National Forests and Grasslands in Texas

2002-2003 Monitoring Report and Strategy for Management Indicators

Introduction

National Forests use Management Indicators (MI) and Management Indicator Species (MIS) as a tool for identifying specialized habitats, formulating habitat objectives and establishing standards and guidelines to provide for a diversity of wildlife, fish, and plant habitats. Additionally, MI provide information concerning the effects to biological resources across the range of alternatives proposed during Forest project planning. Management Indicator Species are used to address issues related to biological diversity, as well as management of wildlife and fish for commercial, recreational, or aesthetic values or uses [Forest Service Manual (FSM) 2621.1]. This document summarizes population and habitat trends to date for MIS identified in the 1996 National Forests and Grasslands of Texas (NFGT) Land and Resource Management Plan (*the Plan*) as required in the Planning Regulations [36 Code of Federal Regulations (CFR) 219.19]. Habitat and population trends are evaluated in relation to Forest Plan requirements, plan implementation and risks to the species, and the probability that the species will persist across the planning area. Where data is inconclusive or suggest species or habitats are declining to a point that their existence across the planning area is at risk, recommendations are made for specific monitoring tasks to be accomplished or management actions amended. This analysis offers a broad evaluation of biodiversity at the landscape level, which can be used to strengthen project development and effects evaluation.

Documentation of Management Indicator Selection

When Forest Service regulations were developed to implement the National Forest Management Act (NFMA), the concept of MI was incorporated into the direction. The MIS approach is designed to function as a means to provide some insight into effects of management direction on plant and animal communities. The concept of MI is to identify a few species that represent many other species and provide a basis to evaluate management by the effects on the species and their habitats. Indicator species were selected from the pool of vertebrate and nonvertebrate species known to occur on the NFGT. The selection of the MIS was based on the following criteria specified in the 1982 Planning Regulations.

> **(S219.19) Fish and Wildlife Resources**. **(a)(1) In the selection of management indicator species, the following categories shall be represented where appropriate; Endangered and threatened plant and animal species identified on the State and Federal lists for the planning area: species with special habitat needs that may be influenced significantly by planned management programs; species commonly hunted, fished, or trapped; non-game species of special**

interest; additional plant and animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality.

The Plan's Environmental Impact Statement (EIS) listed 17 wildlife species, 9 habitat communities, 7 fish species, 2 guilds and a habitat constituent as MI to represent the habitat needs for the fauna and flora present on the NFGT (see *the Plan* EIS, page 103). Table V-2 in *the Plan* lists the Forest and Grassland MI along with their status at the time of Plan development.

To ensure all major habitats and associated species present on national forest (NF) lands were considered in this process, a thorough review and selection methodology was directed. Species, as well as assemblages, were considered as potential MI. In order to fully validate the MI review and selection process, an additional review of available habitats and conditions was developed. This development of habitat criteria utilized and paralleled the developing U.S. Forest Service (USFS) Ecological Classification System (ECS) (see *the Plan*, Appendix A) and Plant Community Characterization (*the Plan* EIS, Appendix H).

From the ECS and plant community information, it was determined that the NFGT supported broadly defined plant communities or vegetation-based systems such as: (1) Longleaf Pine Woodlands and Savannahs, (2) Longleaf Pine Barrens, (3) Herbaceous Wetlands, (4) Bay Shrub Wetlands, (5) Dry Xeric Oak-Pine Forests, (6) Mesic Oak-Pine Forests, (7) Mesic Hardwood Forests, (8) Tallgrass Prairie, and (9) Bottomland Streamsides. In addition, four broad seral stages of wildlife habitat or working groups were identified: (1) 0-20 years, (2) 20-50 years, (3) 50-90 years, and (4) 90+ years. Finally, two broad aquatic habitats were identified: (1) Ponds and Reservoirs, and (2) Rivers and Streams. The implementing regulations for the NFMA direct the management of wildlife habitats to "maintain viable populations of existing native and desired non-native vertebrate species in the planning area." The NFMA further requires each forest to identify MIS through the planning process and to establish objectives to maintain and improve the habitats of these indicator species.

Step 1

The first step in the MI selection process was to develop a long list of plant and animal species and their habitat associations that occur on the NFGT. This step ensured no species, group, assemblage, or guild was left out of the decision process. The list development included review of all vertebrate, invertebrate, and vascular species (both terrestrial and aquatic) that could potentially occur on the NFGT. This review included published literature, contacts with many natural resource professionals, and USFS records.

The long list was further scrutinized to determine viability concerns for species occurring or potentially occurring on NFGT. From the long list, 139 species and

nine plant communities were identified as a viability concern. This viability concern indicates that the range or population status of these species or communities could be at risk. The other species and communities, as reviewed, were not considered dependent on NFGT lands for population viability and were therefore eliminated from further consideration.

Step 2

The long list and the list of 139 species and nine communities were compared to the original list of animal species that was developed for the NFGT 1987 Plan. Since the 1987 Plan MIS process did not identify plant species, this area of the review process received added scrutiny. The long list of species was then reduced by the USFS group to a listing of species that were: (a) directly known to occur on the NFGT, (b) species which appeared to be a viability concern, (c) species that could potentially occur on the NFGT, and (d) those that would be affected directly or indirectly by management actions of the NFGT.

These lists were submitted to biologists, botanists, ecologists, and other scientists to identify any errors, omissions, or recommendations. Several working group meetings were held to review and discuss these species and plant community lists. One recommendation that was virtually unanimous, directed the cross-referencing of species that were habitat or community specific. A decision was made to use the USFS Plant Community Characterization concept to standardize terminology (*the Plan* EIS, Appendix H) and utilize the developing ECS (*the Plan*, Appendix A) descriptions to identify range/habitat relationships.

The fauna and flora that occur within communities of the NFGT can be classified into two general groups: (1) habitat generalist, and (2) habitat specialist. The habitat specialists, because of their specific habitat requirements, are good indicators of effects of management activities. A species list of native habitat specialists was generated with the rationale that habitat specialists are most likely to be affected by management activities occurring on the NFGT.

Step 3

In addition to the nine MIS species identified in the 1987 Plan, a new list was generated to supplement these species. The list is composed of several federally listed species, regional sensitive species, and Neotropical birds. These species became the feedback mechanism to indicate the degree to which fauna and flora goals are being met and whether or not adjustment of *the Plan* is needed.

Altogether 57 species, communities, or habitat conditions have been selected as MI to represent the habitat needs for the fauna and flora present on the NFGT. The MI is considered representative of other species with similar habitat requirements for life and reproduction. By managing for viable populations of MI

and their associated habitat, viability risks for other species found in the same habitat are reduced.

The following species by habitat groups were selected as MIS for the NFGT. The selection of these species used the following criteria:

1. Species included in the Federal, State or Regional list. A neo-tropical bird (identified as easily monitored and an ecological indicator).

2. Species with special habitat needs that may be influenced significantly by planned management programs.

3. Species whose population changes are believed to indicate effects of management activities on other species of a major biological community or on water quality.

4. Represent a particular component of an ecosystem or special habitat in short supply.

5. Are sensitive to changes in their habitat.

6. React to change in a manner that is easily detectable and measurable.

The list contains species and groups of species that can indicate either habitat or ecological conditions or both. In some cases, the difference is the level or scale of measurement. The affected environments selected represent those components of the environments that are critical to an ecosystem, those in short supply, or those that are highly susceptible to change when management is applied. Six species are listed because of public demands for huntable wildlife. These species supply the measurement for commodity wildlife that is to be maintained.

Step 4

Between the Draft EIS (DEIS) and the final Plan, coordination between NFGT personnel, USFS research personnel, Texas Parks and Wildlife Department (TPWD) biologists and U.S. Fish and Wildlife Service (USFWS) biologists identified refinement in the MIS and Communities List that was proposed in the DEIS. Additional comments from the public were also discussed and incorporated into the MIS Review and List during this process. Some of the comments received and discussion points included:

The number of MIS and monitoring effort is too ambitious.

Use of species specific MI's appears to go against Ecosystem Management (EM).

MIS should emphasize habitat monitoring NOT species.

Why use species that conflict with management emphasis such as dwarf salamander in frequently burned longleaf pine?

Develop clearer direction for snag development by seral stage and forest type; existing direction is arbitrary.

These issues were all incorporated into the final MIS List utilized by the NFGT. As monitoring of the species, habitats and procedures develop during Plan implementation, revisions of the MIS List may be needed. Any MIS revision will be fully documented in the Annual Monitoring and Evaluation (M&E) Process and Plan Amendments will be proposed as needed.

The following section describes the current status and trend information, if available, for each of the MI, followed by habitat community MI, animal and fish MI, and guild and habitat constituent MI.

Forestwide Management Indicator Species Habitat Monitoring and Evaluation

Population and habitat data are used to monitor MIS on the NFGT. Since habitat condition is a key factor affecting population levels of MIS, assessment of trends in key habitat parameters is important in estimating population trends.

Management Indicator Species are chosen and grouped to represent key habitats or key stages of habitats. This facilitates habitat monitoring, effects analysis, development of management strategies, and monitoring of Forest Standards and Guidelines. Seral stages of habitat including early successional (forest age class 0 – 20), mid succession (forest age 21 –50), late succession (forest age class 51 – 90), and old growth (forest age class 91+) are recognized in *the Plan* as key stages of habitat to be monitored. The following are MIS grouped by associated habitat group.

Table 1.

Preferred Habitat Group	Management Indicator Species
Forest/Grassland Early Succession 0 – 20 years	Eastern Wild Turkey Whitetail Deer Yellow Breasted Chat Snags
Forest/Grassland Mid Succession 21 –50 years	Eastern Wild Turkey Whitetail Deer Yellow Breasted Chat Pileated Woodpecker Gray/Fox Squirrel Snags
Forest/Grassland Late Succession 51 –90 years	Eastern Wild Turkey Whitetail Deer Yellow Breasted Chat Pileated Woodpecker Gray/Fox Squirrel Snags
Forest/Grassland Old Growth 91+ years	Eastern Wild Turkey Whitetail Deer Pileated Woodpecker Gray/Fox Squirrel Snags
Aquatic – Ponds and Reservoirs	Largemouth Bass Redeared Sunfish Bluegill Sunfish Channel Catfish
Aquatic - Rivers and Streams	Paddlefish Sabine shiner Dusky Darter Scaly Sand Darter Stonefly Guild
Longleaf Pine Woodlands and Savannahs	Red-cockaded Woodpecker Slender Gay Feather Incised Groove Burr Scarlet Catchfly Longleaf – Bluestem series

Table 1. (continued)

Preferred Habitat Group	Management Indicator Species
Longleaf Pine Barrens	Navasota Ladies'-Tresses Little Bluestem–Rayless Goldenrod Series
Herbaceous Wetlands	Yellow Fringeless Orchid Spagnum–Beakrush Series
Bay–Shrub Wetlands	Nodding Nixie Texas Bartonia Sweetbay–Magnolia Series
Dry–Xeric–Oak Pine Forests	Red-cockaded Woodpecker Louisiana Squarehead Shorleaf-Oak Forest
Mesic Oak-Pine Forest	Red-cockaded Woodpecker Loblolly-Oak Forest
Mesic Hardwood Forests	Southern Ladyslipper Beech-White Oak Series
Tallgrass Prairie	Northern Bobwhite Quail Little Bluestem-Indiangrass
Bottomlands Streamsides	Neotropical Migrants- (Yellow-throated Vireo, Wood Thrush, Acadian Flycatcher, and others) Neches River Rose Mallow Bottomland Hardwood

The primary inventory tool for habitat conditions is the Continuous Inventory of Stand Conditions (CISC) data, compiled through periodic inventories of the NFGT. Unfortunately, such inventories are not available for the Grasslands. Other inventory data across the NFGT vary greatly. For example, selected botanical surveys and investigations have been conducted, some were targeted surveys of specific habitats searching for specific rare species, others have been projects such as an August 1995 contract with Sam Houston State University to conduct botanical field surveys on 5,851 acres of the Davy Crockett and Sabine NFs. Survey work on this contract was completed by April 1996 and resulted in five sensitive plant species being located on the Sabine NF. Additional botanical surveys were conducted in 1994, 1995, and 1996 through several Challenge Cost-Share (CCS) Agreements. Over 14,000 acres were surveyed on the Angelina and Sabine NFs, and numerous sensitive species locations were documented. Extensive botanical surveys were conducted on the north Sabine and Angelina NFs after the 1998 blowdown event.

In 1996, a CCS Agreement was made with the Stephen F. Austin State University (SFASU) College of Forestry to map and evaluate all vegetative communities within the Upland Island and Turkey Hill Wildernesses on the

Angelina NF, and to provide Geographic Information System (GIS) maps of the wildernesses.

A CCS project with The Nature Conservancy was initiated in 1997 to determine the status and extent of forest communities in which American Beech is present in the overstory. The ECS landscape model and the GIS and CISC databases were utilized to select 38 sites on the northern Sabine NF for field survey. Community maps and element occurrence data forms for each site will be utilized to incorporate the results of this study into the GIS and CISC databases for the Sabine NF.

Baseline data for monitoring and evaluation of MI plant species and vegetation groups (plant communities) were prepared during the spring of 1999. Future management activities will be compared to these baselines and the outcomes of the activity will be compared to the Desired Future Conditions (DFC) described in *the Plan.* The following section provides recent survey and current status information for the plant and habitat community MI.

Forest Management Indicator Species Population Trend Monitoring and Evaluation By Preferred Habitat Group

The NFGT support a wide diversity of plant and animal species and their habitats. It is comprised of 637,475 acres in four forests and 38,100 acres in two grasslands. The majority of the national forests are either loblolly pine, shortleaf pine stands, with considerably lower acreages in longleaf pine and bottomland hardwoods. The majority of the grasslands are occupied by herbaceous vegetation with a significant amount of oak forests. A much lower amount of acreage is in true tallgrass prairie.

Table 2.
Forest Age Class Distribution

Seral Stage	Age Class	1992	2002	2003	Trend
Early Succession	0-20 years	22%	14%	14%	**-8%**
Mid Succession	21-50 years	11%	15%	15%	**+4%**
Late Succession	51-90 years	61%	55%	54%	**-7%**
Old Growth	91+ years	6%	16%	17%	**+11%**

The Plan set short-term and long-term objectives for a decrease of early and late succession habitats, and an increase in mid-succession and old-growth habitats. The actual trends in age-class distribution recorded in CISC across the forests depict a shift in seral stage towards those objectives.

Table 3.
Forest Type Group Trends

Forest Type Group	1992	2002	2003	Trend
Longleaf Pine Woodlands	5.6%	5.7%	5.7%	**+.1%**
Dry-Xeric Oak Pine Forests	25.8%	25.1%	25.1%	**-.7%**
Mesic Oak-Pine Forests	58.6%	58.3%	58.3%	**-.3%**
Mesic Hardwood Forests	2.9%	3.9%	3.9%	**+1.0%**
Bay-Shrub Wetlands	.4%	.4%	.4%	**No Change**
Bottomland/Streamside Forest	6.7%	6.6%	6.6%	**-.1%**

A slight shift from oak-pine forests to hardwood forests is evident between 1992 and 2003. This could be evidence of the lack of prescribed burning in these forest stands over the ten-year period, but more likely better information in CISC.

Seral Succession Species

Eastern Wild Turkey *(Meleagris gallopavo)*: The eastern wild turkey historically occupied 30 million acres in eastern Texas, but as a result of unregulated hunting and the loss of habitat, were virtually eliminated by 1900. Restocking efforts of Rio Grande, Florida, and pen-raised turkeys from 1924-1978 were unsuccessful. In 1979, restocking of eastern wild turkeys was begun. Most restocking efforts have been done since 1987. Due to these efforts, turkey populations in the Angelina, Sabine, Davy Crockett, and Sam Houston NFs have risen to such sufficient levels that TPWD now allows hunting of this species. This species was selected in *the Plan* as a MI because of its importance as a game species. For consistency purposes, it was listed as a MI for four forest or grassland seral stage habitats: early, mid, late succession, and old growth. Acres of habitat in 1996 were estimated to total 395,000 acres across all seral stages combined, and *the Plan's* short-term objective is to have 372,000 acres. *The Plan* projected that habitat acreage reductions (lower proportion of age classes) would occur in the early and late succession stages, and increases would occur in the mid succession and old- growth stages. The current trend (table 2) indicates a combined increase of fourteen to fifteen percent (14-15%) in mid succession and old growth forest age classes.

The following sources of data and information were used in this analysis:

1. Texas Parks and Wildlife Department. Small Game Research and Surveys. Restore the Eastern Wild Turkey to East Texas. April 9, 2001.

2. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2003).
3. Texas Parks and Wildlife Department. Annual Wild Turkey Population Numbers in East Texas. John Burke. August 1, 2003.
4. USDA Forest Service. Prescribed Fire History on the National Forests of Texas (1992-2003).

Chart 1.

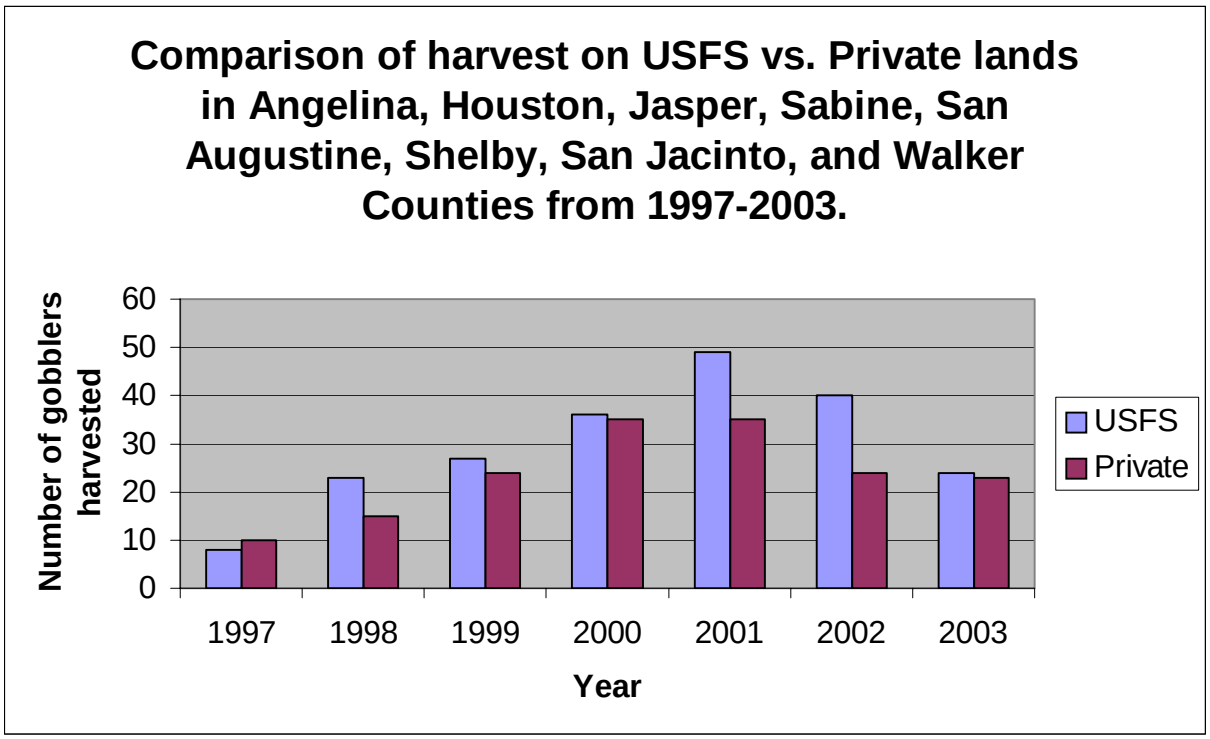


Chart 2.
Number Of Eastern Wild Turkeys Counted During Annual Brood Surveys By Texas Parks And Wildlife Department In Counties Where National Forest Lands Are Located.

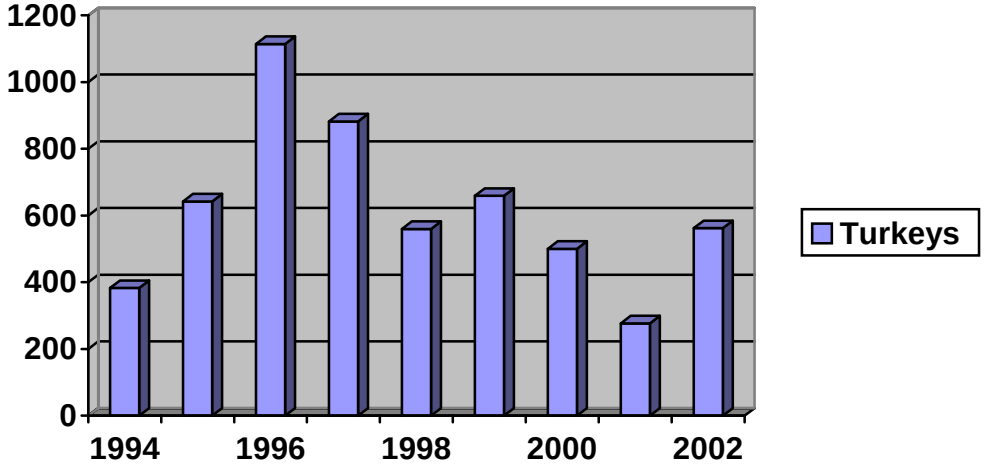
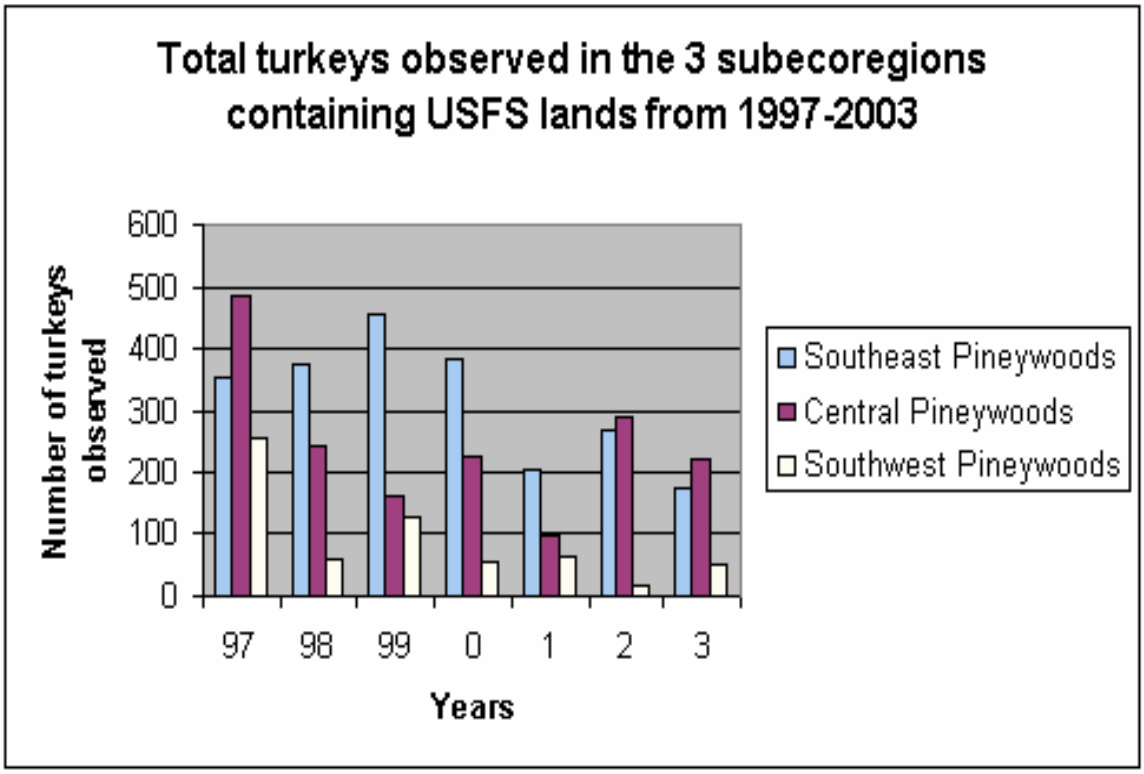


Chart 3.



Effects of Management

The weather during nesting and brooding rearing seasons each year is a major influence on eastern wild turkey populations. Management of forest openings, availability of quality nesting and brood-rearing habitat, and adequate winter foods seem to benefit wild turkey populations. Management of forest openings in early successional habitat provides bugging areas for young broods of turkey. Proper frequency and intensity of prescribed fire in upland pine stands maintain good nesting and brood rearing habitat. Wildlife openings planted to desirable native and non-native species, and mature hardwoods provide needed supplies of winter foods. Although the frequency of prescribed fire is variable and ranges from very effective to only marginally effective, preferred habitats on the National Forests of Texas (NFT) are being maintained. Fire frequency (as impacted by management and litigation) has not been successfully distributed throughout all areas of the Forests. Since 1998, both total numbers (chart 3) and turkey brood surveys (chart 2) have been consistently lower each year, which is speculated to be due to the reduced prescribed fire in areas considered to be the best Eastern Wild Turkey habitat.

Need for Change

The Plan refers to number of suitable acres for eastern wild turkey in all seral stages. How the suitable acres are defined is quite subjective. Tracking of acres of total habitat available and fire frequency in seral stages would give more definitive numbers for trend comparison. Population numbers of turkey should continue to be tracked through general observations, especially through brood surveys conducted during the summer months.

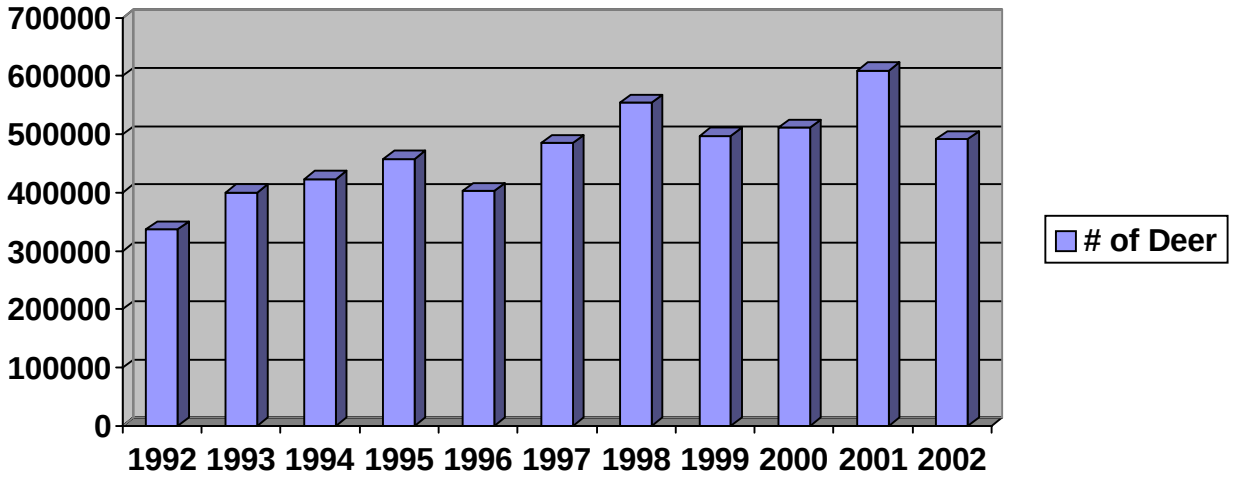
Whitetail Deer *(Odocoileus virginianus)*: This species was also selected in *the Plan* as a MI for four forest or grassland seral stage habitats: early, mid, late succession, and old growth. Acres of habitat in 1996 were estimated to total 315,000 acres across all seral stages combined, and *the Plan's* short-term objective is to have 300,000 acres. *The Plan* projected that the proportions of habitat (available age classes) would occur with fewer available acres in the early and late succession stages; more acreage would occur in the mid-succession and old-growth stages. The current trend over the last ten years shows a combined shift of fourteen percent from the early and mid-succession stages to age-classes considered mid- succession and old-growth habitat.

The following sources of data and information were used in this analysis:

1. Texas Parks and Wildlife Department. Big Game Research and Surveys. White-tailed Deer Population Trends. May 21, 2001, December 12, 2003.
2. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2001).

Chart three (containing all National Forests) depicts the estimated white-tailed deer population size in the Pineywoods Ecological Region. Data used in this chart are extrapolated from annual deer spotlight counts on approximately 83 transects, 1,211 total miles of transect, and over 35,000 acres sampled. The deer population trends for the Ecological Regions surrounding the Grassland Units are described in charts six and seven; data are similarly developed from spotlight count transects conducted within those counties. All three Ecological Regions describe deer herds that are trending upward in population.

Chart 5.
Trends In Estimated White-tailed Deer Populations For The Pineywoods Ecological Region.



Effects of Management

White-tailed deer respond to adequate supplies of browse and escape cover throughout the majority of the year and the availability of hard mast in the fall and winter. Timber harvest techniques, which encourage the release of hard mast producers and maintenance of early succession habitats (escape cover and browse), will ensure quality deer habitat is provided. Population management (in these growing deer herd) through hunting is a vital tool in the regulation of deer herds on the NFGT. Providing opportunity for hunting will aid in preventing habitat destruction by deer herds that may be reaching the carrying capacity of the lands. Quality white-tailed deer habitat is dispersed across the NFGT and as a result they should persist in the foreseeable future.

Chart 6.
Trends In Estimated White-tailed Deer Populations For The Post Oak Savannah Ecological Region
(Caddo National Grassland Included In This Region).

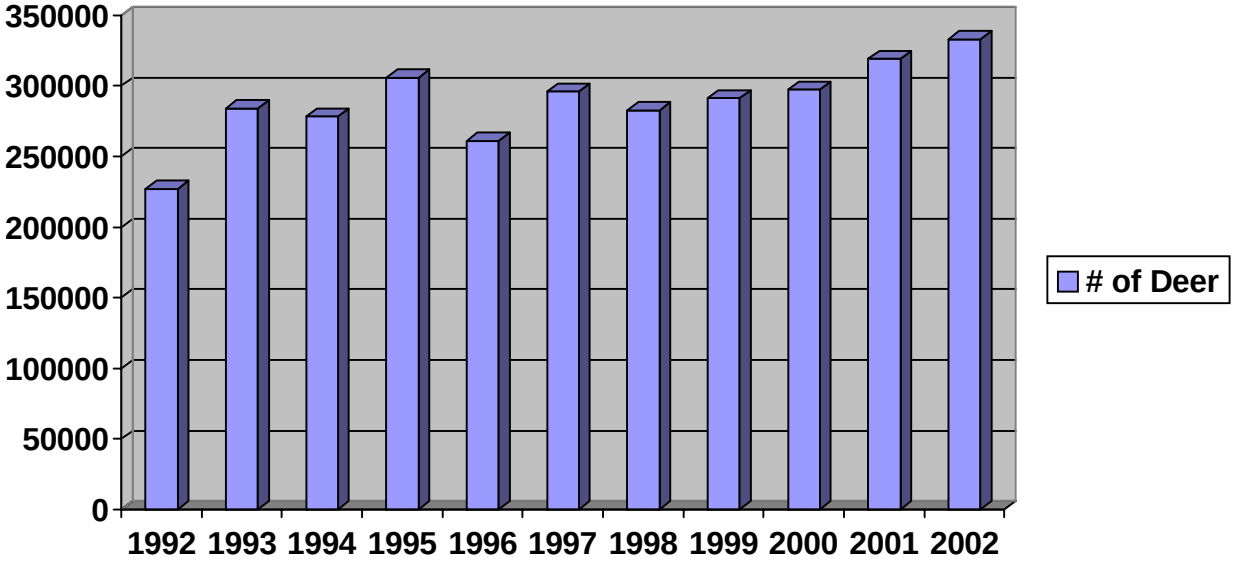
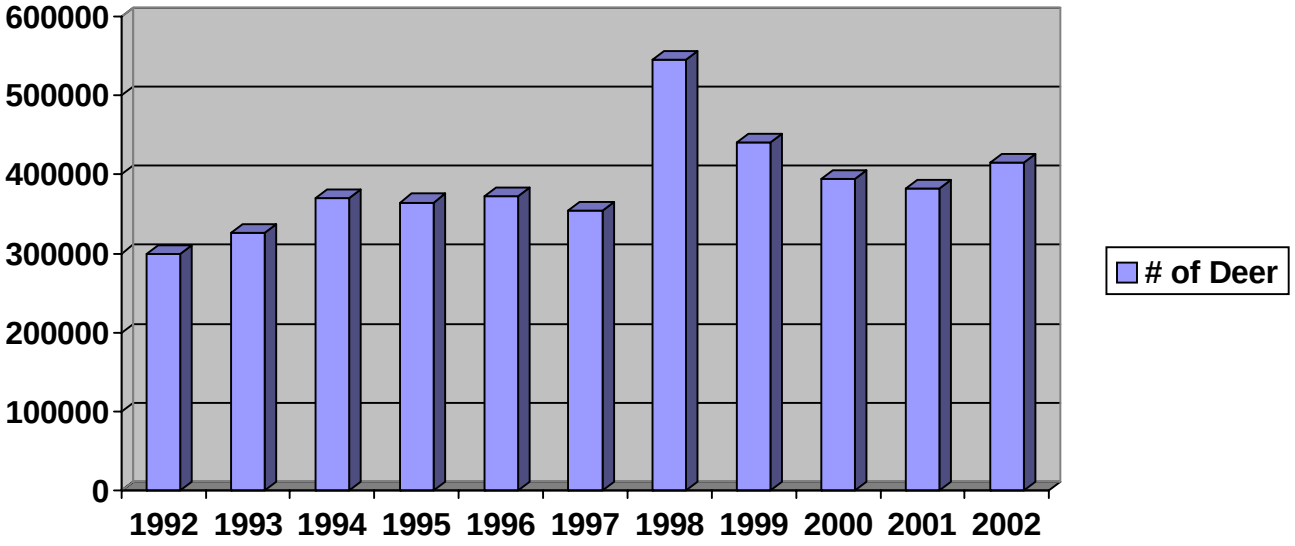


Chart 7.
Trends In Estimated White-tailed Deer Populations For The Cross Timbers and Prairies Ecological Region
(LBJ National Grassland Included In This Region).



Need For Change

White-tailed deer is a generalist not specifically reflective of any seral stage or plant community; thus, the amount of different seral stage habitats on the national forests tell almost nothing relevant to deer populations just as deer populations cannot be used to monitor trends in seral stages on the NFGT. More importantly, use of these broad indicators fails to provide information into the effects of management techniques. ***Due to the likelihood that white-tailed deer are going to persist on NFGT and that their population trends give little insight into management effectiveness, it is recommended we drop them as an indicator species in the next forest plan revision***.

Yellow Breasted Chat *(Icteria virens)*: The yellow-breasted chat (YBCH) is a Neotropical bird of overgrown field, hedgerows, thickets and woodland margins, generally in dry conditions. This species was selected in *the Plan* as a MI for three forest or grassland seral stage habitats: early, mid and late succession. Acres of habitat in 1996 were estimated to total 174,000 acres, and *the Plan's* short-term objective is to have 140,000 acres. *The Plan* projected that habitat acreage reductions would occur in the early and late succession stages, and increases would occur in the mid succession stages.

The following sources of data and information were used in this analysis:

1. Hamel, P.B. 1992. Land Manager's Guide to the Birds of the South. The Nature Conservancy, Southeastern Region, Chapel Hill, NC. 437 p.
2. Meyers, Joseph M., and A. Sydney Johnson. Bird Communities Associated with Succession and Management of Loblolly-Shortleaf Pine Forests. Proceedings of the Workshop on Management of Southern Forests for Nongame Birds. 1978. pp. 50-65
3. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2001).
4. USDA Forest Service. National Forests of Texas. Forest records and annual bird point data (1996-2003).

Effects of Management

Yellow-breasted chats respond to disturbance regimes 3-10 years following an event (hurricanes, wildfire, tornado, or regeneration harvest) and prefer a well-developed shrub layer either in old fields or forested conditions. As early successional habitat declines on the forest, populations of yellow-breasted chats will decline.

Chart 9.
Yellow Breasted Chats Found In 0-20 Year Old Forest Stands.

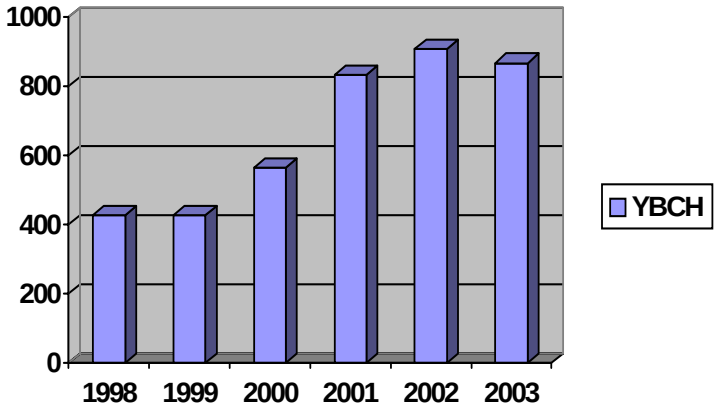


Chart 10.
Yellow Breasted Chats Found In 20-50 Year Old Forest Stands.

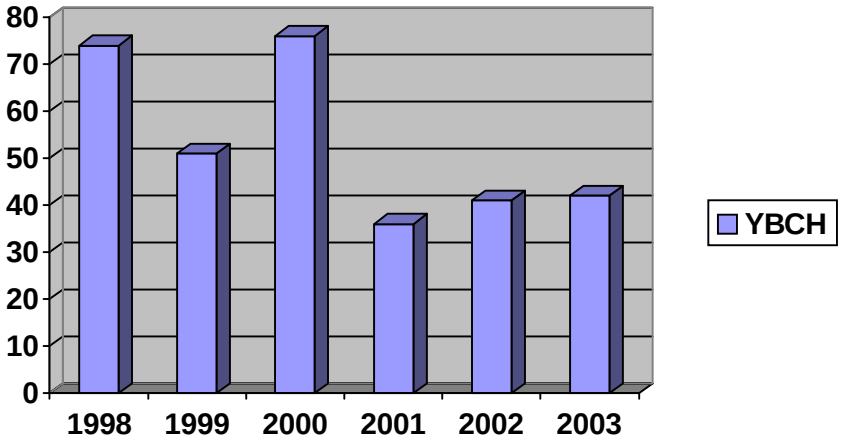
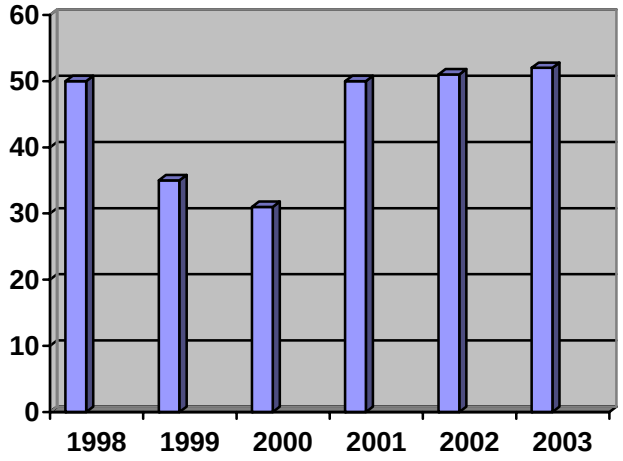


Chart 11
Yellow Breasted Chats Found in 50-90 Year Old Forest Stands



Need for Change

Yellow-breasted chats are birds of disturbance regimes. This lends them to be good indicators of early succession. Their numbers tend to decrease rapidly in forest stands. It is recommended to continue to track population trends of YBCH through annual point count data. This data should only be used as an indicator for early succession (< 10 years) only.

Pileated Woodpecker *(Dryocopus pileatus)*: The pileated woodpecker was identified as a MI for the NFGT because of its specific habitat requirements needing large snags. This species was also selected in *the Plan* as an indicator for three forest or grassland seral stage habitats: mid and late succession and old growth. Acres of habitat in 1996 were estimated to total 280,000 acres, and *the Plan's* short-term objective is to have 372,000 acres. *The Plan* projected that habitat acreage reductions would occur in the late succession stage, and increases would occur in the mid-succession and old- growth stages. Pileated woodpecker populations have been monitored through bird point counts on the NFT since 1996.

The following sources of data and information were used in this analysis:

1. Hamel, P.B. 1992. Land Manager's Guide to the Birds of the South. The Nature Conservancy, Southeastern Region, Chapel Hill, NC. 437 p.
2. Conner, Richard N. Snag Management for Cavity Nesting Birds. Proceedings of the Workshop on Management of Southern Forests for Nongame Birds. 1978. pp. 120-128
3. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2001).
4. USDA Forest Service. National Forests of Texas. Forest records and annual bird point data (1996-2003).

Pileated are birds of the forest, preferring large diameter trees and needing up to 200 acres of foraging habitat per nesting pair. Pileated woodpeckers have demonstrated the ability to adapt to human habitation and are common in managed forests, as well as rural, suburban, and urban park-like settings.

Effects of Management

Pileated woodpeckers prefer mature deciduous forests but will utilize virtually any available forests habitats for foraging. Pileated woodpeckers will persist on the NFT due to net increases of suitable habitat and the availability of a variety of habitats across the national forests.

Chart 12.
Pileated Woodpecker Occurrences In 0-20 Year Old Stands.

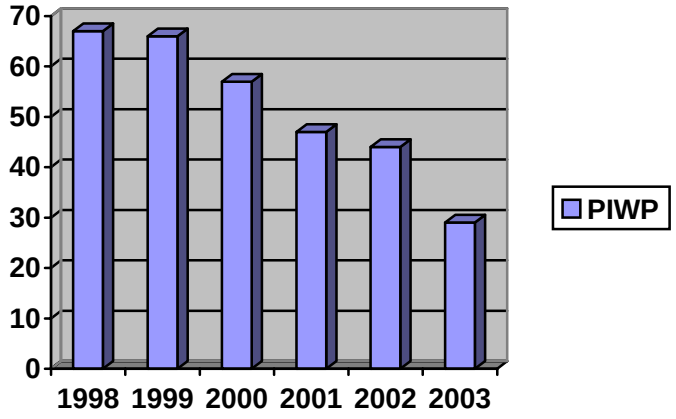


Chart 13.
Pileated Woodpecker Observations In 20-50 Year Old Stands.

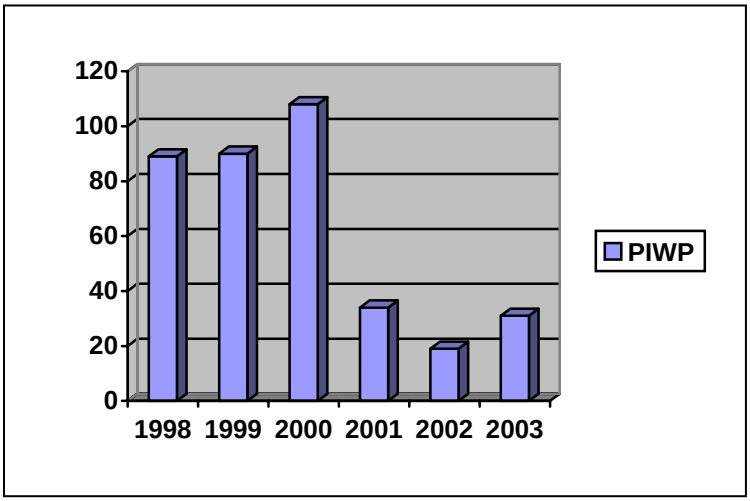
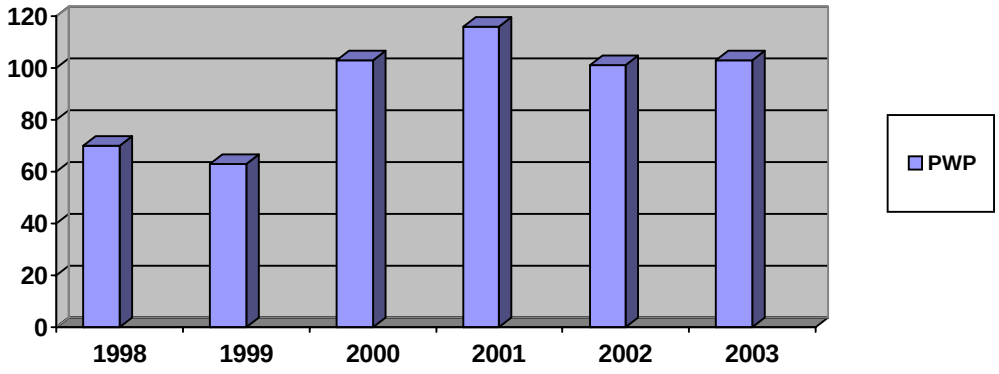
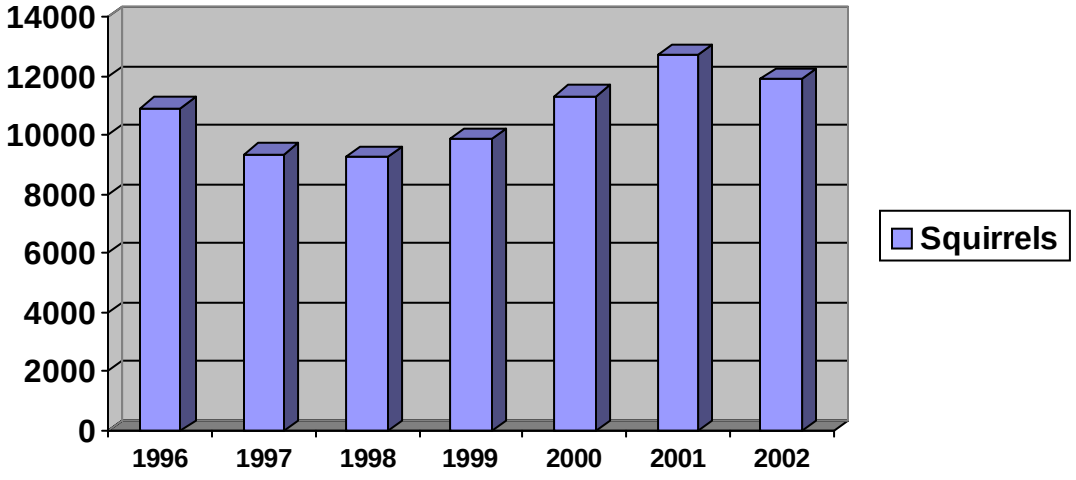


Chart 14.
Pileated Woodpecker Observations In 50-90 Year Old Stands



<u>Gray and Fox Squirrels</u> <u>*(Sciurus carolinensis and Sciurus niger)*</u>: The gray and fox squirrels were chosen as a MI because of their significance as game animals and because of their need for dens and hardwood mast. These species were also selected in *the Plan* as indicators for three forests or grasslands seral stage habitats: mid and late succession and old growth. Acres of habitat in 1996 were estimated to total 200,000 acres, and *the Plan's* short-term objective is to have 264,000 acres. *The Plan* projected that habitat acreage reductions would occur in the mid and late succession stages, and increases would occur in the mid succession and old-growth stages. Texas Parks and Wildlife Department began estimating squirrel harvest on the NFGT in 1996 by hunter surveys.

Chart 15.
Squirrel Harvest Data on the NFGT



The following sources of data and information were used in this analysis:

1. Texas Parks and Wildlife Department. Small game Research and Surveys. Rabbit, Hare, and Squirrel Research, Management, and Regulations. April 19, 2001.
2. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
3. Texas Parks and Wildlife Public Hunting Lands MAP BOOKLET, 2003-2004

Effects of Management

Management that maintains or promotes and improves mast production and mast producing potential of the forest benefits all squirrels. Both species of squirrels will persist on the NFT due to large areas of suitable habitat as well as the availability of a variety of habitats across the national forests

Need For Change

Gray squirrels and eastern fox squirrels are very difficult to monitor and TPWD concluded that squirrel populations closely parallel the previous season's mast crop. Therefore***, it is recommended this species be removed from the MIS list for the NFGT in the next forest plan revision***.

Snags: Snags are a habitat component of virtually all forests, and were identified as a management indicator because of the number of species which depend on them and because the lack of snags can be a limiting factor in increasing populations of some species. This habitat component was selected in *the Plan* as a MI for four forest or grassland seral stage habitats: early, mid and late succession and old growth. The number of snags per acre in 1996 were estimated to average two in early succession habitat, two to four per acre in the mid succession habitat, two to six in the late succession habitat, and six to eight per acre in old-growth habitat. *The Plan* short-term objective is to have two to three snags per acre in early succession habitat, three to six per acre in mid succession habitat, six to eight per acre in late succession habitat, and eight to twelve per acre in old-growth habitat. Snag data has been collected during the vegetative analysis of the annual breeding bird point monitoring. The vegetative data is collected once every four years during the point count monitoring. All snags and their diameter breast heights (DBHs) are recorded within 50 meters of a point count site. These numbers were extrapolated to the entire forest to give estimates of snags per acre per seral stage of habitats.

The following sources of data and information were used in this analysis:

1. Hamel, P.B. 1992. Land Manager's Guide to the Birds of the South. The Nature Conservancy, Southeastern Region, Chapel Hill, NC. 437 p.

2. Conner, Richard N. Snag Management for Cavity Nesting Birds. Proceedings of the Workshop on Management of Southern Forests for Nongame Birds. 1978. pp. 120-128.
3. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
4. USDA Forest Service. National Forests of Texas. Forest records and annual bird point data (1996-2003).

Effects of Management

Prescribed burning activities and wildfires will create and destroy snags in certain circumstances.

Need For Change

Utilization of vegetative data collected during bird point counts has established baseline data of snags on the forest. Continued collection of this information will establish trends over time. Additional surveys for snags may be needed to capture a broader picture of the amount of snags available on the forest. A research project entitled "Long-term Study on the Population Dynamics of Snags in Pine-Hardwood Forests" was initiated in 1994 in cooperation with the Southern Research Station's Nacogdoches Research Work Unit. This study is located on the Stephen F. Austin (SFA) Experimental Forest on the Angelina NF and is examining snag population dynamics for both pine and hardwood species. The results of this study will help the NFGT determine if the snag objectives in *the Plan* are appropriate.

Longleaf Pine Woodlands and Savannahs

Red-cockaded Woodpecker (RCW) *(Picoides borealis)*: The RCW was listed as a federally endangered species under the Endangered Species Act in 1973. Once abundant in pine forests of the southern United States, RCW populations plummeted during the 1900's. The preferred habitat for the RCW, open longleaf/wiregrass and longleaf/bluestem forests, declined across the south from over 24 million acres in the early 1800's to slightly less than 3 million acres remaining today. Attempts at managing RCW populations and their habitats began in the mid-1960s; however, population declines and extirpations continued throughout its range. The Forest Service's role in recovery of the species is critical, as over 50 percent of known RCW occur on National Forest System Lands in the south. The southern National Forests support the majority of core RCW populations required for delisting and therefore have a uniquely important role in recovery of the species (USFWS 2003). In January 2003 The Fish and Wildlife Service signed into implementation the new Red-cockaded Woodpecker Recovery Plan, Second Revision (USFWS 2003) This Recovery Plan gives guidance on management of the RCW on private and public lands across the Southern Region. Incorporation of the new guidelines into the Forest Plan will

occur over the next year. The primary change in management from the previous recovery plan is how foraging acres are calculated. Each cluster is allocated 120 acres of quality (and quality is well defined) foraging habitat which consists of old pines, little or no midstory, and herbaceous ground cover.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. Annual Status Reports of Red-cockaded Woodpecker Population on NFGT. (1992-2003).
2. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2001).
3. USDA Forest Service. National Forests of Texas. Forest records and annual bird point data (1996-2003).
4. USDA Forest Service. Prescribed Fire History on the National Forests of Texas (1992-2003).
5. USDA Fish and Wildlife Service. Southeast Region. Red-cockaded Woodpecker Recovery Plan. January, 27, 2003.

Photo 1. RCW

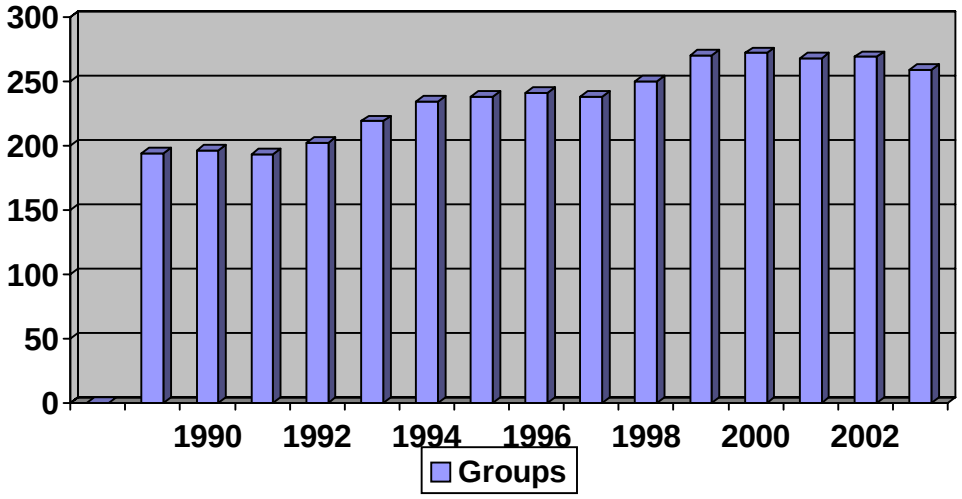
Augmentation/Translocation

The Sam Houston NF west side RCW sub-population is a former donor source for moving RCW to other populations. Donor populations must be of a certain size and exhibit stabile or increasing growth. The Sam Houston National Forest exhibited a slight reduction in active RCW clusters in 2002, allowing translocations internal to the Sam Houston the past two years. Translocations are important to increase populations in suitable habitat where numbers of birds are low. RCWs are moved internally within the same population to augment single birds and to establish new groups by moving two juveniles into a recruitment cluster.

Table 4.
Number Of RCWs Translocated 1990 Through 2003

National Forest	90	91	92	93	94	95	96	97	98	99	00	01	02	03
Angelina	4	0	1	3	5	1	0	13	24	3	1	1	0	0
Sabine	0	0	0	4	17	2	2	1	4	21	1	1	0	0
Sam Houston	2	0	0	3	0	0	4	8	13	15	2	2	25	24
Davy Crockett	1	0	0	0	4	4	1	11	15	6	2	2	5	3

Chart 16.
RCW Forest Wide Population Trends



Effects of Management

Threats to the species include loss of the longleaf pine ecosystem, as a result of fire exclusion, and the number of older pines available as cavity trees (Walters, 1991). Hardwood encroachment due to fire exclusion has been the cause of loss of woodpecker groups on both public and private lands (USFWS, 2000). Court ordered mandates for management of the RCW on the NFGT were lifted on July 25, 2003. Current management follows Management Area two and six (MA-2 and MA-6) direction of *The Plan* as well as by the USFWS RCW Recovery Plan (USFWS 2003). Recent litigation preventing minimum acreages (objectives) of prescribed fire throughout the RCW habitat on the NFT appears to be causing the downward trend in RCW populations, including the Sam Houston donor sub-population.

Need For Change

An analysis of fire history for the forests has shown a lack of fire in 82,438 acres of the HMA for over 10 years. The HMA is approximately 300,000 acres. According to the Southern Region's Recovery Plan for the RCW, this habitat needs to be burned a minimum of once every five years. The forest needs to burn 60,000 different acres every year to accomplish this strategy. Currently, the forest is burning an average of 5,713 different acres (those not burned in the previous five years). Those acres that have not been burned in over ten years may not be recovered to quality habitat without some other type of treatment prior to prescribe burning. ***Tracking habitat quality in the HMA through analysis of treatments should be added as a monitoring task.***

Slender Gay-feather *(Liatris tenuis)*: The TPWD Texas Natural Heritage Program (TNHP) Report and Carroll and Johnston (1979) noted that this species is endemic to Texas occurring in seven southeast Texas counties. It occurs most frequently in fire-maintained dry upland longleaf pine savannas associated with the Catahoula formation. The report also documented nine locations of this species on the NFT: eight on the Angelina NF and one on the Sabine NF which served as the baseline for the LMRP in 1996. Surveys conducted since the 1996 baseline was established found this species to be relatively common in open pine forests with low understories and in rights-of-ways.

Several new populations of Slender Gay Feather have been located in compartments 60 and 61 of the Angelina National Forest during surveys in August of 2003. A total of 163 plants were located in these new populations. 19 different locations were recorded using a Global Positioning System (GPS) receiver. Only one of these locations had been previously known and recorded in the Geographic Information System (GIS). All of the populations found were along roadsides. At the present time no signs have been placed in the rights-of-way to prevent mowing when the plants are flowering *(however these populations have persisted on the road shoulders for a number of years without posting)*. It is expected that with continued fire, those existing and new populations may exceed the long-term objective of 35 populations in the future.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
2. USDA Forest Service. Prescribed Fire History on the National Forests of Texas (1992-2003).
3. Donavan, Stewart Carroll and Johnston, M.C. Manual of Vascular Plants of Texas. The University of Texas at Dallas. 1979.

Effects of Management

Slender gay feather responds negatively to a lack of frequent fire and the development of dense midstory. It benefits from a prescribed burn program that reduces dense midstory conditions and increases herbaceous understory conditions. In the long term, restoration of longleaf pine woodlands and savannas should be beneficial to this species, if the areas are managed with frequent fire creating a largely herbaceous under and mid-story habitat.

Need for Change

Slender gay feather commonly occurs in frequently burned longleaf pine habitat or may be found in areas frequently mowed such as rights-of-way. Simply counting all locations gives very limited information about the quantity or quality of the habitat. A two-tiered method of assessing populations may be appropriate

for assessing slender gay feather. Tracking quality longleaf habitat through prescribed burn history of longleaf communities and determining actual populations through inventories. Only populations that are present within the last five years should be counted towards forest objectives. ***It is suggested to add monitoring task to track number of acres of longleaf habitat burned on 2-3 year cycle.***

Since 2001, approximately 8,000 acres of upland longleaf pine habitat have been burned on the Angelina National Forest. An additional 3,000 acres of upland longleaf pine on the Sabine National Forest has also been burned in the last three years. These prescribed locations will be recorded into the GIS (Geographical Information System) to allow better monitoring of potential slender gay-feather habitat. In the future, all known locations of slender gay-feather will be recorded via GPS for the GIS database. Another suggestion to consider is that signs to protect sites from mowing in the flowering season may also need to be installed in all rights-of-way.

Incised Groovebur *(Agrimonia incisa)*: This species occurs in the coastal plain from southern South Carolina south to north-central Florida and west to Mississippi Valley, Louisiana and Texas. In southeast Texas, it grows in fire-maintained dry upland longleaf pine savannas on well-drained sandy soils and can occur with *Liatris tenuis*. However, *Agrimonia* is much more narrowly distributed on NF land, and is found only within the Longleaf Ridge area. The TNHP Report, completed in May 1990, noted three locations for this species (all in the Trout Creek area of the Angelina NF). The 1996 baseline is four populations in the Longleaf Ridge area of the Angelina NF. Subsequent surveys by biologists identified 20 sites, including two of the TNHP sites. Therefore, 21 locations are known for this species on the NFGT, which meets the short-term objective and approaches the long-term objective in *the Plan*.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
2. Texas Parks and Wildlife Natural Heritage Program. TNHP Report. (May 1990).

Effects of Management

These species responds to frequent fire regimes.

Need For Change

As with *Liatris tenius*, simply counting sites gives very limited information on population sizes, so occasional population counts may be desirable. Where both species occur perhaps only counting one species would suffice as a measure of habitat quality

Approximately 8,000 acres have been burned of upland longleaf sites within the last three years on the Angelina National Forest. Since this species occurs in the same habitat as the Slender gay feather, surveys have been conducted in the same areas that Slender gay feather were located.

Scarlet Catchfly *(Silene subciliata)*: The TNHP Report noted the occurrence of this species in southwest Louisiana and southeast Texas, including five Texas counties. Current records indicate that there are two known populations located on the Stark Tract of the Sabine NF in Newton County and one population located in Fox Hunters Hill. *The Plan's* baseline is two populations on the Sabine NF.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports (1997-2000).
2. USDA Forest Service. Continious Inventory of Stand Condition (CISC). (1992-2003).
3. USDA Forest Service. Prescribed Fire History on the National Forests of Texas (1992-2003).

Effects of Management

Scarlet catchfly grows in the ecotone between upland longleaf pine savannas and forested ravines and is maintained by low-intensity ground fires.

Need for Change

Monitoring scarlet catchfly gives limited information about the quantity or quality of longleaf habitat since it is narrowly distributed on NF lands and is generally found on the ecotone on the edge of longleaf habitat, not within it. An easier method of tracking quality longleaf habitat is through prescribed burn history of longleaf communities. Approximately 3,000 acres of longleaf habitat has been burned since 2001 on the Sabine National Forest. ***Recommend dropping scarlet catchfly as a MI in the next forest plan revision.*** After further evaluation, and if the above recommendation is accepted, little additional or no more survey information may be required.

Longleaf Pine – Little Bluestem Series: This community type is characterized by mainly evergreen woodlands on loamy or sandy acidic soils in southeast Texas. Longleaf pine is the dominant evergreen species, but loblolly and shortleaf pines may also be present. Common deciduous associates are blackjack, bluejack, southern red oaks, and sweetgum. A shrub layer containing flowering dogwood, beautyberry, redbay, wax myrtle and vaccinium is common, along with a well-developed herbaceous layer of little bluestem, panicum, switchgrass, sedges and other species. As of January 2003, a total of 25,124 acres were shown in the CISC database. An additional 894 acres are in longleaf-slash, which has the potential to be converted to longleaf-bluestem. *The Plan's* baseline is 21,000 acres with a short-term objective of 40,000 acres. Most of the planned increase in acreage of this series is expected from the restoration of areas currently occupied by slash and loblolly pine and an aggressive prescribed fire management program where some longleaf overstory currently exists. Prescribed burning, during both the dormant and growing seasons, has maintained or improved the quality of many existing stands but exactly how many and which ones have herbaceous dominated understories is unknown.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
2. USDA Forest Service. Continious Inventory of Stand Condition (CISC). (1992-2003).
3. USDA Forest Service. Prescribed Fire History on the National Forests of Texas (1992-2003).

Effects of Management

Longleaf pine woodlands are fire-dependent communities, requiring frequent low intensity fires to reduce woody midstory growth and encourage a diverse understory that supports a variety of plants and animals. Burning frequency rather than burning season is the single most important factor necessary to restore and maintain longleaf pine-dominated habitats (Glistzenstein and Streng, 1995: Waldrop et.al., 1992).

Need for Change

The Plan objective for prescribed burning of longleaf pine habitat has not been met; within the last four years only 11,126 acres have been burned, compared to *The Plan* baseline of 21,000 acres. In order for the restoration of longleaf pine savanna and woodland habitat to provide the ecological conditions required of many herbaceous plant species and animals (such as the RCW) the prescribed fire effort must be increased.

Longleaf Pine Barrens

Navasota Ladies'-Tresses *(Spiranthes parksii)*: TX endemic. This federal and state listed endangered species is most frequently found in the Post Oak Region of East Central Texas. The 1990 TNHP Report noted populations in nine counties, including a disjunct population on the Angelina NF in Jasper County. This served as the baseline for *the Plan*. The 1996 status of this sole NFGT may have changed to zero. Recent attempts to relocate the population have failed. Detailed research and monitoring is ongoing and will continue cooperatively between the USFWS, Forest Service Research Personnel, TPWD, and the NFGT. This is a perennial species and it is possible that specimens may be found in the future.

Photo 2. Navasota Ladies'-Tresses
Photo ©Paul Montgomery
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In the fall of 2002 a survey for Navasota Ladies'-Tresses was completed in the same area the population was recorded in 1990. The survey was conducted with employees of the research station in Nacogdoches, including Dr. Craig Rudolph. No Navasota Ladies' Tresses were found during this effort.

On October 15, 2003 three camera points were established in compartment 84 of the Angelina National Forest. Two of these points were previous locations where the Navasota Ladies' Tresses seen in the past. However, no Navasota Ladies' Tresses could be located at that time. On October 30, 2003 compartment 84 south of highway 63 was surveyed with no Navasota Ladies' Tresses to be found. Only one individual of the related Nodding ladies'-tresses, *Spiranthes cernua,* was located.

The following sources of data and information were used in this analysis:

1. MacRoberts, Michael H, Babara R. MacRoberts, and Robert E. Evans, Notes on Spirantes Parksii Correll (Orchidaceae) in Deep East Texas, Phytologia, September 1997. 83 (3):133-137.
2. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
3. USDA Forest Service. Continuous Inventory of Stand Condition (CISC). (1992-2003).
4. USDA Forest Service. Prescribed Fire History on the National Forests of Texas (1992-2003).

Effects of Management

The one population of Navasota ladies'-tresses on the Angelina NF is an inclusional community surrounded by fire-maintained communities. This supports the belief that Navasota ladies'-tresses populations need fire as a management tool (MacRoberts et. al. 1997). During the last five years on the Angelina National Forest 17,311 upland longleaf sites have been burned.

Need for Change

A single population of Navasota ladies' tresses consisting of a few individuals on the NFGT is not a good management indicator for longleaf pine barrens. The species is difficult to identify, difficult to monitor on a yearly basis, and population fluctuations may tell little if anything about quality of the Catahoula barrens habitat according to former NFGT botanist Rob Evans. ***Continued monitoring of this population is necessary since it is an endangered species but the recommendation is to remove it as a MI for longleaf pine.*** A cooperative agreement between the Forest Service and TPWD has been initiated for further surveys for this species.

Little Bluestem – Rayless Goldenrod Series: This community type is characterized by open grasslands or forb-dominated barrens, and is restricted to flat, shallow soil areas of the Catahoula formation in the southern portion of the East Texas Pineywoods and Post Oak Savanna. These barrens are often interspersed within deciduous woodlands of post oak and black hickory, or occur below hillside seepage bogs or within dry longleaf pine savannas. *The Plan's* baseline of 440 acres identified from the TNHP Report, documents three sites of 437 acres on the southern Angelina NF. An additional site was found on the northern Angelina NF since *the Plan* was written.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
2. USDA Forest Service. Continuous Inventory of Stand Condition (CISC). (1992-2003).
3. USDA Forest Service. Prescribed Fire History on the National Forests of Texas (1992-2003).

Effects of Management

Silveus dropseed (*Sporobolus silveanus*) is believed to be an important component of little bluestem-rayless goldenrod communities that exhibit high quality characteristics (open grassy or forb-dominated areas). This species is fire dependent and may be a good indicator of the quality of the. Prescribed burning is a key tool for management of these communities.

Need for Change

Several small isolated areas of little bluestem-rayless goldenrod communities were found since *the Plan* was written. These need to be mapped and inventoried. A schedule for monitoring the quality of all sites needs to be established. Silveus dropseed presence or absence and fire history should be included as indicators of quality of habitat. During the last 10 years 58,973 acres of pine/pine hardwood habitat has been burned on the Angelina National Forest. Due to lack of funding no additional surveys have been done for the 2002/2003 years. As funding becomes available surveys will be resumed.

Herbaceous Wetlands (Seepage Bogs)

Yellow Fringeless Orchid *(Platanthera integra)*: This orchid can be found in pine savannas, sphagnum seeps and bogs in the southeastern United States from New Jersey, south to north-central Florida, and west to Tennessee and southeast Texas. The TNHP Report documented two small populations, both in bogs on the southern Angelina NF. These two sites were examined in 1998 and both were still extant. The 1996 baseline is one population. This fire-dependent species becomes dormant or is shaded out by invading woody competition in the absence of fire.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
2. USDA Forest Service. Continuous Inventory of Stand Condition (CISC). (1992-2003).
3. USDA Forest Service. Prescribed Fire History on the National Forests of Texas (1992-2003).

Effects of Management

The lack of frequent prescribed burning is the greatest threat to the yellow fringeless orchid. Seasonally flooding and periodic burning are the key components to the communities where this orchid is found. In the last five years

43,457 acres have been burned in pine/pine/hardwood habitats on the Angelina National Forest.

Need For Change

The only population of yellow fringeless orchid is found on the Angelina NF. Most seepage bogs on the NFGT do not contain this orchid. Therefore, it provides little information as a MI for herbaceous wetlands. ***Recommend dropping it as an indicator species***.

Sphagnum – Beakrush Series: This is an herb-dominated community type which includes various types of seepage bogs. Occurrences are usually small and isolated within a matrix of upland pine or pine-oak forest. Small trees and shrubs such as sweetbay magnolia and evergreen bayberry invade many bogs in the absence of fire. *The Plan's* status of 150 acres came primarily from the TNHP Report, which listed 148 acres on 37 sites in the southern portions of the Angelina and Sabine NFs. A few small isolated sites have been located since, but acreages have not been determined.

Effects of Management

Seasonally wet bogs are typically protected from timber harvest and road building. These communities depend on fire on a regular basis (every 1-5 years).

Need for Change

Extensive mapping and inventory efforts are needed to locate and protect these herbaceous wetland communities. Many sites have been found since the baseline was established in 1990. The quality of these sites is questionable. Periodic monitoring after initial inventorying efforts are completed will be needed to ensure that the characteristic structure and composition of the community is being maintained. Fire history should be the basic indicator of quality of habitat, along with freedom from mechanical disturbance that alters the hydrological flow. Many sites may need midstory control to restore quality herbaceous conditions. Since 1999 the Angelina National Forest has burned 61,976 acres and the Sabine National Forest has burned 66,746 acres of pine/pine/hardwood areas.

Bay-Shrub Wetlands

Nodding Nixie *(Apteria aphylla)*: According to the TNHP Report, Nodding Nixie occurs in seepage areas, stream margins, and other wet situations, often in association with mosses (*Sphagnum spp.)* and is generally restricted to eight counties in southeast Texas. It grows in decaying leaves in deeply shaded seepage bogs or baygalls. The TNHP Report noted five locations of this species on the NFGT, three on the Angelina NF and two on the Sabine NF. Additional

sites have been found on the Sabine NF in the baygall west of Highway 147 in Compartment 51 and in Compartment 90. Houston Sierra Club volunteers located Nodding Nixie on six sites in three compartments (Compartments No. 90, 91, and 94) on the east side of the Sam Houston NF (all of which are confirmed by a Forest Service biologist). *The Plan's* baseline is seven populations. There are currently 18 sites on the southern Angelina NF, with an estimated several thousand plants. The latest population estimate for the NFGT is approximately 24-30 sites. Surveys need to be conducted in the fall.

On October 27, 2003 147 stems of the Nodding Nixie, *Apteria aphylla,* were located in a forested seep in compartment 86 of the Angelina National Forest. The plants were found on both sides of a stream running through the seep.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
2. USDA Forest Service. Continuous Inventory of Stand Condition (CISC). (1992-2003).

Effects of Management

These areas are typically protected during harvest treatments. Occasionally in drier years, prescribed fire may creep into these sites.

Need for Change

This species is difficult to monitor. It is difficult to identify and hard to locate. ***Recommend dropping this species as MI in the next forest plan revision.***

Texas Bartonia *(Bartonia texana)*: This endemic species was not mentioned in the TNHP Report. One population was reported by Bog Research (MacRoberts 1997) on the southern Angelina NF, and a second population was located on the SFA Experimental Forest (this site has not been confirmed) on the northern Angelina NF. A total of two populations have been reported.

On October 27, 2003, compartment 86 of the Angelina National Forest was surveyed for Texas Bartonia *(Baronia texana)*. This seep was previously recorded on the GIS files as a known site of Texas Bartonia. However, no Texas Bartonia was located on this date.

The following sources of data and information were used in this analysis:

1. MacRoberts, Michael H, Babara R. MacRoberts, and Robert E. Evans, Notes on Spirantes Parksii Correll (Orchidaceae) in Deep East Texas, Phytologia, September 1997. 83 (3):133-137.

2. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
3. USDA Forest Service. Continuous Inventory of Stand Condition (CISC). (1992-2001).
4. USDA Forest Service. Prescribed Fire History on the National Forests of Texas (1992-2003).
5. Donavan, Stewart Carroll and Johnston, M.C., Manual of Vascular Plants of Texas. The University of Texas at Dallas. 1979.

Effects of Management

These areas are typically protected during timber harvest and road building operations.

Need for Change

The species is difficult to locate and identify, therefore this species may not be a good indicator of the quality of the bay shrub community as per Rob Evans former NFGT botanist. ***Recommend dropping this species as a MI the next forest plan revision***.

Sweetbay Magnolia Series: This community type is a mainly deciduous to evergreen low forest occurring over seeps, in wet creek bottoms, and in other permanently moist soils in east Texas. It is often associated with the sphagnum-beakrush series, and may be successional to bogs in the absence of fire. The TNHP Report noted 15 locations on 325 acres of the Angelina and Sabine NFs, and another location of 29 acres on the Sam Houston NF. *The Plan's* status is 250 acres, which was determined from 1991 CISC records. According to October 2001 stand record, 680 acres exist on the forest. The increase in acreage is most likely the result of better stand type mapping rather than an actual increase in acreage. It is unknown how many of these acres coincide with the 354 acres mapped by TNHP.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
2. USDA Forest Service. Continuous Inventory of Stand Condition (CISC). (1992-2003).
3. USDA Forest Service. Prescribed Fire History on the National Forests of Texas (1992-2003).

Effects of Management

These areas are typically protected from logging operations. Periodic fire may maintain some grassy vegetation in these habitats.

Need for Change

The TNHP areas need to be checked against CISC records to be sure they are correctly identified in the database. Forest service personnel should be made aware of this habitat type and record it in CISC, providing a more accurate assessment.

Dry-Xeric Oak-Pine Forests

Louisiana Squarehead *(Tetragonetheca ludoviciana):* Also known as the Sawtooth Nerveray, this species has been recorded in 19 east Texas counties as well as in western Louisiana and extreme southwest Arkansas (according to the TNHP report). Populations are known to occur on Davy Crockett, Angelina and Sabine NFs. These populations are extremely small in number of individuals according to Rob Evans former NFGT botanist. The baseline in *the Plan* was five populations, which included two locations that were reported by TNHP, both occurring on the Angelina NF. Inventories and monitoring associated with the tree removal operations following the February 10, 1998 windstorm blowdown, found an additional population on the northern Angelina NF. Other populations on the Davy Crockett are also known to exist, with an estimated number of 20 sites. It is probable with future GPS location records and continued monitoring, this species would meet and exceed *The Plan* objective of 25 populations.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
2. USDA Forest Service. Continuous Inventory of Stand Condition (CISC). (1992-2003).
3. USDA Forest Service. Prescribed Fire History on the National Forests of Texas (1992-2003).

Effects Of Management

Periodic prescribed fire should help maintain this species.

Need for Change

All populations need to be mapped and entered into GIS coverage. Sites should be revisited to determine if they are still persistent. It is important to establish a monitoring protocol for this species and as funding becomes available, surveys will be resumed and populations will be mapped and entered into GIS coverage.

Shortleaf – Oak Forest: This community type occurs primarily in northeast Texas and is characterized by mixed pine-hardwood. It is found on shallow to deep, usually sandy soils. Shortleaf pine is the dominant evergreen species, but loblolly pine may also be present. The common oak species are southern red, white, black, post, and blackjack, and hickories are often present as well. *The Plan's* baseline is 150,000 acres with a short-term objective to increase acreage to 160,000. As of January 2003, a total of 152,900 acres have been inventoried in this type.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2001).
2. USDA Forest Service. Continuous Inventory of Stand Condition (CISC). (1992-2003).
3. USDA Forest Service. Prescribed Fire History on the National Forests of Texas (1992-2003).

Effects of Management

Periodic prescribed fire is the most effective management tool of this community. Frequency and intensity of fires will determine the structure of these communities. More frequent fires will favor shortleaf and infrequent fires will favor hardwoods.

Need for Change

Analysis of fire history using GIS is needed to plan and direct future burning operations in these communities. These communities should persist in the future on the NFT.

Mesic Oak-Pine Forests

Loblolly – Oak Forest: This community type occurs on loamy or sandy acidic soils in east Texas, and is characterized by upland pine-hardwood forest. Loblolly pine is the dominant evergreen species, but shortleaf pine may also be present. The common oak species are southern red, white, post, and water, and hickories are often present as well. *The Plan's* baseline is 300,000 acres. January 2003 stand inventory records show 349,289 acres in this type. *The*

Plan's short-term objective is a reduction to 270,000 acres in this type being replaced by other types on suitable sites (longleaf, shortleaf, bottomland hardwoods, etc.) either by natural succession or management treatment.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2001).
2. USDA Forest Service. Continuous Inventory of Stand Condition (CISC). (1992-2003).
3. USDA Forest Service. Prescribed Fire History on the National Forests of Texas (1992-2003).

Effects of Management

Timber harvest, planting and prescribed fire will convert stands to more desirable species composition consisting of longleaf and shortleaf.

Need For Change

Soil layers in GIS will help managers make better decisions on where stands should be coverted. This is presently being added to the Forest database.

Mesic Hardwood Forests

Southern Lady Slipper *(Cypripedium kentuckiense)*: This species is widely distributed from the Ouachita Mountains in Arkansas east to the Cumberland Plateau in Kentucky and Tennessee, south to the east gulf coastal plain in Alabama and Mississippi, and west to Louisiana, southeastern Oklahoma and eastern Texas. The TNHP Report noted populations in seven counties in east Texas, including three populations on the Sabine NF and one on the Angelina NF. The 1996 status of this species on the NFGT was unknown, so *the Plan* specified a short-term objective to establish the baseline population. Botanists have conducted targeted surveys of the most likely habitats for this species, and more broad-based surveys have also been conducted. These surveys have established a baseline of nine populations, eight of which are on the Sabine NF, and the other is on the northern Angelina NF. Current number of known populations is 11.

Surveys were conducted on the Sabine National Forest for the Southern Lady Slipper in 2003 by Jason Singhurst, botanist employed by the Texas Department of Parks and Wildlife (TPWD). No new populations have been found.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).

2. USDA Forest Service. Continuous Inventory of Stand Condition (CISC). (1992-2003).

Effects Of Management

This species occurs on hardwood slopes in east Texas. These slopes are generally only impacted by prescribed fire on a rare basis, which should be avoided, if possible.

Need For Change

A cooperative agreement between the Forest Service and TPWD has been initiated for further surveys for this species and associated species found in the same communities. Continued inventory of four to six compartments a year should survey all suitable habitat within a three-year period.

Beech-White Oak Series: This community type occupies mesic ravines and ridges within creek bottoms. *The Plan's* baseline of 2,532 acres results from consolidation of the American Beech-White Oak Series and the American Beech-Southern Magnolia Series acres reported by TNHP. Additional area of this type is known and may be typed in CISC as forest type 53 and others. The Nature Conservancy examined the status and extent of forest communities in which American beech is present in the overstory in 1997. The ECS landscape model, the GIS database, and CISC were utilized to select 38 sites on the northern Sabine NF for field survey. Of these sites, 21 were ranked as high-quality examples of natural lower slope mesic forests. Community maps and element occurrence data forms for each site will be utilized to incorporate this information into the GIS and CISC databases for the Sabine NF.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
2. USDA Forest Service. Continuous Inventory of Stand Condition (CISC). (1992-2003).

Effects of Management

Many stands of beech were impacted during the blowdown on the Sabine in 1998; due to the mesic nature of these stands, many have recovered with little or no negative effects of harvest or fire.

Need For Change

Most of the known areas for this community type are unmapped. A consistent means of identifying stands is needed to determine the baseline number of populations. Recent work on the NFT (by Nature Serve under agreement with USFS Region 8) has helped to clarify the range of variability in this type. At the western margin of occurrence on the Sam Houston NF, this community may transition into one dominated by laurel oak. Laurel oak stands acreage should be included in future reports as part of this community type.

Tallgrass Prairie

Bobwhite Quail (Colinus virginianus): Northern Bobwhite was chosen as an MIS for Tallgrass Prairie because of its small home range and habitat diversity requirements. The habitat requirements include brushy areas for cover, grass seeds and greenery in the spring, woody plant fruit in the summer, and forb seeds, berries, and oak mast during the fall and winter. Monitoring of the species according to *the Plan* will be done by annual census methods. Quail route data has been utilized to meet forest-monitoring guidelines. Texas Parks and Wildlife Department obtains statewide data through annual survey routes established in 1976 to determine quail population trends. The Tallgrass Prairie is found on the LBJ and Caddo National Grasslands (NGs).

The following sources of data and information were used in this analysis:

1. Texas Parks and Wildlife. Small Game Research and Surveys. Quail Harvest Regulation Recommendations. (1984-2000).
2. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2001).
3. USDA Forest Service. Prescribed Fire History on the National Forests of Texas (1992-2003).
4. USDA Forest Service. Quail Surveys on LBJ and Caddo National Grasslands. (2002).

Chart 17.
Number of coveys heard during fall point counts for quail on the LBJ and Caddo Grasslands.

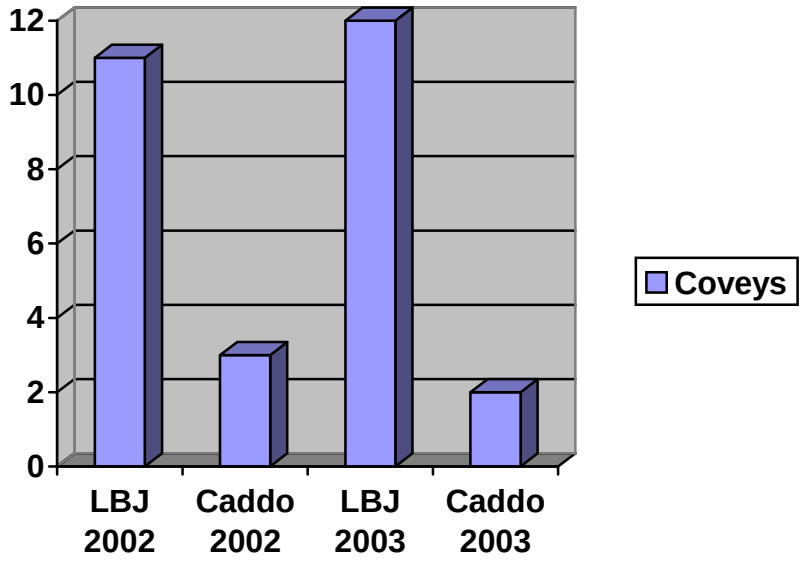
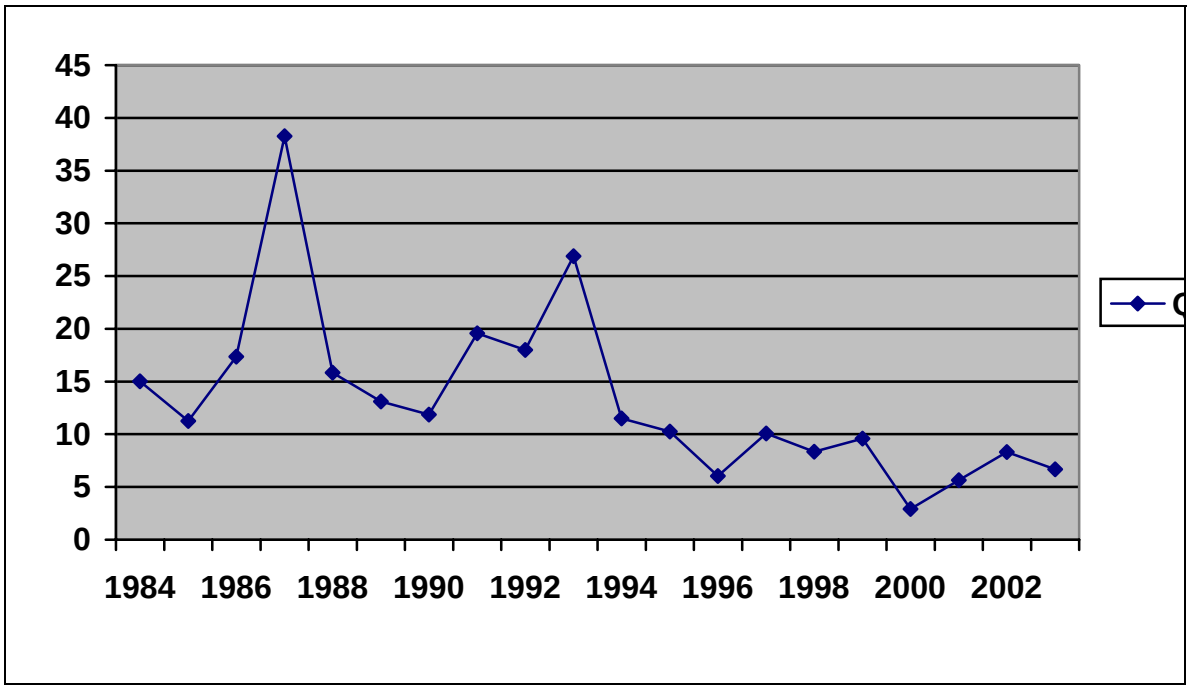


Chart 18.
Mean Number Of Bobwhite Quail Observed/Route In The Cross Timbers Ecological Region of Texas.
(The same routes are run annually.)



In 1996, the population density of bobwhite quail was one per 25 acres for the Cross Timbers Ecological Region. The short-term objective for bobwhite quail in *the Plan* is one per 20 acres with the long-term objective one per 15 acres. Texas Parks and Wildlife Department collects information from hunters on the number of birds harvested, but as this reporting is voluntary, the numbers are of little use for estimating population trends. As depicted in chart 17, the Caddo has fewer quail, as a rule, than the LBJ national Grasslands. Bobwhite quail throughout north Texas experienced declines through the 1990's. Since 2001 (chart 18) this trend has changed and numbers are increasing.

Effects of Management

The Northern Bobwhite responds to frequent burning and any activities that scarify the soil creating grass/herbaceous cover in close association with shrubs, vines, and young trees. Preferred habitat for the Northern Bobwhite is distributed across the Tallgrass Prairie found on the NGs of Texas. It is likely that populations of Northern Bobwhite will persist on the LBJ and Caddo NGs.

Need for Change

Additional surveys were established in 2002 (chart 17) to achieve baseline information on the LBJ and Caddo Grasslands. These surveys need to be continued to understand management actions and effects on bobwhite quail.

Little Bluestem – Indiangrass: This MI, with *the Plan* baseline of approximately 15,000 acres, was intended to identify prairie vegetation. The baseline acreage is located entirely on the Caddo and LBJ NGs, although a small number of potential acres exist on the Sam Houston NF. Surveyed blackland sites to date on the Sam Houston NF are in need of restoration.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
2. USDA Forest Service. Prescribed Fire History on the National Forests of Texas (1992-2003).

Effects Of Management

Currently, prescribed fire and grazing are the management treatments that maintain and restore Little Bluestem-Indiangrass habitats on NFGT. Historical land use has contributed to loss of highly palatable tall grasses. It is unclear whether or not such areas can recover under current management practices, or whether aggressive restoration will be needed. Restoration of additional acres may need mechanical or herbicide treatments if they can no longer be restored with the use of fire.

Need For Change

While prescribed burning on the grasslands has improved the condition of this type, there is no known significant increase in acreage. Development of a management tool similar to CISC to track grassland habitats and conditions is needed.

Bottomland Streamsides

Neotropical Migratory Bird Guild: In 1996 baseline estimates of Neotropical Migratory Bird Species on the NFGT was unknown. *The Plan's* short-term objective is to establish baseline population estimates for these species, which include Yellow-throated Vireo, Wood Thrush, Acadian Flycatcher and others.

The following sources of data and information were used in this analysis:

1. Hamel, P.B. 1992. Land Manager's Guide to the Birds of the South. The Nature Conservancy, Southeastern Region, Chapel Hill, NC. 437 p.
2. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
3. USDA Forest Service. National Forests of Texas. Forest records and annual bird point data (1996-2003).

Chart 19.
Yellow-throated Vireo Observations Made In Bottomland Streamside Stands.

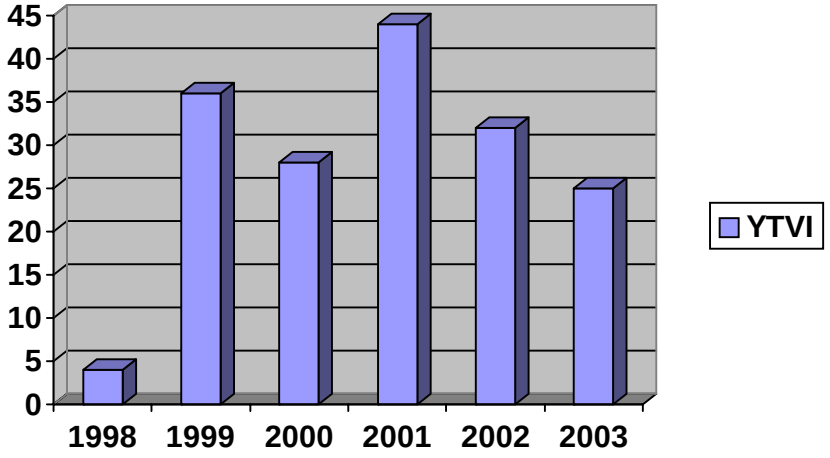


Chart 20.
Acadian Flycatcher Observation Made In Bottomland Streams Habitat.

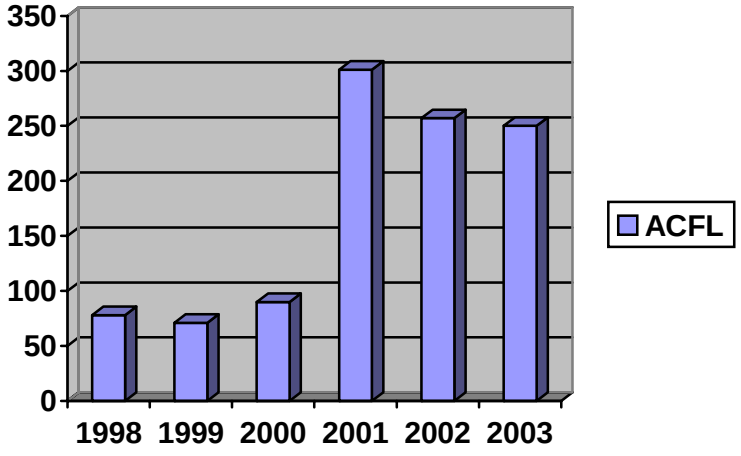
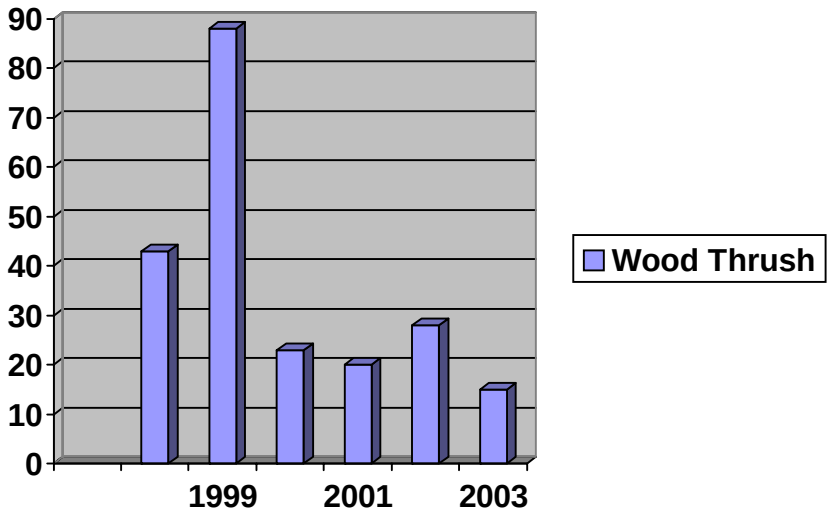


Chart 21.
Wood Thrush Observations Made In Bottomland Streamside Habitat.



Effects Of Management

These habitats are typically protected from timber and road construction projects. Other management actions such as fire will promote the ecotone between bottomlands and the upland forest.

Need For Change

Recommend dropping the guild and monitoring the habitat type through CISC. In addition, monitoring only two species through bird point data in bottomlands and streamside would be in-effective.

Neches River Rose Mallow *(Hibiscus dasycalyx)*: TX. Endemic The known range of this species is limited to the Davy Crockett NF, but suitable habitat may occur elsewhere. The 1996 status was based on a population reported near Hargrove Lake. A sample specimen was reported by a SFASU graduate student and confirmed by Dr. James E. VanKley at SFASU. However, this site could not be re-located during a visit to the site by the student and then by a Forest Service botanist. A cooperative effort between the USFWS, TPWD and SFASU successfully re-introduced almost 700 individual plants to two sites on the Davy Crockett NF in April 2000. The Forest Service purchased the Hargrove Lake Tract that contains likely habitat for, and possibly a population of, this species in FY 1999.

According to Kathy Nemec of U. S. Fish and Wildlife Service, 230 plants were planted in compartment 20 and 450 plants in compartment 16 on the Davy Crockett NF. During July stems (not plants) were counted in the two re-introduction sites; 78 stems in compartment 16 and 263 stems in compartment 20. Jackie Poole (botanist) of TPWD and Anita Tiller of Mercer Arboretum both confirmed that each plant was likely to have several living stems at one time; Poole estimated that these stems represented perhaps 80 plants. The reduction in population size in compartment 16 was probably caused by changes in water level due to beaver activity. Deer had browsed most stems in compartment 20, although this did not prevent the plants from flowering.

During three days in July 2003, Neches River Rose Mallow, *Hibiscus dasycalyx*, stems were counted in compartments 16 and 20 of the Davy Crockett National Forest. The populations in these two compartments were established from plants grown at Stephen F. Austin State University.

In August 2003, James McCormick, along with biologists from USFWS, TXPWD, TXDOT, and SFA, found a natural population in compartment 55 of the Davy Crockett NF.

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2000).
2. USDA Forest Service. Biological Evaluation 03-00-02 Experiment-Establish Neches River Rose Mallow Plant, April 2000.

Effects of Management

These habitats are typically protected from timber and road construction projects.

Need for Change

Inventories are needed bi-annually to monitor progress of restoration efforts. Damage occurred in one area where restoration efforts were implemented. A water-control structure needs to be installed at this site.

Bottomland Hardwood: *The Plan's* baseline was 25,000 acres. Acreage can be retrieved annually using the CISC records; this broad group includes CISC forest types 61, 62, 63, 64, 65, and 75. According to a January 2002 CISC report, these types total 31,493 acres. The increase from 25,000 to 31,493 acres since 1996 is likely the result of stand reclassification during silvicultural exams into one of the above forest types. Some reclassification is attributed to better stand data or succession of mixed hardwood and pine to predominantly hardwood (due to natural mortality of pine)**.**

The following sources of data and information were used in this analysis:

1. USDA Forest Service. National Forests and Grasslands Monitoring Reports. (1997-2001).

2. USDA Forest Service. Continuous Inventory of Stand Condition (CISC). (1992-2003).

Effects of Management

These areas are generally not impacted during timber harvest and road building project.

Need for Change

Acreage of this forest type should persist on the NFGT with minimal or no change in the future.

Aquatic System

Ponds and Reservoirs

Under *the Plan*, fisheries and aquatic monitoring responsibilities are linked to select MI. As such, Appendix G assigns monitoring tasks and timetables relative to these indicators. The following apply to fisheries and aquatics:

> 1a) Are TES species being properly identified? Area wide surveys and habitat inventory are to be conducted annually, along with opportunistic observations during project planning.
>
> 1b) How is the habitat of any listed species being affected? Biologists' databases are to be surveyed annually for changes in habitat trends of MIS and listed species.
>
> -Are viable populations of MIs being sustained? Census/surveys to be conducted on an annual basis.

-What are the viability trends for selected species? Analyses to commence on five-year intervals.

1f) Are streams and corridors maintaining desired wildlife, plants, and fish populations? Annual fish, invertebrate and water quality sampling is dictated to answer these questions.

Limited fish inventory had been done on the NFGT prior to 1990. Some scattered samples from academia and one TPWD pre-reservoir study existed, but most of the information was 20 years old and off-forest. The NFGT began sampling streams in 1991 and contracted "blanket" baseline surveys of each forest for fish, mussels and crayfish, primarily through SFASU and Texas A&M (A&M). These surveys included a minimum of 10 streams sampled quarterly, per district. The final blanket fish survey of the Angelina NF was completed in 2001. Some data gaps in crayfish on the Angelina NF, mussels and crayfish on the Sabine NF and fish, mussels and crayfish on the Caddo/LBJ NGs still exist. During this period of baseline sampling, the NFGT was striving to sample all creeks, especially those tied to projects. Over 200 locations were sampled and logged into a custom Access database along with contracted baseline data. Almost all sampling was done via 100 meter segment electroshocking, in combination with seining and sometimes dip-netting. When possible, pH, conductivity, total dissolved solids, and dissolved oxygen samples were taken. For several years, benthos were also taken by one-minute kick-net or search methods and rated with an abbreviated Environmental Protection Agency (EPA) score-sheet.

Lake and pond sampling also began in earnest around 1992, where there had been almost no prior sampling, except for some one-time events in Ratcliff, Red Hills and Double Lake Recreation Area Lakes. Texas Parks and Wildlife Department has routinely sampled Coffee Mill and Davy Crockett Lakes on the Caddo NG, every other year.

The monitoring report for 1997, 1998 and 1999 displayed some aquatic population trends. Less frequent fisheries sampling occurred in 1999-2000 when budget constraints required the Forest Fisheries Biologist to assume significantly increased duties. Six streams were sampled. Two were in a watershed where the Sabine shiner had been found once before, but no specimens were found at this sampling. A sample of Siep Bayou on the Sabine revealed high conductivity. A follow-up sample still showed elevated levels. Adjacent land practices were reviewed and livestock or pasture activities seemed to be the likely source, but not fully confirmed. Forest crayfish collections, over a five-year period, were compiled and distributed to the Districts. P*rocambarus kensleyi* was noted in four locations on the Davy Crockett NF. This species is on the R8 Sensitive Species List. Texas A&M completed the crayfish/mussel survey of the Sam Houston NF, but only preliminary data are available. The Angelina Fish Survey was also completed. Forest Service personnel did sample two small lakes,

Bouton and Boykin on the Angelina NF, to establish baseline populations. Neither had been sampled before due to difficult access and equipment problems.

The 2001 M&E report briefly cited fish, crayfish and mussel sampling on the Sam Houston National Forest in 1999-2000 and stated that further analysis of those results would be included here. As such, the 1999-2000 sampling points provided good coverage of the District in relation to spatial coverage and all prior NFGT sampling records for the area. The Index of Biotic Integrity (IBI), formulated by Karr (1983) assigns values to fish species based on their tolerance of pollution. That factored with diversity, or the number of different species occurring, provides the basis for the IBI scores. If we look within the Winters Bayou watershed, diversity as well as the number of intolerants are down significantly for the same sites sampled in 1997 (Herbert). Pea creek went from four darter species and one madtom to two darter species and no madtoms. Total diversity was down by 33%. Between the two sample years, Winters Bayou went from three darter species to two and diversity fell by 20%. Also the blackspot shiner, which is one of our endimicity indicators for the sediment model (Clingenpeel pers. comm.), disappeared. The East Fork Caney site lost two darter species, the endemic blackspot shiner and declined 44% in diversity. Field reviews of habitat conditions on the ground have revealed problems with sediment production from eroding roads and some household dumping, but none would seem significant enough to cause such a precipitous decline in indicators. Similar negative indicators from several streams within a watershed seem to imply a larger problem, although area-wide sedimentation has been linked to the drastic decline in mussels over the last 10 years (Howells 1994). The only other area wide impacts could be possible drought regimes during the sample span, but that factor needs to be examined further.

Largemouth Bass (*Micropterus salmoides*) This species was selected for aquatic pond and reservoir habitats because of its focal status as a demand species. The unit of measure is catch rate in fish per hour based on electrofishing results. Trends are based on changes in catch rates along with analysis of length-frequency histograms.

The following sources of data and information were used in this analysis:

Most historic data and analyses are from NFGT electrofishing 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.

Two water bodies on the Angelina National Forest were surveyed via gill-net in 2003. The newly acquired Blox Tract ponds have been altered into swampy marshes over the years by beavers. Inaccessible to an electrofishing boat, sampling was done by gill-netting. In 240 feet of net/pond, only two largemouth bass were caught. This would fall far below the expectation for managed water

bodies. However, these lakes have never been under any management. Given the predominance of lake chubsuckers, the largemouth is not a large enough predator to influence their numbers or attain predator/prey balance.

Lake Davy Crockett on the Caddo National Grassland was gill netted by TPWD in 2002, yielding catch rates of 1.2 for bass and 1.2 for sunfish. Electroshocking in 2003 produced 108 bass/ hour, which is one of the highest catch rates for lakes in that area. 2002 gill netting on Coffee Mill Lake (Caddo NG) provided no bass or sunfish per net night, but bluegill and crappie were abundant in trap net samples.

Effects of Management

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. To date, this is the largest bass ever reported in any USFS Region. Black Creek Lake produced two fish over 10 pounds in 1999.

Table 5.
Largemouth Bass Survey Results From Specified Lakes
During Fiscal Year.
(Numbers indicate fish catch rate per hour via electrofishing.)

Lake	1994	1995	1996	1997	1998	2001	2003
Black Creek	29				72		
Coffeemill		79			93	90	
Cottonwood		19			29		
Clear		3			12		
Crockett	502			2,141		165	108
Fannin	26			53			
Ratcliff	87 (1993)	34	14				
Red Hills		77					

Need for Change

All recreation area lakes that have a demand for fishing should re-initiate habitat and population management. Steps have already been taken on Red Hills Lake where stocking and habitat improvements have already begun.

Sunfish (*Lepomis species*) The "sunfish" indicator includes the bluegill, redear, green sunfish, warmouth and longear. Bluegills predominate most of the samples. Serving as a forage base or prey species for the largemouth bass, this group will not always exhibit concurrent trends.

Effects of Management

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, that was achieved on all lakes that didn't have weed problems.

Table 6.
Sunfish Survey Results From Specified Lakes
During Fiscal Year.
(Numbers indicate fish catch rate per hour via electrofishing.)

Lake	1994	1995	1996	1997	1998	2001	2003
Black Creek	32				76		
Coffeemill	78 (1992)	114			446	133	
Cottonwood		5					
Clear		29			24		
Crockett	255			332		1967	
Fannin	15						
Ratcliff			39				
Red Hills		97				126	

Need for Change

As noted for the largemouth, all recreation area lakes that have a demand for fishing should reinitiate habitat and population management. Steps have already been taken on Red Hills Lake with stocking and brush cover structures.

Channel Catfish (*Ictalurus punctatus*) This species was chosen for aquatic ponds and reservoirs. It is strictly a demand species and is difficult to maintain in a reproductive population. Stocks normally have to be augmented on at least a biannual basis. Federal stockings were curtailed in the mid-1990s and the only fish received since have been sporadic stockings in Ratcliff, Coffeemill and Crockett Lakes by TPWD.

Need for Change

This species needs to be restocked in order to relieve the fishing pressure on the bass and sunfish populations. Options include purchasing additional fish for stocking, constructing spawning structures, and regulating take to protect some of the larger brood fish.

Rivers and Streams

Paddlefish (*Polydon spathula*) This species, endemic to the Angelina, Neches and Sabine River systems, were 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 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 ended.

The following sources of data and information were used in this analysis:

All information came from TPWD records and communications.

Effects of Management

Considering the inherited state of the habitat, NFGT activities have not contributed to further degradation (with the probable exception of some siltation of gravel beds). However it is unknown if suitable gravel bed habitat still existed when the NFT were acquired.

Need for Change

Although the paddlefish is a protected species one criteria 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. ***Recommend this species be removed from as a Forest indicator.***

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 turn this species up with the regularity that was expected.

Effects of Management

In 1997, Herbert found the dusky darter in six creeks on the Sam Houson NF. Only three (or 50 percent) of these same creeks contained duskys 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 duskys from other creeks would 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.

Moye found this darter in Camp Creek on the Davy Crockett NF in 1995, yet Jess 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 Forest Sensitive 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.

The dusky darter was dropped as a recommended sensitive species for R8 Forest lists due to poor correlations with habitat conditions. No scaly sand darters were collected in 2002-2003 and were recommended for removal as an NFGT indicator for the same reason as the dusky darter.

Need for Change

The species has been absent from quality habitats for no apparent reason. It has also been available and elusive 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. Geographically, this should only apply to the North Sabine, where streams have higher gradients. Duskys are rare on the Angelina, but then occur immediately north around Nacogdoches. It doesn't make sense, as the Ouachita also concluded and dropped the species from their MIS rolls. They were the only other Forest in Region 8 with the Dusky on their MIS list. 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 nuances contribute to anomalous results. ***Recommend this species be removed from as a Forest indicator.***

Sabine Shiner (*Notropis sabinae*) Selected as an indicator for rivers and streams, this species is found in clear, silt-free streams with sandy bottoms and once ranged throughout the Angelina and Neches River watersheds.

The following sources of data and information were used in this analysis:

1. Kelly, J.P. 1995. An ichthyological survey of the Davy Crockett National Forest, Texas. Unpubl. M.S. thesis, Stephen F. Austin State University (SFA), Nacogdoches, TX, 212 pp.
2. Provine, W.C. 1972. A preliminary study of the proposed Lake Conroe and a survey of the San Jacinto River. Job completion report, Federal Aid project No. F-12-R-17.
3. NFGT personnel surveys and reports.

Effects of Management

Provine found the Sabine shiner in four different streams on the Sam Houston NF. Despite surveys of over 50 sites by Texas A&M cooperators and 20 sites by Forest Service personnel, this species only appeared in a Peach Creek pool in 1998 during extreme drought conditions. Siltation problems on this Forest from ORVs, roads and private land activities may have impacted this species and its habitat. The construction of Lake Conroe also eliminated some former habitats. 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 in finding the species. This forest also has some erosion problems, primarily caused by roads and crossings. 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 insured.

No Sabine shiners were collected in 2002-2003. However, a key habitat requirement was identified. At the 2003 Texas Chapter of the American Fisheries Society, Dr. Timothy Bonner of Texas State University indicated that their studies of La Nana Creek populations demonstrated a need for at least 13 miles of unimpeded stream reach to facilitate the shiner's life cycle. It would

appear that this requirement is not being met on any of the Forests. "Sabine Shiner Restorations Streams" were identified on each Forest and work was begun to identify and prioritize fish passage work within these watersheds.

Additionally, Dr Neil Douglas's 1974 Survey of Endangered, Threatened, Peripheral, Status Undetermined and Unique Fishes of the National Forests in Texas, was reviewed and the historic collection data on the Angelina and Sabine National Forests were requested from Northeast Louisiana University in Monroe.

Three sites on Banita Creek and one on Lanana Bayou were sampled by Casey Williams of Texas State University from September 2001 through October 2002. These creeks are primarily within and around the city of Nacogdoches, but feed into the Angelina River through Lanana Bayou, which has its confluence with the river on the Angelina Forest near US 59. This study increased greatly changed our understanding of the population status and dynamics within the Texas-Louisiana range. Most critical was the revelation that Kisatchie Bayou does not contain the most stable population. The urban Banita/Lanana stream complex had much greater species diversity and numbers of Sabine shiners. 1246 shiners were collected in monthly samples in the Banita complex while Kisatchie Bayou only yielded 222 individuals. This new information places much greater priority on habitat restoration and protection at the Lanana-Angelina confluence on Forest, especially since it is several hundred feet downstream from a proposed interstate highway bridge project.

Need for Change

It is apparent that this species is extremely depleted on the forest. Reintroduction into a suitable watershed that lies mostly within USFS holdings would be advisable. Repairing and limiting erosive activities on other reaches of the forest would serve to improve habitats and increase the likelihood of natural reoccupation.

Scaly Sand Darter (*Ammocrypta vivax*) Although an inhabitant of creeks and rivers of various size 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. Therefore, we also have it listed as a Forest Sensitive Species.

The following sources of data and information were used in this analysis:

1. William Provine's 1972 survey of 69 sites within East and West Forks of the San Jacinto River, provides us with the best source of historic fisheries data on the NFGTS. Texas A&M cooperators, Matt Herbert

(1997) and Brian Healy (2000) completed blanket coverage on the Sam Houston National Forest.

2. Dr. Jack McCullough of Stephen F. Austin University (SFA) conducted an extensive survey of Graham Creek on the Angelina National Forest in 1980 and his student, P. Dakus Geeslin completed blanket coverage of Graham and other Angelina creeks in 2001.
3. We have little historic data from the Sabine National Forest. SFASU cooperator, Greg Rogers, sampled three streams in 1994. Environmental consultant, Espey-Huston, surveyed several streams in 1994 to monitor a post-construction power line. SFASU coop, Robin Ann Reese monitored three streams in the Indian Mounds Wilderness Area.
4. Forest Fisheries Biologist, Craig Hilburn, did a cursory sampling of several streams on the northwest Davy Crockett National Forest in 1989. SFASU coop, Jess Kelly followed suit with blanket coverage in 1995.
5. Spot samples have been conducted by the current Forest Fisheries Biologist, on all four Forests, since 1991.

Effects of Management

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 1997, Healy 2000) 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 forest (Howells), have greatly impacted this darter.

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

Jess Kelly's 1995 blanket 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).

Need for Change

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 mostly disappeared from the Sam Houston NF due to the same conflicts with ORVs, roads and private land uses that have caused siltation and pollution sufficient to extirpate almost all mussels from the San Jacinto Watershed. Clearly, there is a need for change in terms of land-use activities. 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. This species does not have near the distribution of the dusky darter and may be interchangeable with the redfin darter in some areas.

Stonefly Guild. These include all the macroinvertebrates as a group and rated by an established scoring system, such as the abbreviated EPA form used by the Forest or Hilsenhoff's Biotic Index (HBI), which is similar to an IBI. This index assigns tolerance values to individual organisms. Those with a low tolerance value are more susceptible to pollution, while organisms with a higher tolerance value are more tolerant of pollutants. Other analyses of macroinvertebrate diversity and richness can also be used.

During the 2002-2003 reporting period, three kick-net macroinvertebrate samples were taken in the Pine Spring watershed of the Davy Crockett National Forest. Only scuds were found, which yielded a poor water quality score on the abbreviated EPA form. Possible causes were low pH, lack of flow and siltation from road ditch erosion.

Crayfish are part of the "stonefly" macroinvertebrate cadre and are considered to have moderate tolerance, which can include wide range of water quality conditions. Included also in this moderate group are scuds, clams (mussels) dragonfly nymphs, crane fly larvae and beetle larvae. We do know from prior studies that crayfish are sensitive enough to avoid impacted habitat, such as a creek that was receiving polluted runoff from Ft Polk's vehicle maintenance compound near the Kisatchie National Forest.

In 2002, five sites on the Davy Crockett were sampled, with catches at three sites. Two of the three sites yielded R8 Sensitive Procambarus kensleyi specimens. The more common P. dupratzi was collected from Blue Bayou on the Sabine in 2002. In 2002 Sam Houston sampled 10 streams for crayfish, yielding six sites inhabited by the common P. clarkii. In 2003 11 sites were sampled on the Angelina for crayfish. Specimens were collected at five of these sites. Four sites on the Davy Crockett were trapped, yielding specimens at two sites. Crayfish were collected at three sites on the Sabine in 2003, producing common P. durpratzi and ortmannicus, but also the first record of the R8 Sensitive P. kensleyi on the NFGT. We do believe this species is more common

than thought and that its rarity is primarily an aspect of limited sampling. Of the five samples collected on the Angelina, two contained the R8 Sensitive P. nechesae. These are the first records of this species since it was described in 1990 (Hobbs). Two samples on the Davy Crockett produced both R8 sensitive species, P. nigrocinctus and P. kensleyi specimens.

The tapered pondhorn, a mussel, was collected by consultants on the Sam Houston in 2003. Mussels are considered to be sensitive indicators of siltation, since they are bottom-dwelling filter feeders. They are also part of the Stonefly Guild, grouping of indicators, typical of a wide range of water conditions, but not considered tolerant of pollution. The pondhorn is a hardy mussel that is capable of withstanding drought by burrowing into bottom muds. Its presence is not necessarily an indicator of good water quality, but any mussel presence is positive in an area where mussel disappearance has been a concern.

The following sources of data and information were used in this analysis:

1. Hatfield, W.T. 1997. A benthic macroinvertebrate and physiochemical analyses of three East Texas streams. Unpubl. M.S. thesis, SFA, Nacogdoches, TX, 99 pp.
2. Hobbs, H.H. On the crayfishes (decapoda: cambaridae) of the Neches River basin of eastern Texas with the descriptions of three new species. Proc Biol Soc Wash 103(3), 1990.
3. Reese, R.A. 1998. The effect of southern pine beetle damage on the water quality of two streams in Indian Mounds Wilderness Area: a macroinvertebrate and physiochemical analysis. Unpubl. M.S. thesis, SFA, Nacogdoches, TX, 124 pp.
4. Turner, J.W. 2001. A benthic macroinvertebrate analysis of six streams in the Angelina National Forest, Texas. Unpubl. M.S. thesis, Stephen F. Austin State University, Nacogdoches, TX, 109 pp.
5. Moore, K.L. 2000. An analysis of the effects of large woody debris by macroinvertebrates, physiochemical, and ichthyological surveys of two sites in the Sabine National Forest. Unpubl. M.S. thesis, Stephen F. Austin State University, Nacogdoches, TX, 191 pp.

Effects of Management

On the Angelina NF, only Big and Graham Creeks compared to the South Prong reference stream of having low stress, or an “excellent” rating. Boykin Creek received a “good” rating, while Turkey, Sandy and Scott Creek garnered a “good to fair” rating.

The trend follows through for habitats. Scott Creek showed a large amount of organic matter, resulting in low dissolved oxygen and dark water. Turkey Creek was impacted by drought, exhibiting a high degree of pooling.

Table 8. Percent Comparison Of Habitat Assessment By Stream

Study Stream	Habitat Score	Reference Score	Percent Comparability*	Assessment Category
Big Creek	168	98	171%	Comparable
Boykin Springs	143	98	146%	Comparable
Graham Creek	167	98	170%	Comparable
Sandy Creek	150	98	153%	Comparable
Turkey Creek	134	98	137%	Comparable
Scott Creek	158	98	161%	Comparable

*Percent Comparability = (Study site/Reference site) 100

On the Sabine NF, Cypress Creek was monitored in response to large woody inputs from a storm. As evident below, the HBI scores were actually better than the similar San Augustine reference stream. Overall, Cypress had levels in the "good" range.

Table 9.

Month	Sites		
	Cypress Upstream	Cypress Downstream	San Augustine
January	6.86	5.53	7.63
February	4.72	6.34	8.03
March	6.20	6.00	7.62
April	6.10	5.80	7.53
May	6.50	6.90	6.57
June	7.74	6.70	5.80
July	5.20	6.40	.
August	7.80	6.00	.
September	5.09	4.60	7.75
October	5.10	6.47	6.68
November	5.33	6.65	7.51
December	4.97	5.58	7.47
Annual Mean	5.97	6.08	7.26
Range			
Minimum	4.72	4.60	5.80
Maximum	7.80	6.90	8.03

Robin Ann Reese surveyed three Sabine creeks with comparable results that are displayed below.

Table 10.

ANOVA for HBI	Indian Creek	Hurricane Creek	Bull Creek
Dipnet sample	6.332	6.952	7.17
Grab sample	6.975	8.097	8.213

Intolerant species were more prevalent in Indian Creek, while high percents of tolerant species were noted in Bull Creek [indicative of higher amounts of Southern Pine Beetle (SPB) killed timber and silt in the creek].

William Hatfield sampled creeks on the Angelina, Sabine and Davy Crockett, with HBI values as follows:

Table 11.

Brawley Creek	Camp Creek	Trout Creek
7.88	5.23	5.55

All three streams were said to be of “good” quality, with Trout and Brawley exhibiting some stressful conditions (primarily factors of low pH, flow, detrital input and watershed size). Camp Creek had high-quality indicators year-round.

Need for Change

Although, more finite in displaying causative parameters, macroinvertebrates basically echo what is being found in the fish community. Ground disturbing activities in and near streamside zones lower habitat quality. *The Plan* objective 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.

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