also seem to appear interchangeably in low-gradient habitats and redfin darters may be more transitional between low and high gradients. These indicators would really be more effective as guild indicators, like the macroinvertebrates. The IBI is widely accepted and gives any species of darter the same

score for being present. This helps eliminate the bias of habitat nuances, migration and other factors that contribute to anomalous results.

It is apparent that the Sabine Shiner is extremely depleted on the forest. Reintroduction into a suitable watershed that lies mostly within FS holdings would be advisable. According to what we have learned from their life cycle requirements, preferred and/or essential habitat necessitates an unimpeded reach of at least 13 miles (Casey Williams 2003). Repairing and limiting erosive activities on other reaches of the forest may serve to improve habitats and increase the likelihood of natural reoccupation.

As with the dusky darter, the same logic applies to the scaly sand darter, although it is further complicated by its limited range and sensitivity to perturbations. It is clear that this species has become rare on the Sam Houston NF due to the same conflicts with ORVs, roads and private land uses that have caused siltation and made habitat unsuitable for mussels in the San Jacinto Watershed. The soils are too fragile for standard protocols and large storm-flow volumes exacerbate any exposed soil problems. In terms of this species as an indicator, it should be dropped in favor of an IBI guild system during the next *Plan* Revision process. This species does not have near the distribution of the dusky darter and may be interchangeable with the redfin darter in some areas. It also appears to have a guild relationship with other aquatic indicators this year. Although more finite in displaying causative parameters, macroinvertebrates basically reflect what is being found in the fish community. This is a good technique that should be continued for evaluation of water quality andidentification of stream species composition.

2. TES Species

a. Plants

The prescribed fire program will continue in the foreseeable future, with a goal of burning much of NFGT lands on a 3-to-5 year rotation. This fire frequency will play an important role in restoring rare plant habitats to pre-settlement conditions, which is desirable. However, thick shrub growth on bogs and prairies has accumulated over years of fire suppression, and current prescribed fire is not always penetrating these locations. The result is a degradation of rare plant habitat as the shrub layer shades out rare plants found in the herbaceous layer. Also, growing season burns are more effective at controlling the shrub layer than dormant season burns; consequently, an increase in growing season burns is desirable.

Continued timber thinning, particularly in pine forests, is a desirable activity, as it allows light to penetrate to the forest floor, favoring the growth of rare plants in the herbaceous layer.

b. Animals

Under the *Plan*, as amended, the new USFWS Recovery Plan guidelines (*Plan* Amendment #7) will be implemented. This modified direction utilizes best available information for managing RCW habitat on federal lands.

3. Fish and Wildlife

a. Existing Conditions and Trends

1. Terrestrial Habitat

Game species' population densities on the NFGT are stable to increasing. The whitetail deer is the highest profile game animal in the Pineywoods of East Texas. Populations are monitored through a series of different surveys to evaluate the approximate density, the general health of the herd, and the impact of the deer herd on the habitat. This information is collected through a series of surveys including spotlight lines, age/weight/antler data collection on harvested deer, and browse surveys (TPWD).

Gray and fox squirrels are popular small game throughout the southeastern United States. Squirrel hunting is second only to whitetailed deer hunting in most forested areas. Squirrel populations closely parallel the previous season's mast crop; with populations rising when food is abundant. This factor varies due to weather and is generally not under management control.

Although Eastern wild turkey population densities vary greatly throughout east Texas, the restoration program has successfully achieved the goal of establishing populations throughout the region with an 80 percent success rate. Block stocking efforts were completed in 1999, with a total of more than 7,200 turkeys stocked at 321 release sites in 57 counties. Population densities are highest in the Red River Valley region, followed by Northeast Texas and the Southeastern Pineywoods. The first county-wide spring eastern turkey season was initiated in Red River County during April of 1995. Since 1995, hunting opportunities have expanded rapidly. Currently, there are 37 counties open for spring eastern turkey hunting in East Texas.

2. Aquatic Habitat

b. Factors Influencing Conditions and Trends

1. Disturbances

a. Terrestrial Habitat

Disturbances can adversely affect rare species (PETS and conservation species), more so than non-rare species (most of NFGT's MIS, non-game species, and game species) because of rare species' narrower ecological niches. Rare species do not adapt as well as more common species with broader ecological niches. Humans are the primary disturbers of terrestrial wildlife on the NFGT: cross-country 4-wheeler riders, trail riders on designated trails, year-round recreationists (including hunters) throughout the NFGT, USFS personnel and contractors conducting timber management, fire management, recreation management, and wildlife management activities can have an adverse impact

on terrestrial species. Adherence to NFGT's Revised Forest Plan negates the adverse impacts of disturbances to wildlife to an acceptable level.

b. Aquatic Habitat

Factors that continue to impact fish and aquatic ecosystems may include:

- Localized water quality problems — fecal coliform, low pH, total dissolved solids, and turbidity — that could potentially impact stream fisheries.
- Low dissolved oxygen due to lake turnover, resulting in die-off of plankton and fish communities.
- Short-term and long-term impacts of sedimentation, siltation, and hydrocarbon pollution resulting from timber harvest, road construction and maintenance, and minerals extraction.
- Lack of a full understanding of the occurrence and / or vulnerabilities of many mussels, crayfish, gastropods, and other aquatic species which may lead to their imperilment.
- Placement of road culverts which may become impediments to the movements of many stream fishes, reducing their ranges and limiting their function as mussel *glochidia* hosts. Forty six percent of all streams surveyed in 2006 (n=92) on the ANF, DCNF and SNF were impassable (Center for Aquatic Technology Transfer –CATT). 52 percent of all streams surveyed on the SHNF during 2007 (n=21) were impassable (CATT).
- Major highway development and construction disrupting the natural hydrology of the watershed.
- Any timber, agricultural or commercial activities on private land that do not practice Best Management Practices (BMPs).

Figure 1. Physical habitat alteration/degradation that restricts species movement.

Figure 2. A culvert restricting fish passage.

Figure 3. DCNF- Pine Spring Cr, 524, 25" outlet drop (2006).

c. Projected Future Actions

1. Terrestrial Habitat

Habitat alterations/degradations off the forest and in the neotropical migratory bird wintering grounds will continue. The Forest Service controls activities on the NFGT and it will comply with the management direction in the *Plan* which safeguards against activities which are excessively detrimental to terrestrial wildlife. Therefore, no projected future actions on NFGT that are detrimental to terrestrial wildlife species are likely to occur without mitigation. Off the forest and in neotropical migratory bird wintering grounds, however, habitat alterations/degradations undoubtedly will continue which will not bode well for NFGT management indicator species, game species, and PETS species.

2. Aquatic Habitat

The FS will continue to protect the forest watersheds and manage for viable populations of fish and aquatic species. The NFGT was established, in part, to protect the headwater streams that ultimately replenish and recharge our water table. The forest has strict guidelines in place to protect our streamside and riparian zones.

The forest will continue to manage for recreational fishing.

4. Soil and Water

a. Existing Conditions and Trends

1. Water Quality

The National Forest and Grasslands in Texas (NFGT) lie within water resource Region 12, the Texas-Gulf Region. The NFGT also lie within four water quality management basins: the Sabine River Basin, the Neches River Basin, the Trinity River Basin, and the San Jacinto River Basin. There are eleven 4th level watersheds within these drainage basins. The total volume varies annually, depending on climatic conditions and management practices within the sub-watershed.

Streams listed as impaired by the state that are flowing through and from the NFGT are listed for causes generally beyond the influence of NFGT activities (*i.e.*, bacteria, dissolved oxygen, mercury, and pathogens).

Conductivity is a measure of the capability of water to conduct electrical current and is caused by ionic concentration and total dissolved solids. Waters that have conductivity values between 10-100 micromhos (uS) are usually found to be unpolluted. Conductivity is typically higher in the summer months due to concentration from reduced rainfall. Conductivity is used on the NFGT as a grab indicator of impacts from oil-field brine, fertilizer and livestock concentrations. Anything over 200 uS is considered to be a trigger for scrutinizing sources of runoff above a sample point. In many cases, nothing more than open pasture land upstream is found, but those lands are often fertilized, grazed or both. In two cases where concentrated grazing and cattle had access to SMZs upstream, it led to four-fold increases in conductivity over background. These examples occurred on the Sam Houston and Davy Crockett NFs. On an occasion outside this reporting period, an upper tributary of Caney Creek on the Davy Crockett unexpectedly exhibited conductivity over 2000 uS. Knowing that prior samples had been 60 uS, we looked upstream at the Trinity County Airport for answers. The stream actually originates from a spring under the runway. An inquiry revealed that a private timber company had used the airstrip, without authorization, to load fertilizer on planes. Similar utility was found in tracking oil-field brine dumping and leaks over the reporting period.

Plotting conductivity on forest maps revealed an interesting trend. All readings around Alabama Creek on the Davy Crockett were consistently over 200 us, with Lancaster Creek showing 1700 uS. Since the NFGT owns the entire Lancaster watershed, we walked Lancaster to its headwaters to find elevated conductivity throughout. It later became apparent that there is a naturally occurring saline formation in this area that is even expressed in saline flats with unique vegetation. In conclusion, conductivity appears to be a good parameter for indicating perturbations in a waterway or watershed, but must not be viewed subjectively without investigating likely sources.

2. Soils

The NFGT's soils have been intensively classified and mapped according to the criteria developed by the Natural Resources Conservation Service (NRCS) for Order II soil surveys. These soil surveys identify soil properties which are used to determine soil suitability for a variety of management practices and to indicate necessary mitigation. Soil properties also indicate ecological potential. Standards and guidelines have been

developed to reduce or mitigate the potential impacts of soil erosion or compaction. Erosion control guidelines generally set forth time frames, methods for revegetating disturbed sites, and erosion control practices based on erosion potential. To overcome the compaction problems related to certain management activities, guidelines associated with compaction and rutting potential identify time periods and soil moisture conditions when the soil can support specific practices and methods.

Soil quality reports that include monitoring and mitigations to ensure soil productivity are conducted on various project activities located on the NFGT. The purpose is to determine if soil losses from disturbed sites will lower soil productivity, as determined by the NRCS for any given soil type. Sites included are those that have been clear cut, site prepared, prescribed burned, and planted. The rationale is that these are the most intensively managed sites on the national forests, and if these sites do not exceed allowable soil loss, then other sites receiving less intense treatment will likewise fall within soil loss tolerances. Monitoring various projects has indicated that soil productivity is being maintained throughout the NFGT.

Each year watershed improvement activities are implemented on small projects across the NFGT. The NFGT had a watershed improvement annual target of about 50 acres from year to year.

In 2006, Natural Resources Conservation Service dug two soil pits on the NFGT. One was located on the Angelina and another on the Davy Crockett NF. Each pit was 4.5 feet wide by 8 feet long by 7 feet deep. Soil samples were sent to the NRCS National laboratory for classification. These points will also serve as interpretative areas for use by the NFGT and the public. The sites were immediately filled and rehabilitated after samples were taken, which resulted in no adverse resource damage. An estimated six pits are planned throughout the national forests in 2009 and 2010.

b. Factors Influencing Conditions and Trends

The types of activities normally thought of as potentially influencing soil and water conditions and trends on the NFGT include timber management activities (harvest and site preparation), road and trail construction, and prescribed fire. These activities involve use of heavy mechanized equipment capable of exposing soil, mixing soil, and compacting and rutting soil. In addition, prescribed fire can remove soil cover over broad areas exposing them to erosive forces, primarily storm runoff. Excessive loss of surface soil can lower soil productivity and impact water quality. Poorly constructed fire lines can erode and become rills or gullies. Skid trails and log landings inadequately stabilized, and roads and trails not properly constructed and/or maintained can erode excessively.

Another activity with potential and documented soil and water impact is recreational off-highway vehicle (OHV) operation on the NFGT. User created OHV trails can and have caused highly disturbed stream banks and excessive erosion in both the uplands and riparian areas. In many cases riders use firelines as OHV trails, destroying erosion controls on the firelines, which results in accelerated erosion and stream sedimentation. Areas adjacent to designated OHV trails also suffer from unauthorized use. Riders frequently ride off the designated trails and cause erosion in sensitive areas. Four wheel

drive vehicles operating in wet conditions on low level roads can and do cause damage to road surfaces and road drainage, which can then erode and cause sedimentation.

Designated OHV trails themselves can be erosion and sediment concerns. Some receive heavy use. Multiple passes, especially in wet conditions and with careless operation resulting in excessive wheel slippage, can and do result in soil movement. Without good control of users and proper trail maintenance these trails become significant erosion problems.

c**.** Projected Future Actions

1. Water Quality

Actions proposed for the future would utilize water protection mitigation prescribed in the *Plan*'s standards and guidelines. Therefore, no Forest Service actions are expected to have any major effects. As projects are proposed, site-specific data will be used to determine effects and needed mitigation.

2. Soils

Law enforcement on the NFGT currently plays a role in protecting soil and water conditions. Law Enforcement Officers and Forest Protection Officers make regular contact with the public. They serve to educate national forest and national grassland users, and issue citations to violators causing soil and water damage. Possible grant funding may provide additional law enforcement presence and/or surveillance capability for future enforcement actions.

5. Riparian Habitats

a. Existing Conditions and Trends

Stream channels will remain stable providing suitable water quality. ***Limited*** *manipulation of vegetation will filter sediment, thus maintaining aquatic habitat for those dependent species (MA-4 DFC).*

If we use physical changes and water quality to gauge riparian health, it would appear that these habitats on the NFGTs are in a declining trend. Soil movement into riparian zones and streams generally follow man-made arterial intersects which are obvious and easy to monitor. Similarly, channel down-cutting and soil/substrate loss from streams and riparian zones is even more evident as there are many static structures in place that show changes in channel depth and substrate loss over time, basically in the same manner as a photo-point.

The riparian vegetation corridors that are used as measures of protection in filtering runoff to streams have also shown a declining trend on the NFGT.

The quality of water flowing within streams is supposed to reflect the effectiveness of the filtration character and integrity of the streamside management zone (SMZ) vegetation. This parameter is rarely completely under our control since streams pass through many

private tracts that often impact water quality with various practices ranging from livestock to oil and gas development. Within NFGT control, many new activities have been permitted that are not compatible with water quality/riparian areas and have not followed many *Plan* protocols or enforced protective measures in contracts.

A forest-wide watershed assessment within the Boswell Creek Watershed is planned for 2009. The assessment will analyze watershed conditions and vulnerabilities and their effect on water quality.

b. Factors Influencing Conditions and Trends

1. Watershed

Watersheds are land areas from which water flows. A number of factors determine how water comes off a watershed, or runoff, and the quality of that water. These factors include watershed drainage area, slope, shape, aspect, geology, soils, impervious area, drainage density, and vegetation.

Any activity in the watershed which affects any one of these parameters can affect runoff. Some of these parameters are fairly fixed and not easily altered by human activity. Others are more susceptible to management effects, such as vegetation, soil characteristics, and drainage density. Land conversions such as roads, urban development, industrial development, or commercial development increases impenetrability, resulting in more runoff to stream flow. Vegetative conversions, such as converting forests to crops, pastures, or rights-of-ways can reduce rainfall interception, evapotranspiration, and infiltration capacity of the soil, resulting in more runoff. Even converting from one forest cover to another can affect seasonal antecedent soil moisture content, therefore runoff, due to differences in evapotranspiration by the different forest types. Road and trail drainage systems, or any feature that routes storm water to streams, can increase drainage density and reduce the time of concentration by intercepting surface runoff and directing more water to streams faster than before. Even recreation activity can affect runoff by compacting soils, removing vegetation, and increasing drainage density through developed or user created trails. These watershed changes can affect the total runoff from a watershed, the timing of runoff, or both.

Flowing water possesses kinetic energy, and delivers that energy to the channels in which it flows. Stream channels, therefore, are affected by the stream flow. As stream flow increases, erosive potential increases, and channels are more prone to erosion. As flow decreases, streams can’t carry as much sediment, and if sediment supply remains the same, channels may begin to fill in due to sediment deposition.

Roads and trails can also affect stream channels. Bridge and culvert crossings can alter stream energy in the channel by constricting flow or otherwise changing channel slope over short distances. The effects are easily seen at many crossings by looking upstream and downstream. Sediment or debris accumulation, or erosion can be observed above crossings, and channel bars and eroded banks below crossings.

Energy gradient changes can be caused by other actions, such as channel realignments. These energy gradient changes can have upstream effects. Channels adjust to new energy slopes and can head cut for some distance upstream until new stable slopes are

established. The effects can carry for a long distance into the upper watersheds, and considerable channel sediment can result.

Fifty acres of watershed improvement work was completed in the Denton Creek sub-watershed in FY 2007. This watershed covers the Lyndon B. Johnson National Grassland in Texas.

2. Riparian

Riparian ecosystems, as defined by the Eastern Region of the United States Forest Service, are areas "extending away from the bank or shore to include land with direct land-water interactions, and whose aerial extent is variable based on its ability to perform ecologic functions" (Verry, Hornbeck, and Dolloff 2000). Essential to this ecosystem then are water supply, soil, and the associated vegetation.

Water has to be in sufficient quantity and be accessible to the ecosystem. Water quantity can be altered in a number of ways, such as diversions, water withdrawals, or watershed alterations that change runoff patterns. If water quantity is sufficiently reduced, then it is not available for delivery to the riparian ecosystem.

Water access can be affected by channel changes which prevent water from reaching the riparian ecosystem. For instance, if a channel erodes such that stream flows which used to flood out of the banks stay inside the channel instead, then water isn't delivered to the riparian ecosystem. This can also result in increased channel erosion due to floods and erosive energy being confined to the channel and not distributed to riparian areas and flood plains. This condition can further reduce water access to riparian ecosystems.

Riparian soils are exposed to erosion from floods in streams or wave action along shore lines, and of course, soils removed from a riparian ecosystem are not available as a component of that system. Vegetation is important to holding those soils in place. Trees, vines, shrubs, and herbaceous vegetation help protect from floods or waves by slowing the erosive velocities of water and by providing cover from water erosion. Roots of these and other plants hold tightly onto soil particles so they aren't easily detached and carried away. Another factor affecting riparian soils is physical disturbance from off highway vehicles (OHVs). Operating OHVs in riparian areas destroys riparian vegetation, soil structure, and soil cohesiveness, and reshapes physical riparian form.

Sediment from floods is important to replace riparian soil lost through erosion. Water velocities slow as floods spread over stream riparian areas. Slower water doesn't hold as much sediment as faster water, so sediment drops from suspension. Dense vegetation also physically traps sediment from the water. Therefore, floods that can rob soils from riparian ecosystems through erosion serve a dual role of soil replenishment.

Vegetation that is so important in holding riparian soils in place makes up the above ground component of riparian ecosystems. Riparian vegetation provides nesting and foraging habitat for the associated fauna, but it also is an important energy source for aquatic biota. Factors affecting typical riparian vegetation presence or density include canopy closure, OHVs and other dispersed or developed recreation, and off-site vegetation such as dense loblolly pine stands.

Riparian trees that completely crown over reduce sunlight for some more intolerant vegetation. This can reduce stem density, soil cover, and some fine root density, not only affecting the vegetative component but also the soils. Direct physical destruction by OHVs of riparian vegetation and soils is widely documented on the forest. The same is true of other recreation activities occurring in riparian areas.

3. Roads

Riparian zones are most profoundly affected by roads, whether they be for public access or commodity access such as timber or oil and gas. Each road-riparian intersect not only removes the protective filter strip, but also forms and unnatural conduit that collects more water from slopes and moves it much more quickly into a channel than the same transect in native vegetation. Roads often "pull" water from slopes as the road profile cuts into soil layers and allows them to seep out into the road ditch rather than infiltrating normally into the soil horizons. *Plan* standards are written to enable needed road access with minimal impacts to resources; however, they are totally dependent on good decisions and implementation – *Design and construct roads to minimize siltation and be maintained to provide surface water drainage away from streams and into vegetated buffer strips or other filtering systems (FW-053).*

Roads create new unnatural conduits for transmitting water directly into riparian areas and concentrating this energy at one point, which is usually the stream channel. Planning and construction are often problem areas, but even more so is road maintenance because it has been viewed an unchangeable parameter or "part of the system." Any road on a slope must control runoff with wing ditches, crossover drains, etc. The NFGT will continue to monitor new road construction or reconstruction to make sure that these structures are built to standard.

Road drainage structures must be constructed properly so that silt does not enter into the streams. All wing ditches are supposed to be "J-hooked" following an FLT decision years ago. Care must be taken during road construction that wing ditches are built to standard.

Figure 4. Wing ditch on new road depositing silt in riparian area and dumping directly into creek due to lack of J-hooking.

4. Rights-of-ways (ROWs)

Rights-of-ways comprise the second major impact on streams because they are basically minimally maintained roadways for utility/pipeline access and maintenance by mowing. However, unlike roads they have no drainage control structure. Occasionally unpermitted crossing of Streamside Management Zones (SMZs) with heavy maintenance equipment can occur. ROWs should be monitored closely and any problems corrected as quickly as possible.

5. Firelines

Occasinally during fireline construction, personnel have crossed the creeks to get the job done rather than going around. Protocol has been to hand-rake 50’ to the creek to protect the SMZ with a waterbar at the top. Often personnel have trouble distinguishing between ephemeral, intermittent and perennial streams and deciding where and when to cross. Training should be given to field going personnel to assist them with making better decisions on where and when to cross streams during fireline construction.

Figure 5. Austin Branch showing dozer activity through SMZ into channel.

6. Oil and Gas

Oil and Gas facilities and development greatly increased during the Five-Year Review period. Pads are often built adjacent to SMZs with poor drainage control resulting in material leaving the pad and entering riparian areas. This is not only limited to siltation, but also contamination in fluids escaping sites due to leaks or open storage flooded by rains.

c. Projected Future Actions

Management direction for the smaller floodplain areas is aimed at maintaining or improving aquatic and riparian ecosystems and water quality. Minimizing risks to flood loss and public safety are additional management concerns on the Forest. Management direction for wetlands is focused on preventing their loss or degradation.

6. Insects and Diseases

a. Existing Conditions and Trends

Southern pine bark beetles are the primary mortality agents of pines on the NFGT, and the southern pine beetle (SPB) historically has been the predominate tree killer. Loblolly and shortleaf pines are the preferred hosts of SPB, though longleaf pine and other conifers may be attacked during outbreaks. Infestations are initiated in weakened or wounded trees, or in pines previously attacked by other bark beetles. When populations are low, infestations rarely spread beyond the initial tree attacked. As populations build, expanding infestations begin to develop, and soon even healthy pines are attacked and

killed. Densely stocked pine stands are conducive to the establishment and spread of SPB infestations. The overall hazard for SPB on the NFGT is high, due to extensive stands composed primarily of loblolly and shortleaf pine. Some thinning of pine stands has been accomplished through funds provided by the SPB Prevention Program. Several thinning projects have been delayed by legal challenges, and future hazard reduction treatments are contingent on continued funding and judicial clearance.

The last SPB outbreak on the NFGT occurred from 1991-to-1994. Due to SPB suppression treatments, less than 2% of the susceptible host type was killed outside of wilderness. Within wilderness, over 40% of susceptible host type was affected. SPB populations have remained in the latent phase in eastern Texas for the past ten years. No SPB infestations have been detected since 1998. Very few SPBs have been collected in eastern Texas during the annual spring surveys. The current population trend is in contrast to observed cycles in the previous half century. SPB outbreaks typically occur every 7-to-10 years, and last 2-to-4 years. Suitable habitat for SPB is plentiful on the NFGT, and historical patterns suggest an outbreak is overdue. However, there is no indication that an outbreak is likely in the next two years.

In the absence of SPB, *Ips* bark beetles have been the dominant bark beetles on the NFGT during the past ten years. *Ips* beetles usually function as secondary bark beetles, only attacking dying, severely wounded, or weakened pines. *Ips* populations cycle with precipitation levels. During periods of extended drought, their numbers can escalate, and widespread mortality may occur. The general pattern of infestation consists of scattered individual trees, but multiple tree infestations can develop. Scattered, widespread pine mortality occurred during the drought of 2006, but *Ips* population numbers declined in 2007. Population levels are expected to remain dependent on precipitation totals.

The black turpentine beetle (BTB) is another secondary bark beetle. Attacks are confined to the lower 10 feet of bole, with a majority of attacks at the base of the tree. BTB attacks often occur subsequent to attacks by other bark beetles. Infestation levels may increase following storm damage or prescribed burning, but tree mortality is rare. The last reported BTB outbreak on the NFGT occurred in the 1960s.

Non-native invasive insects have not caused observable damage on the NFGT. Several exotic species of ambrosia beetles have been trapped on the NFGT, but none of them have achieved pest status to date. Potential pests such as the emerald ash borer, Asian longhorned beetle, the woodwasp *Sirex noctilio*, gypsy moth, and the banded elm bark beetle have not been detected in easternTexas.

Tree diseases also have had little impact on tree growth and mortality on the NFGT. Fusiform rust infects scattered loblolly pines. This disease can cause galls or cankers that weaken the trunks or branches, which may lead to increased tree damage during storms. Annosus root disease is associated with well-drained, sandy soils. It is primarily initiated via thinning or other tree removal actions, as freshly-cut stumps provide a suitable infection court for the spores. The disease then moves through the roots to infect living trees. Visible symptoms have been rare and mortality levels low.

Brown-spot needle blight can cause severe growth loss or mortality of longleaf pine in the grass stage. Other pines may be infected, but only longleaf suffers significant damage due to an extended period in its unique grass stage. Impacts on the NFGT have been slight, but they could become more significant with the trend toward increased longleaf pine planting. The potential impacts of brown-spot needle blight could be diminished with improved regeneration technologies and integrated forest pest management.

Red heart is a disease affecting mature and overmature pines in the south. The fungus enters through broken braches stubs and spreads through the heartwood. Pines are not killed, but their structural integrity is compromised. Hoof-shaped fungal conks on the boles of infested trees are symptomatic of infection. Incidence of red heart should increase on the NFGT with the shift to longer pine rotations. Pines with red heart are favored by the red-cockaded woodpecker for cavity construction.

Another disease associated with aging pines is schweinitzii root and butt disease. Older trees may become infected through root damage or basal fire and mechanical wounds. Infection can spread to nearby trees with similar wounds or through root-root contact between trees. The fungus causes a red-brown, cubical rot of roots and the lower bole. Pines usually are not killed, but windthrow and breakage sometimes result.

b. Factors affecting Conditions and Trends

1. Disturbances

a. Fire. Wildfires have the potential to damage the roots and cambial layer, leaving pines temporarily more susceptible to bark beetles and disease. The prudent use of prescribed fire reduces the incidence of serious wildfires. Prescribed burning also can help increase the vigor of overstory trees by reducing competition from understory trees and shrubs. Prescribed burning is beneficial for longleaf pine in the grass stage, as it reduces the incidence and impact of brown-spot needle blight. However, too frequent prescribed burning, particularly in stands dominated by loblolly or shortleaf pines, may duplicate the effects of wildfire.

b. Severe storms. Lightning-struck pines are excellent hosts for pine bark beetles. Increases in the number of lightning-struck pines would increase the chances of survival for dispersing pine bark beetles, and facilitate the dispersion of bark beetles across the landscape. They also may serve as epicenters for expanding southern pine beetle infestations. Tornados, hurricanes, and other high wind events result in broken, windthrown, and otherwise damaged trees that are susceptible to insects and diseases. Secondary bark beetles quickly colonize the affected trees, but infestations generally do not spread to healthy residual trees.

c. Drought. Extended drought weakens pines, resulting in increased activity of *Ips* beetles and black turpentine beetles. During severe drought, *Ips* beetles may kill groups of pines rather than just individual scattered trees. Waterlogged root systems can stress

pines, leaving them susceptible to bark beetle attack. Extremely wet winters and springs have been correlated with the onset of southern pine beetle outbreaks.

d. Thinning. Thinning reduces competition, increasing tree vigor. Lowering the basal area of pine stands lowers the southern pine beetle hazard. The ground disturbance and residual tree damage associated with thinning may temporarily increase susceptibility to insects and disease, but the long-term benefits greatly outweigh any short-term effects. Thinning can promote annosus root rot, but serious infections in eastern Texas have been and should remain rare. Damaged and diseased trees can be removed during thinning, improving overall stand health.

2. Successional Processes

The current *Plan* for the NFGT mandates longer rotations for pine stands for loblolly and shortleaf pine stands. Allowing trees to become overmature increase their susceptibility to insects and disease. Older pines typically are more susceptible to southern pine beetles. Maintaining pine basal areas near 80 ft^2/ac in older stands helps offset this increased vulnerability. Older pines are primary hosts for schweinitzii disease and red heart, and an increase in the latter would be beneficial to red-cockaded woodpecker populations.

Selecting the right tree species for a site can minimize forest health concerns. Conversion of offsite loblolly pine stands to longleaf pine on should reduce the incidence of insect and disease problems. Longleaf pine generally is more resistant to health problems than shortleaf and loblolly pines when planted on suitable sites.

Most regeneration on the NFGT is natural. Natural pine regeneration has lower infestation levels of Nantucket pine tip moth than areas that were site-prepped and planted. Tip moth levels on the NFGT therefore have been very low. Natural pine regeneration may result in dense pine stands which eventually become susceptible to bark beetles. A combination of thinning and prescribed burning may be required to reduce the hazard. In areas that are planted, decreasing the number of trees planted per acre is recommended to reduce future bark beetle susceptibility.

Maintaining tree diversity within a stand also can lessen forest health problems. Increased prescribed burning in pine stands and midstory removal in red-cockaded woodpecker habitat serve to create pine monocultures. Keeping the basal area low and minimizing disturbances can help mitigate the impacts of insects and diseases in these stands.

b. Projected Future Actions

The NFGT will continue to conduct spring trapping for the southern pine beetle. NFGT also maintains communication and cooperation with other agencies including APHIS and the Texas Forest Service that monitor for potential pests such as the gypsy moth, sudden oak death, and *Sirex noctilio*. Incipient pest populations will be addressed swiftly to

prevent spread and diminish impacts. The NFGT will participate in the early detection, rapid response trapping program for non-native invasive beetles when funding is available.

The SPB hazard rating map created by the Forest Health Technology Enterprise Team will be used to plan hazard reduction activities, primarily thinning. Priority areas include high hazard stands near wilderness, adjacent to pine forest on private land, and in red-cockaded woodpecker management areas. The SPB strategic plan for the NFGT will be used to plan for the next SPB outbreak and effectively manage detection and suppression activities.

The NFGT will pursue alternate markets for the material cut during SPB prevention and suppression actions. Finding viable markets for all diameters of woody material should accelerate the pace of SPB hazard reduction.

Conversion of suitable sites to longleaf pine will continue whenever conditions, funding, and personnel allow.

7. Wildfire Protection

a. Existing Conditions and Trends

Extreme burning conditions are not a common occurrence on the NFGT. The most important reasons for this are that the condition of forest fuels in well maintained, short rotation, fire dependent ecosystems (Figure 6); low hazardous fuels buildup levels associated with these conditions; and typically frequent rainfall.

From 1998 through 2007, the NFGT averaged about 57 wildfires per year, 87% of which are human-caused. These fires burn an average of 664 acres on national grassland and national forest lands and 196 private acres annually.

A wide variety of techniques and practices are currently used to minimize resource loss and suppression costs from wildland fires. The appropriate management response to wildfire will be used. Appropriate management response for these fires can range from initial attack to a combination of strategies to confine the fire. The primary criteria for choosing the appropriate management response and the supporting fire suppression strategies are to maximize safety, while minimizing suppression costs, resource loss, and environmental damage. Suppression strategies and tactics are not selected to achieve resource benefits, suppression dollars are not used with the objective of achieving resource benefits.

According to the *Plan,* MA-7-43 and MA-7-47, Wildland Fire Use (WFU) may be conducted in designated wilderness areas (Management Area 7) following the completion of Limits of Acceptable Change process and preparation of Wilderness Fire Management Plans. For the time being, the Wilderness FMU will not permit Wildland Fire Use. Wildland Fire Use is not addressed for any other Management Area under the *Plan.*

The NFGT maintains no aerial detection resources and does not pay the Texas Forest Service (TFS) to conduct wildfire detection flights under the cooperative agreement between the two agencies. The TFS employs a system of aerial and fixed detection

resources, and has historically notified the NFGT of fires located on federal lands. While increased use of the national grasslands and national forests raises the risk of human-caused fires, it also contributes to early detection. The increasing presence of rural fire departments also contributes to overall early detection and suppression of small fires.

The fire organization is equipped with modern mechanized fire fighting equipment, including dozer units, used for plowing bare-earth firelines around wildfires, and Type 5 and Type 6 engines. Helicopters and large air tankers are sometimes used. Dozer units are by far the most common suppression tool. An exception is in designated wilderness, where preferred methods of suppression emphasize minimum-impact-suppression techniques using hand tools such as rakes, flaps, axes, shovels, backpack pumps, and aerial or ground delivery of water and retardants.

A Cooperative Agreement and an Annual Operating Plan is maintained with the State of Texas, Texas Forest Service (TFS). This agreement specifies initial attack responsibilities for all lands within and directly adjacent to the forest. It also provides for cooperation between agencies. The Agreement includes the operations of the Texas Interagency Coordination Center (TICC) which is a joint effort between the State of Texas, US Forest Service, and the Department of the Interior. TICC is responsible for coordinating the mobilization fire resources for state or national response.

b. Factors Influencing Conditions and Trends

1. Disturbances

Wildfire is among the oldest of natural phenomena. Today, the overwhelming majority of all wildfires in the south result from humans and the majority of those human-caused fires are arson-related. Most fires on the NFGT are of moderate intensity and are suppressed at a small size. This is a result of frequent and widespread prescribed burning that keeps forest fuels at moderate levels (Figure 6), and a fire suppression organization with mechanized fire suppression equipment.

2. Successional Processes

Normally, as the average age of the national forests becomes older, surface wildfires are expected to result in less damage to stands. However, if fuels are allowed to accumulate, then larger, catastrophic fires will occur which can reset the ecosystem to an early succession stage.

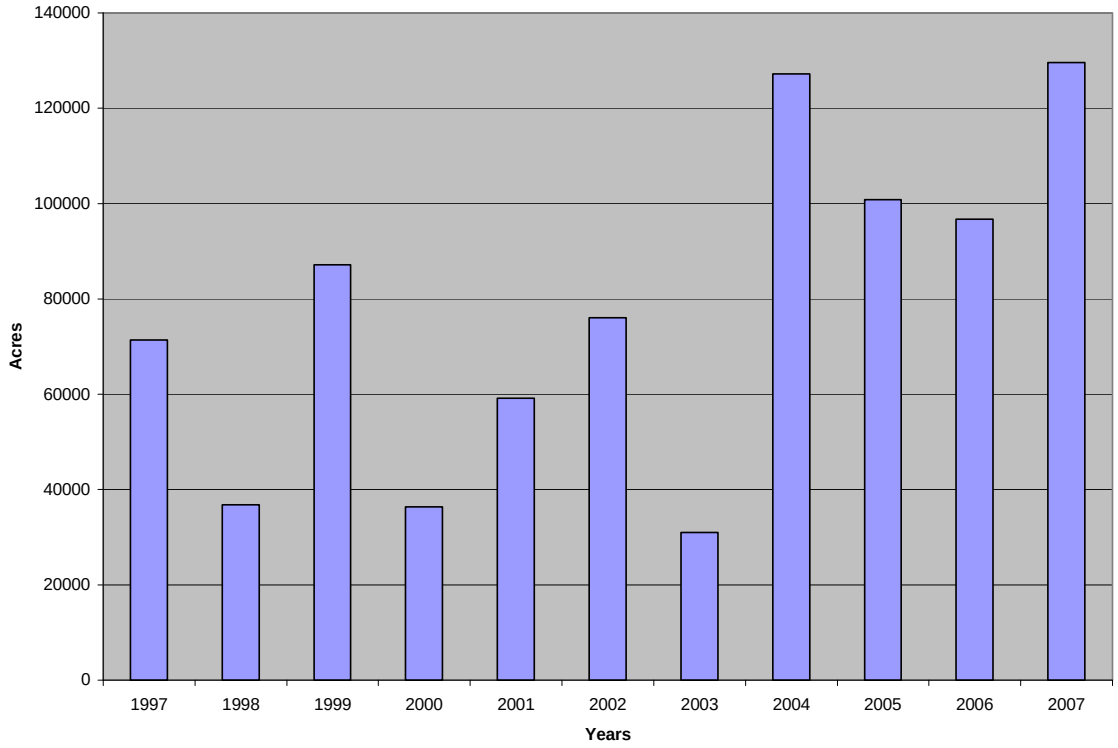
c. Projected Future Actions

All units on the NFGT have a large amount of wildland-urban interface (WUI) lands, in which wildland fuels are mixed with residences and subdivisions. Wildland fuels can pose a hazard when combined with residences. Treating these hazardous fuels on federal lands is a priority to the NFGT. Treatments can take the form of prescribed fire or mechanically treating fuels on federal lands to reduce the fuel loads prior to a period of fire danger. Since Hurricane Rita in 2005, the Angelina and Sabine Ranger Districts have been installing mechanically prepared fire breaks along landlines in order to provide

access into wildfires as well as provide a location to stop these fires. The NFGT takes WUI into consideration when planning fuel reduction needs.

Efforts are underway, in cooperation with the State of Texas, to write Community Wildfire Protection Plans for the counties with federal lands. These plans will document issues such areas in need of hazardous fuels reduction projects, evacuation plans, and fire contacts at all organization levels.

Figure 6. Prescribed Fire Acres



8. Air Quality

a. Existing Conditions and Trends

The NFGT is located in thirteen, predominantly rural, counties in eastern and northern Texas where the air quality is generally good. Smoke from wildfires and prescribed burning can adversely affect air quality, predominantly by the production of particulate matter and ozone. Smoke from NFGT prescribed fires is considered by State air regulatory agencies to be an intermittent contributor to a minor amount of air pollution.

Only one county contains NFGT lands where air quality is an issue. Montgomery County is part of the Houston metropolitan area, which is a non-attainment area for ozone. Smoke from NFGT prescribed fires is a minor contributor to ozone air pollution problems, both in terms of ozone precursor pollution (nitrogen oxides and volatile organic compounds) and small amounts of direct ozone generation.

All areas of the NFGT are in attainment of the National Ambient Air Quality Standards (NAAQS) for particulate matter (PM 2.5). Of the thirteen counties in Texas that encompass NFGT lands, there is only one monitoring station, which is located in Montgomery County. There are no monitoring stations located on NFGT lands.

The NFGT mitigates the effects of prescribed fires by following regional and forest standards and guidelines. Burn plans are prepared for all proposed prescribed fire burn units, identifying smoke sensitive areas and targets with existing visibility or air quality problems. In addition, site-specific concerns and smoke management criteria for individual burn units are identified in the individual burn plans.

b. Factors Influencing Conditions and Trends

1. Disturbances

Prescribed burning and wildfires have the highest potential for adversely affecting air quality on the forest. In order to mitigate these effects, daily fire weather forecasts include smoke management parameters for transport wind speed, mixing height, and dispersal. Burns are not ignited unless a forecast is obtained and all smoke management prescription parameters are met. A smoke-screening map is required to be attached to the burn plans identifying forecasted wind direction and the projected smoke plume. Smoke dispersal is monitored throughout the burn period of each fire. Smoke plume direction and spread is monitored via helicopter. Post-burn evaluation is performed and includes a requirement to note any smoke management violations.

c. Projected Future Actions

In order to restore and maintain more fire-dependent communities like longleaf pine, shortleaf pine, and grasslands the forest will utilize prescribed fire more frequently. This will have the potential to increase particulate emissions during the burning seasons.