

4 Document, in the permanent planning records for a forest plan or project-level plan, the rationale, assumptions, and procedures used in selecting management indicators.

5 Document, within the forest or project plan, how management indicators collectively address issues, concerns, and opportunities for meeting overall wildlife and fish, including endangered, threatened, and sensitive species goals for the plan or project area

### **2621.2 Determination of Conservation Strategies.**

To preclude trends toward endangerment that would result in the need for Federal listing, units must develop conservation strategies for those sensitive species whose continued existence may be negatively affected by the forest plan or a proposed project. To devise conservation strategies, first conduct biological assessments of identified sensitive species. In each assessment, meet these requirements.

1. Base the assessment on the current geographic range of the species and the area affected by the plan or project. If the entire range of the species is contained within the plan or project area, limit the area of analysis to the immediate plan or project area. If the geographic range of the species is beyond the plan or project area, expand the area of analysis accordingly.

2 Identify and consider, as appropriate for the species and area, factors that may affect the continued downward trend of the population, including such factors as: distribution of habitats, genetics, demographics, habitat fragmentation, and risk associated with catastrophic events

3. Display findings under the various management alternatives considered in the plan or project (including the no-action alternative).

Biological assessments may also be needed for endangered or threatened species for which recovery plans are not available. See FSM 2670 for direction on biological assessments for endangered and threatened species.

### **2621.3 Analysis of Habitat Capability.**

In analyzing proposed actions, conduct habitat analyses to determine the cumulative effects of each alternative on management indicators selected in the plan or project area. Follow these guidelines for the analyses

1. Define analysis areas of sufficient size to allow adequate evaluation of the cumulative effects on management indicators.

2 Use models, coefficients, and other components of the Wildlife and Fish Habitat Relationships System (FSM 2603, para. 6) to quantify conditions, trends, and responses of management indicators to each management alternative being considered, and the desired future condition.

3. Include in the analysis all management activities proposed for the current planning period, their interactions and collective effects on the distribution and abundance of habitat in space and time, on vegetation succession, and on natural disturbance regimes

#### **2621.4 Determination of Standards, Guidelines, and Objectives.**

The forest plan must identify habitat components required by management indicators, determine goals and objectives for management indicators, specify standards, guidelines, and prescriptions needed to meet management requirements, goals, and objectives for management indicators. Prescribe mitigation measures, as appropriate, to ensure that requirements, goals, and objectives for each management indicator will be sufficiently met during plan implementation at the project level.

#### **2621.5 Monitoring and Evaluation of Management Indicators.**

Conduct monitoring of plans and projects to determine whether standards, guidelines, and management prescriptions for management indicators are being met and are effective in achieving expected results. Use monitoring and evaluation to guide adjustments in management and to revise or refine habitat relationships information and analysis tools used in planning. Follow direction in FSM 1922.7 and FSH 1909.12, chapter 6, in conducting monitoring and evaluation of management indicators.

Involve Research Stations, universities, and other research entities in monitoring to ensure that appropriate sampling methods are employed and statistically valid results are obtained.

### **2622 BIOLOGICAL DIVERSITY REQUIREMENTS.**

#### **2622.0 Authority.**

In the USDA Decision of Review of Administrative Appeals of the Beaverhead National Forest Land and Resource Management Plan of August 17, 1989, the Office of the Secretary interpreted the requirements of 36 CFR 219.19 and DR 9500-4 (sec 2620 1) to require that plans should identify or be amended to identify known sensitive species and provide forest standards and guidelines that ensure conservation when an activity or project is proposed that would affect the habitat of a sensitive species. A forest plan must address biological diversity through consideration of the distribution and abundance of plant and animal species, and communities to meet overall multiple-use objectives.

1. Management direction in a forest plan shall contribute to the recovery of Federally listed threatened or endangered species (Endangered Species Act, 36 CFR 219 19).
2. Management of habitat provides for the maintenance of viable populations of existing native and desired non-native, wildlife, fish (36 CFR 219.19), and plant species (USDA Regulation 9500-4) generally well distributed throughout their current geographic range (sec 2620 01).
3. Management of those plant and animal communities identified in Regional Guides or Forest Plans as issues that warrant special measures achieves overall multiple-use objectives (36 CFR 219.8, 219 12(b), 219.27)
4. Management direction in a forest plan shall include objectives for selected management indicators (36 CFR 219 19) Specify the following for plant and animal species, communities, and/or special habitats identified as major Forest Plan issues or as management indicators in the plan:

- a. Standards and guidelines for protection, viability, recovery, or restoration as appropriate to meet overall multiple-use objectives (36 CFR 219 27),
- b. The expected future conditions in terms of distribution and abundance of populations or habitats to meet overall multiple-use objectives (36 CFR 219 11, 219 26),
- c. The schedule for monitoring and evaluation of standards, guidelines, and objectives for plant and animal species, communities (36 CFR 219 27), and
- d. The discussion of any proposed type conversions. If any conversion results in a reduction in diversity, explanation must be provided as to why the conversion is necessary to achieve multiple use objectives (36 CFR 219.27).

## **2623 QUANTIFYING OUTPUTS AND VALUES.**

In all forest plans and project level plans, express habitat objectives, outputs, and effects in quantitative terms using the following data elements:

1. **Habitat Capability.** Use habitat capability to specify habitat objectives and to project outputs and cumulative effects. Report habitat capability as the net change in potential numbers of animals (or biomass of fish) that can be supported within the area of evaluation
2. **Acres and Structures** Express planned or completed habitat improvements as the number of acres treated or structures installed. Accompany these reports with the outputs (changes in habitat capability for the management indicators) expected to result from the improvements.
3. **Recovery Tasks.** Establish objectives and report accomplishments for endangered or threatened species as the Forest Service share of recovery tasks achieved pursuant to species recovery plans in coordination with the States and the U S Fish and Wildlife Service (FSM 2671.1 and 2671.4) or in accordance with Forest Service conservation strategies
4. **Economic Value** Conduct economic analyses in compliance with guidelines in FSM 1970 and FSH 1909 17 (Economic and Social Analysis Handbook). For projects producing recreational outputs (user days), value these outputs based on prices established in Appendix E of the 1990 Renewable Resource Program (RPA). For proposals producing outputs of commercial value, such as anadromous fish, use market-clearing prices established in the 1990 RPA Program or local dockside values adjusted according to the methods in Appendix E of the 1990 Program

## **2624 SIKES ACT PLANNING.**

### **2624.01 Authority.**

The Sikes Act as amended (74 Stat. 1052, 88 Stat. 1369) 16 U.S.C. 670g) requires that the Secretaries of Agriculture, Defense and the Interior develop comprehensive plans for management and improvement of wildlife, fish, and threatened and endangered species habitat on lands under their control in cooperation with State wildlife and fisheries agencies.

### **2624.1 Integration With Forest Planning.**

Meet requirements of the Sikes Act through the Forest planning process. Coordinate management and improvement of wildlife, fish, and endangered and threatened species habitat through implementation of Forest plans. Implement Sikes Act schedules as 5-year operating plans for accomplishing wildlife and fisheries goals identified in Forest plans. Link these operating plans with the program planning and budgeting process. Ensure Sikes Act agreements are consistent with Forest plans.

## **2625 INVENTORY AND DATA MANAGEMENT.**

Avoid collecting unnecessary information. Be sure that collection, storage, or manipulation of data on wildlife, fish, and their habitats is needed to meet specific information needs and objectives. To the extent possible, obtain and manage information as follows to achieve integration with existing systems and to prevent collection and storage of non-essential data.

- 1 Identify the specific data items required to support habitat evaluations for management indicators within the plan or project area. Obtain these data from existing sources such as vegetation inventories, timber or soil surveys, or integrated resource databases. Collect additional field data if required items are not available or if field verification of existing data is needed.
- 2 Obtain information on actual occurrence and status of populations as required for assessments or to meet legal requirements for endangered and threatened species in plans and projects. Seek data first from existing sources such as State Heritage Databases or records of the U.S. Fish and Wildlife Service or State wildlife and fish agencies. Conduct field surveys as necessary to verify or supplement available information.
- 3 Coordinate collection of all of new data with Forest, Regional, and National information management programs (FSM 1390) including the Wildlife and Fish Habitat Relationships System (FS-2600-WLF).
- 4 Ensure that data acquisition and management occur in coordination with the Service-wide integrated data environment standards and implementation of geographic information systems (FSM 1390).
5. Retain resource data, surveys, and inventories until superseded by new information on the same area.

# EXHIBIT D

## Species and Communities of the NFGT

### MAMMALS

The mammals of the National Forests and Grasslands are identified and discussed separately.

#### Mammals of the Forest

Some 161 species of mammals have been recorded in Texas (Davis 1978), of these, six are introduced and have become established in the wild. Four species are classified as extirpated, including the bison, gray wolf, grizzly bear, and the red wolf. The extirpated red wolf's range recently included the pineywoods of East Texas. Another large mammal, the Louisiana black bear, has not been a resident of east Texas for many years, however recently reports of black bear have been documented. Eighteen of the species recorded in Texas are marine species found in the coastal waters of the state. Of the remaining 132 species, 90 are considered not to be endemic to the pineywoods or are not dependent on forested habitats.

**42**      *Forty-two mammalian species are found on the planning area and are dependent on forested habitats.*

A species habitat matrix was constructed for these 42 species from information contained in The Mammals of Texas (Davis 1973)

#### Mammals of the Grasslands

Of the 161 species of mammals recorded in Texas, 50 are known from one or both of the Texas National Grasslands. There are 33 species common to both Grasslands. The LBJ has another eight species not found on the Caddo, for a total of 41 species. The Caddo has nine species not found on the LBJ for a total of 42 species.

Of the 41 LBJ species, six are considered not to be dependent on the LBJ habitat. Of the 42 Caddo species, seven are considered not to be dependent on the Caddo habitat.

**35**      *Thirty five mammalian species are found on each Grasslands planning area and are dependent on these habitats.*

Species habitat matrices were constructed for the 35 LBJ species and the 35 Caddo species which are dependent upon National Grassland habitat.

### BIRDS

The birds of the National Forests and Grasslands are identified and discussed separately.

## Birds of the Forest

Some 550 species of birds including those that are now believed extinct or extirpated and those that are accidental or hypothetical in occurrence have been recorded in Texas (Peterson 1963). Texas can claim diversity by virtue of size alone, but even more significant than size in determining its rich avifauna is the state's location on the North American continent. Not only does East meet West, biologically, in the state, but also North meets South and many birds from the northern plains meet Mexican types. A large percentage of those North American birds that spend the winter in the tropics pass through Texas on their migrations, greatly augmenting a large winter and a large resident population. Almost 400 miles of coastline and numerous large inland reservoirs provide favorable conditions for those species with an affinity for large open bodies of water or aquatic habitats.

Of the 550 species recorded, five—the Eskimo curlew, passenger pigeon, Carolina parakeet, ivory-billed woodpecker, and Bachman's warbler, are either extinct or extirpated. Three species—the trumpeter swan, California condor and sharp-tailed grouse formerly lived in or visited Texas but no longer do so. Fifty-five species, those that have been recorded in the State but whose occurrence in the State are unexpected, are classified as accidental or hypothetical.

Of the 487 species remaining, 303 have been recorded in the pineywoods of east Texas (Fisher and Wolf 1979; Peterson 1963). A number of those species recorded in east Texas, approximately 135, can be classified as not being dependent on forested habitats or not occurring on the National Forests in Texas. The remaining 163 species are those that are known or suspected to occur on the planning area and are dependent on forested habitats. Of the 303 species of east Texas birds, 116 are known or suspected to breed in the region, 96 of which are known or suspected to breed on the planning area and are dependent on forested habitats.

A bird checklist of the region (Fisher and Wolf 1979) shows the fluctuation in numbers of species throughout the year: Spring (March-May) - 261 species, Summer (June-July) - 132 species, Fall (August-November) - 267 species, Winter (December-February) - 162 species. This shows that the summer and winter resident populations are bolstered during the spring and fall migrations. East Texas forested habitats, even though they may not be essential breeding or wintering habitat, provide many of those species in transit with temporary refuge, resting, and feeding areas.

**107      *One Hundred seven bird species are found on the Forest planning area and are dependent on these habitats.***

The 170 species known to occur on the planning area and dependent on forested habitats are shown in the habitat matrix included in the Appendix. The matrix was constructed primarily from information contained in Bird-Habitat Associations on Southeastern Forest Lands (Legrand and Hamel 1980), Relative Abundance of Breeding Birds in Forest Stands in the Southeast (Dickson, Conner and Williamson 1980), Forest Habitats for Birds of the Northeast (Degraaf, et. al. 1981), Process Record for Selection of Management Indicator Species, National Forests in Alabama (Hedrick, 1981), A Guide to Field Identification of Birds of North America (Robbins, Bruun and Zim 1966), and A Field Guide to the Birds of Texas (Peterson 1963).

## **Birds of the Grasslands**

Of the some 550 species of birds recorded in Texas, 273 are known or expected to occur on one or both of the Texas National Grasslands. There are 249 species common to both of the Grasslands. The LBJ has another 14 species, not found on the Caddo, for a total of 263 species. The Caddo has 10 species not found on the LBJ, for a total of 259 species.

Of the 263 LBJ species, 118 are considered not to be dependent on the LBJ Grassland habitat. Of the 259 Caddo species, 119 are considered not to be dependent on the Caddo Grassland habitat.

Of the 119 "not dependent" Caddo species, 82 are considered associates of water, 37 are associated with other habitats.

Of the 118 "not dependent" LBJ species, 80 are considered associates of water and 38 with other habitats.

**145**      *One Hundred forty five bird species are found on each Grasslands planning area and are dependent on these habitats.*

Species habitat matrices were constructed for the 145 LBJ species and the 140 Caddo species.

## **REPTILES AND AMPHIBIANS**

The reptiles and amphibians of the National Forests and Grasslands are identified and discussed separately.

### **Reptiles and amphibians of the Forests**

Some 148 species and subspecies of reptiles and 62 species and subspecies of amphibians have been recorded in Texas east of the 100th meridian (Conant 1958). Of these, 59 reptiles and 30 amphibians are endemic to the pineywoods of East Texas. These include 19 reptiles and eight amphibians that are most closely associated with aquatic habitats.

**61**      *40 reptiles and 21 amphibians are known to occur on the planning area and are dependent on forested habitats.*

Habitat matrices were constructed for these 61 Forest species.

### **Reptiles and amphibians of the Grasslands**

Of the some 148 species and subspecies of reptiles and 62 species and subspecies of amphibians that have been recorded in the eastern half of Texas, 70 reptiles and 22 amphibians are endemic to one or both of the Texas National Grasslands.

There are 37 reptiles and nine amphibians common to the Grasslands. The LBJ has another 17 reptiles and seven amphibians not found on the Caddo, for a total of 54 reptiles and 16 amphibians. The Caddo has 16 reptiles and six amphibians not found on the LBJ, for a total of 53 reptiles and 15 amphibians.

Ten of the 54 LBJ reptiles and 2 of the 16 amphibians are considered to be not dependent upon the LBJ Grasslands habitat. Eighteen of the 53 Caddo reptiles and 5 of the 15 Caddo amphibians are considered not to be dependent upon grasslands habitat

**58/45** *Fifty eight species (LBJ) and forty five (CADDO) species found on each Grasslands planning area and are dependent on these habitats.*

Species habitat matrices were constructed for the 44 LBJ reptiles and 14 amphibians and the 35 Caddo reptiles and 10 amphibians

## FISHES

The fishes of the National Forests and Grasslands are identified and discussed separately

### Fishes of the Forests

Some 218 species of fish have been recorded in the freshwater of Texas (Hubbs 1972; Eddy 1969). Of these, at least 11 species were introduced into the state and have successfully become established. Another 48 species are those that typically inhabit brackish or salt water and enter only the coastal streams. Of the remaining 159 species, 112 have ranges that include the waters of the pineywoods of East Texas (Hubbs 1972).

**89** *Eighty nine fish species are found on the Forest planning area that are dependent on associated aquatic habitats.*

Of the 112 East Texas species, 89 are known or suspected to exist on or immediately adjacent to the lands of at least one of the four Texas National Forest (Seehorn, undated).

### Fishes of the Grasslands

Of the 218 species of fish recorded in the freshwaters of Texas, 77 are known or suspected to occur on one or both of the Texas National Grasslands. There are 44 species common to both of the Grasslands. The LBJ has another eight species not found on the Caddo, for a total of 52 species. The Caddo has 25 species not found on the LBJ, for a total of 69 species.

**52** *fifty two fish species are found on LBJ Grasslands planning area and are dependent on associated aquatic habitats.*

**69** *Sixty nine fish species are found on Caddo Grasslands planning area and are dependent on associated aquatic habitats.*

# EXHIBIT D

## NFGT Short List of Species - Communities

### NATIONAL FOREST & GRASSLAND MAMMALS

Common Name	Scientific Name
Opossum	<i>Didelphis virginiana</i>
Eastern Mole	<i>Scalopus aquaticus</i>
Short-tailed Shrew	<i>Blarina brevicauda</i>
Least Shrew	<i>Cryptotis parva</i>
Georgia Bat	<i>Pipistrellus subflavus</i>
Big Brown Bat	<i>Eptesicus fuscus</i>
Hoary Bat	<i>Lasiurus cinereus</i>
Red Bat	<i>Lasiurus borealis</i>
Seminole Bat	<i>Lasiurus seminolus</i>
Evening Bat	<i>Nycticeius humeralis</i>
Rafinesque's Big-eared Bat	<i>Plecotus rafinesquii</i>
Florida Free-tailed Bat	<i>Tadarida cynocephala</i>
Raccoon	<i>Procyon lotor</i>
Long-tailed Weasel	<i>Mustela frenata</i>
Mink	<i>Mustela vison</i>
River Otter	<i>Lutra canadensis</i>
Eastern Spotted Skunk	<i>Spilogale putorius</i>
Striped Skunk	<i>Mephitis mephitis</i>
Hog-nosed Skunk	<i>Conepateus mesoleucus telemestes</i>
Red Fox	<i>Vulpes vulpes</i>
Gray Fox	<i>Urocyon cinereoargenteus</i>
Coyote	<i>Canis latrans</i>
Bobcat	<i>Felis rufus</i>
Eastern Gray Squirrel	<i>Sciurus carolinensis</i>
Fox Squirrel	<i>Sciurus niger</i>
Eastern Flying Squirrel	<i>Glaucomys volans</i>
Plains Pocket Gopher	<i>Geomys breviceps</i>
Hispid Pocket Mouse	<i>Perognathus hispidus</i>
Beaver	<i>Castor canadensis</i>
Fulvous Harvest Mouse	<i>Reithrodontomys fulvescens</i>
Dwarf Harvest Mouse	<i>Reithrodontomys humulis merriami</i>
Deer Mouse	<i>Peromyscus maniculatus ozarkiarum</i>
White-footed Mouse	<i>Peromyscus leucopus</i>
Cotton Mouse	<i>Peromyscus gossypinus</i>
Golden Mouse	<i>Ochrotomys nuttalli</i>
Northern Rice Rat	<i>Oryzomys palustris</i>

## MAMMALS (continued)

Common Name	Scientific Name
Hispid Cotton Rat	<i>Sigmodon hispidus</i>
Florida Wood Rat	<i>Neotoma floridana rubida</i>
Wood Rat	<i>Neotoma floridana attwateri</i>
Pine Vole	<i>Microtus pinetorum</i>
Eastern Cottontail	<i>Sylvilagus floridanus</i>
Swamp Rabbit	<i>Sylvilagus aquaticus</i>
White-tailed Deer	<i>Odocoileus virginianus</i>
Nine-banded Armadillo	<i>Dasypus novemcinctus</i>
Guano Bat	<i>Tadarida mexicana</i>
Mexican Free-tailed Bat	<i>Tadarida brasiliensis</i>
Thirteen-lined Ground Squirrel	<i>Spermophilus tridecemlineatus</i>
Plains Harvest Mouse	<i>Reithrodontomys montanus</i>
Pygmy Mouse	<i>Baiomys taylori</i>
Texas Mouse	<i>Peromyscus attwateri</i>
Muskrat	<i>Ondatra zibethicus</i>
Blacktail Jackrabbit	<i>Lepus californicus</i>

## NATIONAL FOREST & GRASSLAND BIRDS

Common Name	Scientific Name
Double-crested Cormorant	<i>Phalacrocorax auritus</i>
Anhinga	<i>Anhinga anhinga</i>
Great Blue Heron	<i>Ardea herodias</i>
Green Heron	<i>Butorides striatus</i>
Little Blue Heron	<i>Egretta caerulea</i>
Cattle Egret	<i>Bubulcus ibis</i>
Great Egret	<i>Casmerodius albus</i>
Snowy Egret	<i>Egretta thula</i>
Louisiana Heron	<i>Egretta tricolor</i>
Yellow-crowned Night Heron	<i>Nycticorax violaceus</i>
Wood Stork	<i>Mycteria americana</i>
White Ibis	<i>Eudocimus albus</i>
Wood Duck	<i>Aix sponsa</i>
Hooded Merganser	<i>Lophodytes cucullatus</i>
Turkey Vulture	<i>Cathartes aura</i>
Black Vulture	<i>Coragyps atratus</i>
Swallow-tailed Kite	<i>Elanoides forficatus</i>
Mississippi Kite	<i>Ictinia mississippiensis</i>
Sharp-shinned Hawk	<i>Accipiter striatus</i>
Cooper's Hawk	<i>Accipiter cooperii</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>
Red-shouldered Hawk	<i>Buteo lineatus</i>
Broad-winged Hawk	<i>Buteo platypterus</i>
Rough-legged Hawk	<i>Buteo lagopus</i>
Golden Eagle	<i>Aquila chrysaetos</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>
Osprey	<i>Pandion Haliaeetus</i>
American Kestrel	<i>Falco sparverius</i>
Northern Bobwhite Quail	<i>Colinus virginianus</i>
Turkey	<i>Meleagris gallopavo</i>
Killdeer	<i>Charadrius vociferus</i>
American Woodcock	<i>Scolopax minor</i>
Mourning Dove	<i>Zenaida macroura</i>
Common Ground Dove	<i>Columbina passerina</i>
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>
Greater Roadrunner	<i>Geococcyx californianus</i>
Barn Owl	<i>Tyto alba</i>
Eastern Screech Owl	<i>Otus asio</i>
Great Horned Owl	<i>Bubo virginianus</i>
Barred Owl	<i>Strix varia</i>
Short-eared Owl	<i>Asio flammeus</i>
Chuck-will's widow	<i>Caprimulgus carolinensis</i>
Whip-poor-will	<i>Caprimulgus vociferus</i>
Ruby-throated Hummingbird	<i>Archilochus colubris</i>

BIRDS (continued)

Common Name	Scientific Name
Belted Kingfisher	Magaceryle alcyon
Common Flicker	Colaptes auratus
Pileated Woodpecker	Dryocopus pileatus
Red-bellied Woodpecker	Melanerpes carolinus
Red-headed Woodpecker	Melanerpes erythrocephalus
Hairy Woodpecker	Picoides villosus
Downy Woodpecker	Picoides pubescens
Red-cockaded Woodpecker	Picoides borealis
Eastern Kingbird	Tyrannus tyrannus
Western Kingbird	Tyrannus verticalis
Scissor-tailed Flycatcher	Tyrannus forficatus
Great Crested Flycatcher	Myiarchus crinitus
Eastern Phoebe	Sayornis phoebe
Yellow-bellied Flycatcher	Empidonax flaviventris
Acadian Flycatcher	Empidonax virescens
Willow Flycatcher	Empidonax traillii
Least Flycatcher	Empidonax minimus
Eastern Wood-Pewee	Contopus virens
Olive-sided Flycatcher	Contopus borealis
Blue Jay	Cyanocitta cristata
American Crow	Corvus brachyrhynchos
Carolina Chickadee	Parus carolinensis
Tufted Titmouse	Parus bicolor
White-breasted Nuthatch	Sitta carolinensis
Red-breasted Nuthatch	Sitta canadensis
Brown-headed Nuthatch	Sitta pusilla
Brown Creeper	Certhia americana
House Wren	Troglodytes aedon
Winter Wren	Troglodytes troglodytes
Carolina Wren	Thryothorus ludovicianus
Northern Mockingbird	Mimus polyglottos
Gray Catbird	Dumetella carolinensis
Brown Thrasher	Toxostoma rufum
American Robin	Turdus migratorius
Wood Thrush	Hylocichla mustelina
Hermit Thrush	Catharus guttatus
Swainson's Thrush	Catharus ustulatus
Gray-cheeked Thrush	Catharus minimus
Veery	Catharus fuscescens
Eastern Bluebird	Sialia sialis
Blue-Gray Gnatcatcher	Poliptilia caerulea
Golden-crowned Kinglet	Regulus satrapa
Ruby-crowned Kinglet	Regulus calendula
Cedar Waxwing	Bombycilla cedrorum
Loggerhead Shrike	Lanius ludovicianus

## BIRDS (continued)

Common Name	Scientific Name
White-eyed Vireo	<i>Vireo griseus</i>
Bell's Vireo	<i>Vireo bellii</i>
Yellow-throated Vireo	<i>Vireo flavifrons</i>
Solitary Vireo	<i>Vireo solitarius</i>
Red-eyed Vireo	<i>Vireo olivaceus</i>
Philadelphia Vireo	<i>Vireo philadelphicus</i>
Warbling Vireo	<i>Vireo gilvus</i>
Black-and white Warbler	<i>Mniotilta varia</i>
Prothonotary Warbler	<i>Protonotaria citrea</i>
Swainson's Warbler	<i>Limnithlypis swainsonii</i>
Worm-eating Warbler	<i>Helmitheros vermivorus</i>
Golden-winged Warbler	<i>Vermivora chrysoptera</i>
Blue-winged Warbler	<i>Vermivora pinus</i>
Tennessee Warbler	<i>Vermivora peregrina</i>
Orange-crowned Warbler	<i>Vermivora celata</i>
Nashville Warbler	<i>Vermivora ruficapilla</i>
Northern Parula	<i>Parula americana</i>
Yellow Warbler	<i>Dendroica petechia</i>
Magnolia Warbler	<i>Dendroica magnolia</i>
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>
Yellow-rumped Warbler	<i>Dendroica coronata</i>
Black-throated Green Warbler	<i>Dendroica virens</i>
Cerulean Warbler	<i>Dendroica cerulea</i>
Blackburnian Warbler	<i>Dendroica fusca</i>
Yellow-throated Warbler	<i>Dendroica dominica</i>
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>
Bay-breasted Warbler	<i>Dendroica castanea</i>
Blackpoll Warbler	<i>Dendroica striata</i>
Pine Warbler	<i>Dendroica pinus</i>
Prairie Warbler	<i>Dendroica discolor</i>
Palm Warbler	<i>Dendroica palmarum</i>
Ovenbird	<i>Seiurus aurocapillus</i>
Northern Waterthrush	<i>Seiurus noveboracensis</i>
Louisiana Waterthrush	<i>Seiurus motacilla</i>
Kentucky Warbler	<i>Oporornis formosus</i>
Mourning Warbler	<i>Oporornis philadelphia</i>
Common Yellowthroat	<i>Geothlypis trichas</i>
Yellow-breasted Chat	<i>Icteria virens</i>
Hooded Warbler	<i>Wilsonia citrina</i>
Wilson's Warbler	<i>Wilsonia pusilla</i>
Canada Warbler	<i>Wilsonia canadensis</i>
American Redstart	<i>Setophaga ruticilla</i>
Bobolink	<i>Dolichonyx oryzivorus</i>
Eastern Meadowlark	<i>Sturnella magna</i>
Western Meadowlark	<i>Sturnella neglecta</i>

## BIRDS (continued)

Common Name	Scientific Name
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>
Red-winged Blackbird	<i>Agelaius phoeniceus</i>
Rusty Blackbird	<i>Euphagus carolinus</i>
Common Grackle	<i>Quiscalus quiscula</i>
Brown-headed Cowbird	<i>Molothrus ater</i>
Scarlet Tanager	<i>Piranga olivacea</i>
Summer Tanager	<i>Piranga rubra</i>
Northern Cardinal	<i>Cardinalis cardinalis</i>
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>
Blue Grosbeak	<i>Guiraca caerulea</i>
Indigo Bunting	<i>Passerina cyanea</i>
Painted Bunting	<i>Passerina ciris</i>
Dickcissel	<i>Spiza americana</i>
Evening Grosbeak	<i>Coccothraustes vespertinus</i>
Purple Finch	<i>Carpodacus purpureus</i>
Pine Siskin	<i>Carduelis pinus</i>
American Goldfinch	<i>Carduelis tristis</i>
Rufous-sided Towhee	<i>Pipilo erythrophthalmus</i>
Savannah Sparrow	<i>Passerculus sandwichensis</i>
Grasshopper Sparrow	<i>Ammodramus savannarum</i>
LeConte's Sparrow	<i>Ammodramus lecontei</i>
Henslow's Sparrow	<i>Ammodramus henslowii</i>
Vesper Sparrow	<i>Poocetes gramineus</i>
Lark Sparrow	<i>Chondestes grammacus</i>
Bachman's Sparrow	<i>Aimophila aestivalis</i>
Dark-eyed Junco	<i>Junco hyemalis</i>
Chipping Sparrow	<i>Spizella passerina</i>
Clay-colored Sparrow	<i>Spizella pallida</i>
Field Sparrow	<i>Spizella pusilla</i>
Harris' Sparrow	<i>Zonotrichia querula</i>
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>
White-throated Sparrow	<i>Zonotrichia albicollis</i>
Fox Sparrow	<i>Passerella iliaca</i>
Lincoln's sparrow	<i>Melospiza lincolni</i>
Swamp Sparrow	<i>Melospiza georgiana</i>
Song Sparrow	<i>Melospiza melodia</i>
Northern Goshawk	<i>Accipiter gentilis</i>
Marsh Hawk (Northern Harrier)	<i>Circus cyaneus</i>
Ferruginous Hawk	<i>Buteo regalis</i>
Harlan's Hawk	<i>Buteo jamaicensis</i>
Swainson's Hawk	<i>Buteo swainsoni</i>
Merlin	<i>Falco columbarius</i>
Burrowing Owl	<i>Athene cunicularia</i>
Saw-whet Owl	<i>Aegolius acadicus</i>
Long-eared Owl	<i>Asio otus</i>

BIRDS (continued)

Common Name	Scientific Name
Short-eared Owl	<i>Asio flammeus</i>
Common Nighthawk	<i>Chordeiles minor</i>
Chimney Swift	<i>Chaetura pelagica</i>
Black-chinned Hummingbird	<i>Archilochus alexandri</i>
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>
Ladder-backed Woodpecker	<i>Picoides scalaris</i>
Horned Lark	<i>Eremophila alpestris</i>
Barn Swallow	<i>Hirundo rustica</i>
Cliff Swallow	<i>Hirundo pyrrhonota</i>
Bank Swallow	<i>Riparia riparia</i>
Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>
Purple Martin	<i>Progne subis</i>
Bewick's Wren	<i>Thryomanes bewickii</i>
Mountain Bluebird	<i>Sialia currucoides</i>
Water Pipit	<i>Anthus spinoletta</i>
Sprague's Pipit	<i>Anthus spragueii</i>
Starling	<i>Sturnus vulgaris</i>
Black-capped Vireo	<i>Vireo atricapillus</i>
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>
Orchard Oriole	<i>Icterus spurius</i>
Northern Oriole	<i>Icterus galbula</i>
Lesser Goldfinch	<i>Carduelis psaltria</i>
Dickcissel	<i>Spiza americana</i>
Rufous-crowned Sparrow	<i>Aimophila ruficeps</i>
Tree Sparrow	<i>Spizella arborea</i>
McCown's Longspur	<i>Calcarius mccownii</i>
Chestnut-collared Longspur	<i>Calcarius ornatus</i>
Smith's Longspur	<i>Calcarius pictus</i>
Upland Sandpiper	<i>Bartramia longicauda</i>

NATIONAL FOREST & GRASSLAND AMPHIBIANS

Common Name	Scientific Name
Mole Salamander	<i>Ambystoma talpoideum</i>
Spotted Salamander	<i>Ambystoma maculatum</i>
Small-mouthed Salamander	<i>Ambystoma texanum</i>
Marbled Salamander	<i>Ambystoma opacum</i>
Eastern Tiger Salamander	<i>Ambystoma tigrinum tigrinum</i>
Southern Dusky Salamander	<i>Desmognathus auriculatus</i>
Ouachita Red-backed Salamander	<i>Plethodon cinereus serratus</i>
Dwarf Salamander	<i>Eurycea quadridigitata</i>
Hurter's Spadefoot Toad	<i>Scaphiopus holbrooki hurteri</i>
Fowler's Toad	<i>Bufo woodhousei fowleri</i>
Woodhouse's Toad	<i>Bufo woodhousei woodhousei</i>
Northern Spring Peeper	<i>Hyla crucifer crucifer</i>
Southern Gray Treefrog	<i>Hyla versicolor chrysocephala</i>
Squirrel Treefrog	<i>Hyla squirella</i>
Green Treefrog	<i>Hyla cinerea</i>
Eastern Narrow-mouthed Toad	<i>Gastrophryne carolinensis</i>
Northern Cricket Frog	<i>Acris crepitans crepitans</i>
Blanchards Cricket Frog	<i>Acris crepitans blanchardi</i>
Upland Chorus Frog	<i>Pseudacris triseriata feriarum</i>
Southern Leopard Frog	<i>Rana sphenoccephala</i>
Pickereel Frog	<i>Rana palustris</i>
Pig Frog	<i>Rana grylio</i>
Barred Tiger Salamander	<i>Ambystoma tigrinum mavortium</i>
Couch's Spadefoot	<i>Scaphiopus couchi</i>
Texas Toad	<i>Bufo speciosus</i>
Red-spotted Toad	<i>Bufo punctatus</i>
Eastern Green Toad	<i>Bufo debilis debilis</i>
Great Plains Narrow-mouthed Toad	<i>Gastrophryne olivacea</i>
Strecker's Chorus Frog	<i>Pseudacris streckeri</i>
Spotted Chorus Frog	<i>Pseudacris clarki</i>

## NATIONAL FOREST & GRASSLAND REPTILES

Common Name	Scientific Name
American Alligator	<i>Alligator mississippiensis</i>
Three-toed Box Turtle	<i>Terrapene carolina triunguis</i>
Green Anole	<i>Anolis carolinensis carolinensis</i>
Northern Fence Lizard	<i>Sceloporus undulatus hyacinthinus</i>
Texas Horned Lizard	<i>Phrynosoma cornutum</i>
Ground Skink	<i>Scincella lateralis</i>
Five-lined Skink	<i>Eumeces fasciatus</i>
Broad-headed Shink	<i>Eumeces laticeps</i>
Southern Coal Skink	<i>Eumeces anthracinus pluvialis</i>
Six-lined Racerunner	<i>Cnemidophorus sexlineatus sexlineatus</i>
Western Slender Glass Lizard	<i>Ophisaurus attenuatus attenuatus</i>
Rough Earth Snake	<i>Virginia striatula</i>
Western Smooth Earth Snake	<i>Virginia valerae elegans</i>
Northern Red-bellied Snake	<i>Storeria occipitomaculata occipitomaculata</i>
Texas Brown Snake	<i>Storeria dekayi texana</i>
Midland Brown Snake	<i>Storeria dekayi wrightorum</i>
Glossy Water Snake	<i>Natrix rigida</i>
Diamond Backed Water Snake	<i>Nerodia rhombifera rhombifera</i>
Broad Banded Water Snake	<i>Nerodia fasciata confluens</i>
Blotched Water Snake	<i>Nerodia erythrogaster transversa</i>
Yellow-bellied Water Snake	<i>Nerodia erythrogaster flavigaster</i>
Green Water Snake	<i>Nerodia cyclopion</i>
Eastern Garter Snake	<i>Thamnophis sirtalis sirtalis</i>
Western Ribbon Snake	<i>Thamnophis proximus proximus</i>
Western Mud Snake	<i>Farancia abacura reinwardti</i>
Eastern Hognose Snake	<i>Heterodon platyrhinos</i>
Mississippi Ringneck Snake	<i>Diadophis punctatus stictogenys</i>
Buttermilk Snake	<i>Coluber constrictor anthicus</i>
Eastern Yellow-bellied Racer	<i>Coluber constrictor flaviventris</i>
Eastern Coachwhip	<i>Masticophis flagellum flagellum</i>
Rough Green Snake	<i>Opheodrys aestivus</i>
Louisiana Pine Snake	<i>Pituophis melanoleucus ruthveni</i>
Texas Rat Snake	<i>Elaphe obsoleta lindheimeri</i>
Northern Scarlet Snake	<i>Cemophora coccinea copei</i>
Louisiana Milk Snake	<i>Lampropeltis triangulum amaura</i>
Prairie Kingsnake	<i>Lampropeltis calligaster calligaster</i>
Speckled Kingsnake	<i>Lampropeltis getulus holbrooki</i>
Flat-headed Snake	<i>Tantilla gracilis</i>
Texas Coral Snake	<i>Micrurus fulvius tenere</i>
Southern Copperhead	<i>Agkistrodon contortrix contortrix</i>
Western Pygmy Rattlesnake	<i>Sistrurus miliarius streckeri</i>
Canebrake Rattlesnake	<i>Crotalus horridus atricaudatus</i>
Timber Rattlesnake	<i>Crotalus horridus horridus</i>
Western Diamondback Rattlesnake	<i>Crotalus atrox</i>
Ornate Box Turtle	<i>Terrapene ornata ornata</i>

REPTILES (continued)

Common Name	Scientific Name
Collard Lizard	<i>Crotaphytus collaris</i>
Texas Spiny Lizard	<i>Sceloporus olivaceus</i>
Eastern Earless Lizard	<i>Holbrookia maculata perspicua</i>
Southern Prairie Lizard	<i>Sceloporus undulatus garmani</i>
Southern Prairie Skink	<i>Eumeces septentrionalis obtusirostris</i>
Great Plains Skink	<i>Eumeces obsoletus</i>
Spotted Whiptail	<i>Cnemidophorus gularis gularis</i>
Plains Blind Snake	<i>Leptotyphlops dulcis dulcis</i>
Texas Garter Snake	<i>Thamnophis sirtalis annectens</i>
Texas Lined Snake	<i>Tropidoclonion lineatum texanum</i>
Central Lined Snake	<i>Tropidoclonion lineatum annectens</i>
Dusty Hognose Snake	<i>Heterodon nasicus gloydi</i>
Prairie Ringneck Snake	<i>Diadophis punctatus arnyi</i>
Western Coachwhip	<i>Masticophis flagellum testaceus</i>
Great Plains Rat Snake	<i>Elaphe guttata emoryi</i>
Bullsnake	<i>Pituophis melanoleucus sayi</i>
Texas Long-nosed Snake	<i>Rhinocheilus lecontei tessellatus</i>
Great Plains Ground Snake	<i>Sonora episcopa episcopa</i>
Texas Night Snake	<i>Hypsiglena torquata texana</i>
Broad-banded Copperhead	<i>Agkistrodon contortrix laticinctus</i>
Western Massasauga	<i>Sistrurus catenatus tergeminus</i>

## NATIONAL FOREST FISHES

Common Name	Scientific Name
Brook Lamprey	<i>Ichthyomyzon gagei</i>
Paddlefish	<i>Poliodon spathula</i>
Alligator Gar	<i>Lepisosteus spatula</i>
Shortnose Gar	<i>Lepisosteus platostomus</i>
Spotted Gar	<i>Lepisosteus oculatus</i>
Longnose Gar	<i>Lepisosteus osseus</i>
Bowfin	<i>Amia calva</i>
Skipjack Herring	<i>Alosa chrysochloris</i>
Threadfin Shad	<i>Dorosoma petenense</i>
Gizzard Shad	<i>Dorosoma cepedianum</i>
Redfin Pickerel (Grass pickerel)	<i>Esox americanus</i>
Chain Pickerel	<i>Esox niger</i>
Golden Shiner	<i>Notemigonus crysoleucas</i>
Creek Chub	<i>Semotilus atromaculatus</i>
Speckled Chub	<i>Hybopsis aestivalis</i>
Suckermouth Minnow	<i>Phenacobius mirabilis</i>
Emerald Shiner	<i>Notropis atherinoides</i>
Ribbon Shiner	<i>Notropis fumeus</i>
Redfin Shiner	<i>Notropis umbratilis</i>
Ironcolor Shiner	<i>Notropis chalybaeus</i>
Weed Shiner	<i>Notropis texanus</i>
Pallid Shiner	<i>Notropis amnis</i>
Blacktail Shiner	<i>Notropis venustus</i>
Red Shiner	<i>Notropis lutrensis</i>
Blackspot Shiner	<i>Notropis atrocaudalis</i>
Mimic Shiner	<i>Notropis volucellus</i>
Ghost Shiner	<i>Notropis buchanaui</i>
Taillight Shiner	<i>Notropis maculatus</i>
Silvery Minnow	<i>Hybognathus nuchalis</i>
Cypress Minnow	<i>Hybognathus hayi</i>
Bullhead Minnow	<i>Pimephalis vigilax</i>
Stoneroller	<i>Campostoma anomalum</i>
Blue Sucker	<i>Cycleptus elongatus</i>
Smallmouth Buffalo	<i>Ictiobus bubalus</i>
River Carpsucker	<i>Carpionodes carpio</i>
Gray Redhorse	<i>Moxostoma congestum</i>
Blacktail Redhorse	<i>Moxostoma poecilurum</i>
Spotted Sucker	<i>Moxostoma melanopa</i>
Lake Chubsucker	<i>Erimyzon sucetta</i>
Creek Chubsucker	<i>Erimyzon oblongus</i>
Channel catfish	<i>Ictalurus punctatus</i>
Blue Catfish	<i>Ictalurus furcatus</i>
Black Bullhead	<i>Ictalurus melas</i>
Yellow Bullhead	<i>Ictalurus natalis</i>
Flathead Catfish	<i>Pylodictis olivaris</i>
Tadpole Madtom	<i>Noturus gyrinus</i>

FISHES (continued)

Common Name	Scientific Name
American Eel	<i>Anguilla rostrata</i>
Pirate Perch	<i>Aphredoderus sayanus</i>
Atlantic Needlefish	<i>Strongylura marina</i>
Golden Topminnow	<i>Fundulus chrysotus</i>
Starhead Topminnow	<i>Fundulus notti</i>
Blackstrip Topminnow	<i>Zygonectes notatus</i>
Blackspotted Topminnow	<i>Zygonectes olivaceus</i>
Mosquitofish	<i>Gambusia affinis</i>
Brook Silverside	<i>Labidesthes sicculus</i>
White Bass	<i>Morone chrysops</i>
Yellow Bass	<i>Morone mississippiensis</i>
Spotted Bass	<i>Micropterus punctulatus</i>
Largemouth Bass	<i>Micropterus salmoides</i>
Warmouth	<i>Lepomis gulosus</i>
Green Sunfish	<i>Lepomis cyanellus</i>
Bantam Sunfish	<i>Lepomis symmetricus</i>
Spotted Sunfish	<i>Lepomis punctatus</i>
Redear Sunfish	<i>Lepomis microlophus</i>
Bluegill	<i>Lepomis macrochirus</i>
Orangespotted Sunfish	<i>Lepomis humilis</i>
Redbreast Sunfish	<i>Lepomis auitus</i>
Longear Sunfish	<i>Lepomis megalotis</i>
Dollar Sunfish	<i>Lepomis marginatus</i>
White Crappie	<i>Pomoxis annularis</i>
Black Crappie	<i>Pomoxis nigromaculatus</i>
Flier	<i>Centrarchus macropterus</i>
Banded Pygmy Sunfish	<i>Elassoma zonatum</i>
Sauger	<i>Stizostedion canadense</i>
Dusky Darter	<i>Percina sciera</i>
River Darter	<i>Percina shumardi</i>
Logperch	<i>Percina caprodes</i>
Big Scale Logperch	<i>Percina macrolepida</i>
Scaly Sand Darter	<i>Ammocrypta vivax</i>
Western Sand Darter	<i>Ammocrypta clara</i>
Bluntnose Darter	<i>Etheostoma chlorosomum</i>
Harlequin Darter	<i>Etheostoma histris</i>
Slough Darter	<i>Etheostoma gracile</i>
Swamp Darter	<i>Etheostoma fusiforme</i>
Mud Darter	<i>Etheostoma asprigene</i>
Goldstripe Darter	<i>Etheostoma parvipinne</i>
Cypress Darter	<i>Etheostoma proeliare</i>
Redfin Darter	<i>Etheostoma whipplei</i>
Creole Darter	<i>Etheostoma colletti</i>
Speckled Darter	<i>Etheostoma stigmaticum</i>
Freshwater Drum	<i>Aplodinotus grunniens</i>
Striped Mullet	<i>Mugil cephalus</i>

## FRESHWATER MUSSELS (UNIONIDAE) OF NFGT

Common Name	Scientific Name
Amblema plicata plicata	Threeridge
Amblema plicata perplicata	Roundlake
Anodonta grandis	Giant Floater
Anodonta imbecillis	Paper Pondshell
Anodonta suborbiculata	Flat floater
Arcidens confragosus	Rock Pocketbook
Arkansia wheeleri	Oauchita Rock Pocketbook
Corbicula fluminea	Asiatic clam
Cyrtoniais tampicoensis	Tampico Pearlymussel
Ellipsara lineolata	Yellow lance
Elliptio dilatata	Spike mussel
Fusconara askewi	Texas pigtoe
Fusconara flav	Wabash pigtoe
Fusconara lananensis	Triangle pigtoe
Glebula rotundata	Round pearishell
Lampsilis bracteata	Texas fatmucket
Lasmigona complanata	White heelsplitter
Megalonia nervosa	Round washboard
Obliquana reflexa	Threehorn wartyback
Obovaria jacksoniana	Southern hickorynut
Plectomerus dombeyanus	Bank climber
Pleurobema riddelli	Louisiana pigtoe
Potamilus amphichaenus	Texas heelsplitter
Ligumia subrostrata	Pondmussel
Leptodea fragilis	Fragile papershell
Lampsilis teres	Yellow sandshell
Lampsilis hydiana	Louisiana fatmucket*
Lampsilis Satur	Sandbank pocketbook
Lampsilis cardium	Plain pocketbook
Plectomerus dombeyanus	Bankclimber
Potamilus ohioensis	Pink papershell
Potamilus purpuratus	Bleufer
Ptychobranthus occidentalis	Ouachita kidneyshell
Pyganodon grandis	Giant Floater
Quadrula apiculata	Southern mapleleaf
Quadrula nodulata	Wartyback
Quadrula pustulosa mortoni	Western pimpleback
Quadrula p. pustulosa	Pimpleback
Quadrula quadrula	Mapleleaf
Quadrula houstonensis	Smooth pimpleback
Quincuncina mitchelli	False spike
Strophitus subvexus	Southern creekmussel
Strophitus undulatus	Squawfoot

## FRESHWATER MUSSELS (continued)

<b>Common Name</b>	<b>Scientific Name</b>
Toxolasma parvus	Lilliput
Toxolasma texasensis	Texas lilliput
Tritogonia verrucosa	Pistolgrip
Truncilla donaciformis	Fawnsfoot
Truncilla macrodon	Macrodon
Truncilla truncata	Deertoe
Unio merus declivus	Tapered pondhorn
Unio merus tetralasmus	Pondhorn
Utlerbackia imbecillis	paper pondshell
Villosa lienosa	Little spectaclecase

TABLE V-2 - FOREST & GRASSLAND MANAGEMENT INDICATORS

VEGETATION GROUPS	MANAGEMENT INDICATOR	UNITS	CURRENT STATUS	SHORT TERM OBJECTIVE	LONG TERM OBJECTIVE
Longleaf Pine Woodlands & Savannas	Red-cockaded Woodpecker	Active Clusters	25	200	300
	Slender Gay Feather	Populations	9	15	35
	Incised Groove Burr	Populations	4	20	50
	Scarlet Catchfly	Populations	2	5	10
	Longleaf - Bluestem Series	Acres	21,000	40,000	96,000
*Longleaf Pine Barrens	Navasota Ladies Tress	Populations	1	2	5
	Little Bluestem-Rayless Goldenrod Series	Acres	440	475	500
*Herbaceous Wetlands	Yellow Fringeless Orchid	Populations	1	5	10
	Spagnum - Beakrush Series	Acres	150	200	300
*Bay-Shrub Wetlands	Nodding Nixie	Populations	7	20	35
	Texas Bartonnia	Populations	1	5	15
	Sweetbay - Magnolia Series	Acres	250	300	400
Dry-Xeric Oak-Pine Forests	Red-cockaded Woodpecker	Active Clusters	75	300	400
	Louisiana Squarehead	Populations	5	10	25
	Shortleaf-Oak Forest	Acres	150,000	160,000	170,000
Mesic Oak-Pine Forests	Red-cockaded Woodpecker	Active Clusters	130	350	450
	Loblolly-Oak Forest	Acres	300,000	270,000	210,000
Mesic Hardwood Forests	Southern Ladyshipper	Occurrence	Unknown	Establish Base	Increase Base
	Beech - White Oak Series	Acres	2532	3000	3500
Tallgrass Prairie	Bobwhite Quail	Population Density	1/25 acres	1/20 acres	1/15 acres
	Little Bluestem-Indiangrass	Acres	15,000	20,000	25,000
Bottomlands Streambanks	Neotropical Migrants **	Occurrence	Unknown	Establish Base	Increase Base
	Neches River Rose Mallow	Populations	1	3	6
	Bottomland Hardwood	Acres	25,000	50,000	60,000

\* Inclusional community or habitat groups within the Longleaf Pine Woodlands

\*\* Neotropical migratory bird guild includes Yellow-throated Vireo, Wood Thrush, Acadian Flycatcher and others

## MANAGEMENT INDICATORS COMMON TO ALL AREAS

SERIAL STAGE HABITAT	MANAGEMENT INDICATOR	UNITS	CURRENT STATUS	SHORT TERM OBJECTIVE	LONG TERM OBJECTIVE
Forest/Grassland Early Succession 0-20 years	Eastern Wild Turkey	Acres of Habitat	30,000	24,000	15,000
	Whitetail Deer	Acres of Habitat	75,000	50,000	30,000
	Yellow Breasted Chat	Acres of Habitat	60,000	45,000	25,000
	Snags	Number	2	2-3	2-4
Forest/Grassland Mid Succession 20-50 years	Eastern Wild Turkey	Acres of Habitat	30,000	38,000	45,000
	Whitetail Deer	Acres of Habitat	25,000	30,000	35,000
	Yellow Breasted Chat	Acres of Habitat	24,000	30,000	35,000
	Pileated Woodpecker	Acres of Habitat	20,000	22,000	25,000
	Gray/Fox Squirrel	Acres of Habitat	30,000	24,000	15,000
Snags	Number	2-4	3-6	4-6	
Forest/Grassland Late Succession 50-90 years	Eastern Wild Turkey	Acres of Habitat	275,000	160,000	45,000
	Whitetail Deer	Acres of Habitat	180,000	100,000	80,000
	Yellow Breasted Chat	Acres of Habitat	90,000	65,000	40,000
	Pileated Woodpecker	Acres of Habitat	200,000	150,000	100,000
	Gray/Fox Squirrel	Acres of Habitat	130,000	90,000	50,000
Snags	Number	2-6	6-8	8	
Forest/Grassland Old Growth 90 + years	Eastern Wild Turkey	Acres of Habitat	60,000	150,000	240,000
	Whitetail Deer	Acres of Habitat	35,000	120,000	180,000
	Pileated Woodpecker	Acres of Habitat	60,000	200,000	350,000
	Gray/Fox Squirrel	Acres of Habitat	40,000	150,000	250,000
	Snags	Number	6-8	8-12	12+
Aquatic - Ponds and Reservoirs	Largemouth Bass	Catch/Unit Effort	24-81	40-90	60-90
	Sunfish (RE & BG)	Catch/Unit Effort	12-250	40-250	50-275
	Channel Catfish	Catch/Unit Effort	2-22	10-20	15-20
Aquatic - Rivers and Streams	Paddlefish	Occurrence	0	6+ Reprod Adults	6+ Adults/ Rerprod
	Sabine Shiner	number streams	4	10	20
	Dusky Darter	Occurrence/slow	16	25-30	30-40
	Scaly Sand Darter	Occurrence/swift	5	8-12	12-20
	Stonefly Guild	Occurrence/Score	Fair-Good	Good-Excellent	Excellent

# Appendix G

## Research Natural Area Evaluation

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### Introduction

A Research Natural Area (RNA) is “a physical or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural physical and biological processes to prevail without human intervention. However, under unusual circumstances, deliberate manipulation may be utilized to maintain the unique feature that the Research Natural Area was established to protect” (Federal Committee on Ecological Reserves, 1977 Forest Service Manual (FSM) 4063.05, Amend. 4000-90-1). Research Natural Areas are part of a national network of ecological areas designated in perpetuity for research or to maintain biological diversity or both on National Forest System lands (FSM 4063, Amend. 4000-90-1).

The United States Forest Service (USFS) designed the RNA system to provide examples of ecological areas for long-term research investigations and baseline information on the diverse array of natural ecological systems across North America. Strict guidance was and is provided for the evaluation, selection, and establishment of RNA's. These guidelines are as follows:

### Evaluation and Establishment of RNA

Forest planning must include evaluation of potential RNA's:

“Forest planning shall provide for the establishment of Research Natural Areas (RNA's). Planning shall make provisions for the identification of examples of important forest, shrubland, grassland, alpine, aquatic, and geologic types that have special or unique characteristics of scientific interest and importance and that are needed to complete the national network of RNA's. Types needed for the network shall be identified.” (36 CFR 219.25)

The objectives of establishing RNA's are to (FSM 4063.01, Amend. 4000-90-1):

- “ \* Preserve a wide spectrum of pristine representative areas that typify important.. natural situations that have special or unique characteristics of scientific interest and importance, that in combination, form a national network of ecological areas for research, education, and maintenance of biological diversity.
- \* Preserve and maintain genetic diversity.
- \* Protect against serious environmental disruptions.

- \* Serve as reference areas for the study of succession
- \* Provide on site and extension educational activities
- \* Serve as baseline areas for measuring long-term ecological changes
- \* Serve as control areas for comparing results from manipulative research.
- \* Monitor effects of resource management techniques and practices ”

Forest Service Manual 4063 (Amend. 4000-90-1) contains direction and criteria for selection of RNA's

“Research Natural Areas must be large enough to provide essentially unmodified conditions within their interiors. In the West, 300 acres...of land is generally considered the minimum size. In the East, consider establishing smaller areas, especially in grassland systems and in areas with special vegetative, aquatic, or geologic situations. Incorporate enough acres to ensure unmodified conditions within their interiors and to protect the features and/or qualities for which the Research Natural Area is to be established.”

“Locate those Research Natural Areas that best represent the ecological conditions needed to complete the natural area system in areas where conflicting uses are minimal. Wherever possible, select proposed areas that show no evidence of major disturbance by humans. for the past 50 years. Where possible, select entire small drainages ..”

“In the selection of representative areas, a pristine condition is the goal. However, when candidate areas in a pristine condition are unavailable, then areas that reflect the pristine condition as closely as possible may be selected.”

## **Review and Establishment Procedures**

The establishment process begins with evaluation of candidate areas. This is a joint effort of the Forest and the Southern Forest Experiment Station. Appropriate staff from these units are assigned to head the review team and invite individuals who can provide expertise or useful input to join the team. This team then examines and evaluates the candidate areas for suitability as RNA's or as other specially designated areas and documents the findings.

Since the designation of an area as an RNA is a land allocation decision, the candidate areas are analyzed during the forest planning process. If the review team's evaluation and the Forest planning analysis find an area to be appropriate for RNA status, an Establishment Record is prepared, usually by a USFS research station scientist. The Establishment Record is evaluated by the Southern Research Natural Area Committee.

and the Washington Office. If the reviews are favorable, the Establishment Record is given to the Chief of the Forest Service for final approval of designation.

In the above example, the environmental analysis process and National Environmental Policy Act (NEPA) documentation proceed concurrently with the development of the Forest Plan. If candidate areas are reviewed for RNA eligibility after a Forest Plan has been approved, a separate environmental analysis with NEPA documentation is required. After completing the analysis, the forest will prepare an Environmental Assessment, a combined Decision Notice and Designation Order (DN/DO), and a Finding of No Significant Impact (FONSI). The DN/DO will contain wording to amend the Forest Plan. If the Chief agrees with the forest's findings, he signs the DN/DO, thereby completing the National Environmental Policy Act (NEPA), RNA designation, and Plan amendment processes with one decision.

## **RNA Candidate Areas in the Plan Revision**

Mill Creek Cove was evaluated for designation as an RNA during preparation of the 1987 Forest Plan. Questions about an existing RNA, the Cross Timbers RNA, were also addressed. When the Forest Plan was approved, several parties appealed. One issue raised in the appeals was whether the Plan violated the National Forest Management Act (NFMA) because it did not designate RNA's. Deputy Chief David Unger responded to this issue in a letter dated April 1, 1989.

“ . it is important to distinguish between things that must be considered during planning and things a Forest Plan must ultimately contain. The . . . regulation . . . does not require that every Forest Plan must necessarily contain or recommend the establishment of RNA . . . the regulations do not require that examples of each category must be provided on each unit for which a Forest Plan is developed. Rather, examples . . . that are needed to complete the National network of RNA's will be established throughout the National Forest System.”

Proposals for the designation of four additional RNA's on the National Forests & Grasslands in Texas (NFGT) were received soon after the current Forest Plan was approved in 1987. These proposed RNA's were Mill Creek Cove RNA, Boykin Springs Longleaf RNA, Trout Creek RNA, and Neches River Banks RNA. Three more RNA proposals surfaced during the Revision process. During the initial RNA committee discussions, Mr. Edward C. Fritz, Chair of the Forest Task Force of the Texas Committee on Natural Resources (TCONR), reminded committee leader Ron Haugen that his proposal for an RNA at McGee Bend had not been discussed. It was discovered that the McGee Bend proposal was received by the forest in 1989 and had not been filed as an RNA proposal. It was decided to include this proposal in further review of the RNA candidates. The Texas Organization for Endangered

Species (TOES) proposed two RNA candidates in a March, 1992 letter to NFGT. These areas are Upper Colorow Creek and Catahoula Barrens.

The forest also discovered problems with the Cross Timbers RNA, an existing RNA on the LBJ National Grassland. These problems related to confusion over a boundary location and to possible conflicting uses.

The review committee evaluated all seven of the candidate areas and the Cross Timbers RNA in 1992. The committee's findings were documented and passed on to the Southern Research Natural Area Committee (SRNAC) and the Forest Supervisor for further consideration. Areas determined to be potentially suitable for RNA or other special status will be considered in the Land Management Planning (LMP) planning process. The preferred alternative stated in the LMP will identify proposed RNA's to be recommended to the Chief of the USFS for inclusion in the RNA system. The seven candidate areas and the Cross Timbers RNA are discussed in more detail later in this summary and in Exhibits 1-8.

Only six general comments relative to RNA's were received during the scoping process. The Notice of Intent published in the Federal Register on October 23, 1990, which solicited scoping input for the Revision, limited the scope of the Revision as follows:

"The scope of the Revision does not include the following where previously made decisions will continue to apply: (b) allocations of existing Scenic, Protective, and Research Natural Areas."

Scoping comments and the proposals for consideration of the seven areas for designation as RNA's are detailed in the LMP process records in the office of the Supervisor of NFGT. Summaries of these comments and proposals follow.

### **Proposed Mill Creek Cove RNA**

The Mill Creek Cove area was considered for designation as an RNA in the environmental analysis for the 1987 Forest Plan. This area was evaluated by forest and research personnel but was not recommended for RNA status because the beech-magnolia stand was not judged to be a high-quality representative of this type. No better examples of this type are known to occur on the NFGT. This area was established as a scenic area and not an RNA in the 1987 Forest Plan.

In a letter of August 11, 1988, the Texas Parks and Wildlife Department (TPWD) proposed the establishment of a Mill Creek Cove RNA to represent Society of American Foresters (SAF) cover type 82 Southeastern U.S. (SEUS) Community Class Beech-Magnolia Forest or Texas Natural Heritage Program (TNHP) series American Beech-Southern Magnolia.

SAF cover type 82 was not identified in the 1984 Regional Guide for the South as a potential RNA candidate in Texas, but this cover type is not presently represented in the national RNA system

After much discussion, Forest Supervisor Lannan agreed in 1989 that Mill Creek Cove would be reevaluated for designation as an RNA by a review team after TNHP submitted their report with RNA recommendations. The TNHP report, which was finalized in 1991, recommended the area for RNA status. Formal committee review of Mill Creek was held on January 21, 1992, and the committee's findings are summarized in Exhibit 1.

The RNA committee recommended that a Mill Creek RNA be established in the LMP Revision process.

### **Proposed Boykin Springs Longleaf RNA**

In its letter of August 11, 1988, the TPWD also proposed the establishment of a Boykin Springs Longleaf RNA. The Boykin Springs area contains approximately 350 acres of upland longleaf pine savanna (SAF Cover Type 70). At the time of the proposal, the national RNA network included only 32 acres of this type. The Boykin Springs area has an exceptionally diverse herbaceous layer. At least 170 understory species are present, and these include several rare or sensitive plants. In addition, the area contains two active red-cockaded woodpecker (RCW) clusters and habitat for other nearby RCW clusters. It also contains roads, trails, and other evidence of man's impact on this ecosystem.

The NFGT deferred action on this proposal until a final proposal was received from the State. In 1991 the Texas Natural Heritage Program Inventory of National Forests and Grasslands in Texas report recommended establishment of the site as an RNA.

Formal committee review of the Boykin Springs proposal was held on January 22, 1992. The committee's findings are summarized in Exhibit 2. The RNA committee recommended that a Boykin Springs Longleaf RNA be established in the LMP Revision process. SRNAC suggested that the Forest consider the area for some special designation that might be compatible with more intensive RCW management than would be permitted if under RNA status.

### **Proposed Trout Creek RNA**

In December, 1988, Mr. Edward C. Fritz, Chair of the Forest Task Force of the TCONR, nominated the Trout Creek area on the Angelina National Forest as a RNA. The Southern Forest Experiment Station responded to Mr. Fritz by letter in December 1988. This letter explained the evaluation and establishment procedures for RNA's and suggested that this particular area would be unsuitable because of past cutting

and stated that the final eligibility determination would be made by a review committee. This letter also mentioned the TNHP survey and stated that the Forest would be dealing with RNA proposals after the final report was received.

TNHP inventoried the Trout Creek area and found three SEUS ecological communities: (1) Western Gulf Coastal Plain Upland Longleaf Pine Forest, (2) Coastal Plain Hillside Herbaceous Seepage Bog, and (3) Coastal Plain Seepage Shrub Slope. The Western Gulf Coastal Plain Upland Longleaf Pine Forest community, which occupies most of the area, was found to be moderately disturbed. The other two communities were lightly to moderately disturbed.

The review team found that the area included 12 RCW clusters that would require special management to ensure maintenance of the population. Certain RCW management activities may be contrary to RNA guidelines and philosophy. The area is currently grazed and receives heavy use by horseback riders and ORV enthusiasts. The findings by TNHP supported the Southern Forest Experiment Station's assessment that the area might not be suitable as an RNA. The RNA review committee formally evaluated the Trout Creek area on January 22, 1992. The committee's findings are summarized in Exhibit 3. The RNA committee determined that the area does not meet the criteria for RNA status and recommended that the area be considered for designation as a special interest area in the LMP revision. SRNAC concurred with the committee's findings.

### **Proposed Neches River Banks RNA**

In April, 1991, Edward Fritz nominated the Neches River Banks area on the Angelina National Forest as a RNA.

Much of the proposed RNA is within one-quarter of a mile of the Neches River. This riverside corridor, which is designated as Management Area 14, is being managed under a Special Interest Area prescription under the current Forest Plan. This prescription protects the riverside corridor (timber harvesting is not permitted). At least six natural lakes occur within this area, and these may add to the area's natural value.

About 185 acres of this 1,120-acre proposed RNA is included in one of the sites discussed in the TNHP inventory report. The TNHP classified this site, Bouton Lake-Neches River Bottoms, as a Loblolly Pine-Oak Series (SEUS Loblolly Pine-Shortleaf Pine-Oak Forest Community Class or SAF Cover Types 82, 86, and 76) in lightly modified condition. This particular community type is represented in the national RNA system. The TNHP report recommended that this area be managed as a Special Interest Area and that it be considered for inclusion in the National Wild and Scenic River System. The area's status was

reviewed by the RNA committee on January 23, 1992. The committee's findings are summarized in Exhibit 4. The RNA review committee recommended that the area be considered for RNA status in the LMP revision, and SRNAC concurred.

### **Proposed McGee Bend RNA**

In July 1989, Edward Fritz, nominated the 1,200-acre McGee Bend area (Compartment 82) of the Angelina National Forest as an RNA. No action was taken on the nomination for 2 years. Mr. Fritz inquired about the status of the McGee Bend nomination in an August, 1991 letter to the Southern Forest Experiment Station, adding that McGee Bend was included in the recently completed TNHP inventory. The Station responded that since the NFGT was revising the Forest Plan, additional RNA proposals would be considered as part of the revision effort.

During the initial meeting of the RNA review committee for Boykin Springs, Neches River Banks, Mill Creek Cove, and Trout Creek, Mr. Fritz again inquired about the status of McGee Bend. It was decided at that time that RNA coordinator Ron Haugen would review the record for McGee Bend and schedule a subsequent meeting of the committee to review the nomination.

The TNHP summary identified McGee Bend as 632 acres lying 1.2 miles south of Sam Rayburn Dam in a natural bend of the Angelina River. It is a relatively remote hardwood, pine-hardwood forest on a stream terrace sloping gradually into the alluvial floodplain. The TNHP recommended that the area be managed as a Special Interest Area, with special emphasis on retaining its wilderness-like qualities, and on allowing the mature forest to become old growth.

The RNA review committee evaluated McGee Bend on April 16, 1992. The committee's findings are summarized in Exhibit 5. The committee noted three concerns: (1) the area contained an appreciable amount of exotic slash pine, which should not be present in an RNA, (2) the roads and powerline right-of-way might detract from the character of the featured plant community, and (3) the creation of artificial water levels in the former river channel constitute significant alteration by humans. In response, the committee chair proposed to SRNAC that a smaller area be given RNA status. The reduced area would consist mainly of the hardwood areas along the river floodplain and would exclude the exotics and developed areas. Mr. Fritz, acting on behalf of TCONR, disagreed with this recommendation and submitted a second recommendation for a 963-acre area that included all of compartment 82 with the exception of stand 8. SRNAC concurred with the committee chair's proposal that the natural area be reduced to approximately 375 acres.

### **Proposed Upper Colorow Creek RNA**

On April 21, 1992, TOES recommended Colorow Creek on the Sabine National Forest for RNA status. TOES cited the TNHP report as the basis for this recommendation. The RNA committee chairman established a committee and scheduled the initial review of the area for July 1, 1992.

The TNHP report describes the 306-acre area as a mesic American beech-white oak forest with features unmatched elsewhere on NFGT. TNHP recommendations included establishment as a botanical area, with management to ensure protection from excessive visitor use. The findings of the committee are summarized in Exhibit 6.

The RNA review committee found stretches of exposed rock and a land bridge unique and significant. These features accentuate the relatively steep-sided ravine and ridge top system of the area. The presence of the exposed rock and the land bridge, and the relatively undisturbed nature of the vegetation associated with the steep ravine environment, prompted the RNA committee to recommend RNA status. The team suggested that this area could be an excellent reference area for genetic diversity and natural plant succession if managed as an RNA.

### **Proposed Catahoula Barrens RNA**

On April 21, 1992, TOES recommended three segments of the Catahoula Barrens on the Angelina National Forest for RNA status. TOES cited the TNHP report as the basis for this recommendation. The RNA committee chair established a committee and scheduled the initial review of the area for July 2, 1992.

The three parcels of Catahoula Barrens consist of the 359-acre Black Branch Barrens; the 59-acre Buck Branch Barrens, and the 166-acre Rocky Branch Barrens. The areas are natural prairie-like openings typified by shallow, nutrient-poor soils, acidic that are high in aluminum. Many of the plants in the barrens are restricted to these specialized habitats in Texas, and include the endangered Navasota ladies'-tresses (*Spiranthes parksii*). The committee summary and findings are in Exhibit 7.

Because the areas had a history of disturbance, the RNA committee did not recommend them for RNA status. The group did recommend that management of this area be directed to the unique botanical characteristics. Restoration of these natural prairie-like systems to some semblance of the historic or presettlement conditions should be considered.

## **Proposed Cross Timbers RNA Management Recommendations**

### ***Cross Timbers Summary***

Initial review of the management situation on the Cross Timbers RNA for the Forest Plan Revision revealed discrepancies in descriptions of boundaries and management objectives. The Cross Timbers RNA was designated by Chief McGuire on June 8, 1977. The Establishment Report had been approved by Supervisor Courtenay on July 8, 1975. The Establishment Report consisted mainly of a description of the area, with very little direction concerning objectives or management practices.

Discrepancies in descriptions of boundaries were noticed after the designation order was signed. One map in the official folder showed the western, southern, and eastern boundaries following the edge of the mesa, and another indicated an expanded boundary along Forest Development Roads (FDR) 900 and 900-A. The narrative in the Establishment Report clearly describes the boundary as following the two roads. This is the official boundary. This discrepancy has caused problems because the area between the road and the edge of the mesa has a history of dispersed recreational use. This use has been and will continue to be very difficult to control.

Management practices prior to U.S. ownership have resulted in problem erosion within the RNA. Watershed restoration, primarily in the form of check dams, had been undertaken prior to RNA establishment, and some of these structures need rehabilitation.

There is dispersed recreational use (camping and target shooting) between the mesa rim and the road.

### ***Cross Timbers RNA Evaluation***

The soils and vegetation in the area represent two major vegetation zones, the Western Cross Timbers and the Grand Prairie. Fire could be used to restore and maintain native prairie grasses. The committee concluded that while the RNA represents the original vegetation conditions, some changes have resulted from protection from fire.

Several draws in the RNA have been eroded, and about a half dozen check dams have been constructed to control this problem. These check dams require periodic maintenance, often with heavy equipment. Because frequent or extensive use of such equipment in RNA's is undesirable, the committee determined that decisions on future erosion control should be made on a case-by-case basis with an emphasis on using non-mechanized methods.

The consensus was that the Cross Timbers RNA contains examples of the Cross Timbers and Grand Prairie vegetation zones that should be featured in RNA. The following recommendations were made.

#### Cross Timbers RNA Evaluation

- (1) Adjust the RNA boundary to exclude dispersed recreation areas
- (2) The management prescription for the RNA in the Forest Plan should contain range management practices that keep livestock use to a minimum
- (3) The management direction in the Forest Plan should call for periodic monitoring of the check dams. If maintenance or rehabilitation is needed, the least intensive methods should be employed. The Forest RNA Coordinator should be consulted for guidance.
- (4) The use of prescribed fire is recommended
- (5) The Forest Coordinator should request funds to complete a boundary survey
- (6) The Forest Coordinator and the Station Scientist should rewrite the Establishment Report to list specific objectives and management strategies to accomplish RNA objectives. The committee agreed on the following objectives, as a minimum. (1) Maintain native prairie grasses, (2) encourage reestablishment of the oak savanna, and (3) maintain the wooded oak draws. These objectives should be put in the management prescription for the Forest Plan's management area covering this RNA

# Research Natural Areas - Exhibit 1

## Mill Creek Cove RNA Candidate Information

**Candidate Name:** Mill Creek Cove

**Date of Report(s):** 2/5/92

**Forest:** Sabine National Forest

**District:** Yellowpine

**Forest Coordinator:** Ron Haugen

**Assigned Scientist:** Margaret Devall

**Candidate Proposed by:** Texas Parks and Wildlife, Texas Committee on Natural Resources, and Texas Natural Heritage Program

**Acres:** 225 (approx )

**Hectares:** 90 (approx )

**Land Class:** 310, 500, 820

**Major Cover Types:** Beech-Magnolia (SAF 82) Loblolly Pine-Hardwood

**Unique Feature:** This is a relatively undisturbed area of old-growth Beech-Magnolia

**T & E Species/Sensitive Species:** No Federally listed T&E species See TNHP Report for State Sensitive Species.

**Description/Comments (include land ownership concerns):**

The area consists of two peninsulas of old-growth beech-magnolia forest on the western shore of Toledo Bend Reservoir. The area has been described as the highest-quality example of this community in the West Gulf region (TNHP). Because access from the west is limited by adjacent private property, the area receives little public use. Disturbances in the area are very minor and small. There is a small private inholding near the end of the northern peninsula. See TNHP report for details.

**List of Review Team Membership:**

Margaret Devall  
Ron Haugen  
Rob Evans  
Larry Shelton  
Sue Langevin

Bob Smiley  
Elray Nixon  
Ned Fritz  
Ike McWhorter

**Meeting Dates:**

1/21/92

**List of Interested Publics Not Part of Review Team:** Lone Star Chapter of the Sierra Club and adjacent landowners.

**Describe Current and Past Use/Management Activities:** Mill Creek Cove (southern peninsula) was designated as a Scenic Area in the current Forest Plan. There are regenerated clearcuts.

(7 and 20 years old) on adjacent National Forest lands. Adjacent private land is in developed pasture, pine plantations, and home sites. There is no evidence of timber harvest within the proposed boundaries. Sabine River Authority controls Toledo Bend water levels. The Forest Service has no control over lake use or shoreline access to this area, but lake use and shoreline access do not present problems at this time.

**Review Team's Recommendation:** Review team recommends RNA status and recommends acquisition of small private inholding.

**Probable Objective for the Area:** Preserve representative of pristine old-growth beech-magnolia; serve as reference area for study of succession, and serve as baseline for measuring long-term ecological changes.

**Cooperators to Pursue and Their Anticipated Role:** Rice University and Texas Academy of Science might cooperate with FS in continuing research.

## Research Natural Areas - Exhibit 2

### Boykin Springs RNA Candidate Information

**Candidate Name:** Boykin Springs

**Date of Report:** 2/5/92

**Forest:** Angelina National Forest

**District:** Angelina

**Forest Coordinator:** Ron Haugen

**Assigned Scientist:** Margaret Devall

**Candidate Proposed by:** Texas Parks & Wildlife

**Acres:** 380 (approx )

**Hectares:** 152 (approx )

**Land Class:** 500, 801, 802

**Major Cover Types:** Longleaf pine (SAF 70)

**Unique Feature:** Old-growth, longleaf pine-little bluestem community maintained by fire, (considered to be the best example in the western Gulf Region), several hillside seepage bogs

**T&E Species/Sensitive Species:** Red-cockaded woodpecker. See TNHP Report for State Sensitive Species.

**Description/Comments (include land ownership concerns):** This is a large, relatively undisturbed area of mature longleaf pine-little bluestem. Because of frequent use of light prescribed fire, the site exhibits open, park-like, savanna conditions. The area is nearly surrounded by roads and is close to the Boykin Springs campground. Recreational use in the proposed area, and in the surrounding general forest, is heavy. All-terrain vehicles (ATV) trails are common. There are three RCW clusters in the proposed area and two of these are currently active. Part of the area is in an active grazing allotment.

**List of Review Team Membership:**

Margaret Devall  
Ron Haugen  
Rob Evans  
Jerry Larson  
Dick Rosemier  
Alfredo Sanchez

Larry Shelton  
Ike McWhorter  
Sue Langevin  
Dave Diamond  
Bill Carr  
Ned Fritz

**Meeting Dates:**

1/22/92

**List of Interested Publics Not Part of Review Team:** ATV Riders Association, special use permittees, grazing permittee, and Lone Star Chapter of Sierra Club

**Describe Current and Past Use/Management Activities:** The area was commercially thinned about 20 years ago. The effects of this are not apparent at this time. No other significant timber harvest has occurred recently. Frequent light prescribed burns have occurred. Removal

*of midstory in RCW clusters was accomplished two years ago. About half of the area is grazed lightly. The District Auto Tour includes one stop featuring this area. The District plans to develop a handicap access trail into the area to permit viewing of a RCW cavity tree. ATV use is common in the area and in the surrounding Forest. This general area has been one of the more popular recreational areas on this District.*

**Review Team's Recommendation:** Review team recommends RNA status, because the areas has unique features. Review team acknowledges conflicts with other uses which must be resolved

**Probable Objective for the Area:** Preservation of unique old-growth longleaf stand. Preservation and maintenance of genetic diversity. Provision of onsite and extension educational activities. Monitoring of effects of resource management techniques and practices

**Cooperators to Pursue and Their Anticipated Role:** Texas Parks & Wildlife, The Nature Conservancy, U S Fish & Wildlife Service, Rice University, Stephen F. Austin State University might cooperate with Forest Service in research and might provide guidance in RCW habitat.



**Describe Current and Past Use/Management Activities:** Intensive timber management is apparent, including clearcuts, seed-tree cuts, and commercial thinning. Five stands have been regenerated and are less than 20 years old. Court-ordered RCW thinning has occurred on much of the area in the last two to three years. Recreational use is common and includes use of ATV and horse trails. Roads have been improved in conjunction with timber sales. The entire area is expected to be designated as a Habitat Management Area for RCW.

**Review Team's Recommendation:** Review team finds that the Trout Creek area does not meet the criteria for RNA designation. Committee suggests that the Forest act to have the Trout Creek area designated as a Special Interest Area.

**Probable Objective for the Area:** Restoration of functional longleaf ecosystem.

**Cooperators to Pursue and Their Anticipated Role:** Texas Parks & Wildlife, The Nature Conservancy, and U.S. Fish & Wildlife Service. Their role would be to suggest techniques for restoring longleaf to its original dominance and for providing for needs of RCW.

## Research Natural Areas - Exhibit 4

### Neches River Banks RNA Candidate Information

**Candidate Name:** Neches River Banks

**Date of Report:** 2/5/92

**Forest:** Angelina National Forest

**District:** Angelina

**Forest Coordinator:** Ron Haugen

**Assigned Scientist:** Margaret Devall

**Candidate Proposed by:** Texas Committee on Natural Resources

**Acres:** 510 (approx.) **Hectares:** 204 (approx )

**Land Class:** 500, 820

**Major Cover Types:** Bottomland Hardwood and Loblolly Pine-Hardwood (SAF 82)

**Unique Feature:** Relatively undisturbed stands dominated by large, old-growth bottomland hardwoods and pine, including several baldcypress sloughs

**T&E Species/Sensitive Species:** No Federally listed T&E species See TNHP Report for State Sensitive Species.

**Description/Comments (include land ownership concerns):** The proposed area consists of a 4-mile-long and one-fourth mile wide band of loblolly pine and bottomland hardwoods along the north banks of the Neches River Wild & Scenic River designation has been proposed for this same stretch of river. The candidate area is separated into two noncontiguous parts of private land The Sawmill Hiking Trail runs along the Neches River for nearly the entire length of the area This trail receives moderate use throughout much of the year The Old Aldridge Sawmill site lies adjacent to the eastern part of the proposed area. This site contains the ruins of an early 1900's sawmill

**List of Review Team Membership:**

Margaret Devall  
Ron Haugen  
Rob Evans  
Jerry Larson  
Dick Rosemier  
Alfredo Sanchez  
Ned Fritz

Larry Shelton  
Ike McWhorter  
Sue Langevin  
Dave Diamond  
Bill Carr

**Meeting Dates:**

1/23/92

**List of Interested Publics Not Part of Review Team:** Lone Star Chapter of the Sierra Club and adjacent landowners.

**Describe Current and Past Use/Management Activities:** Bouton Lake Recreation Area lies at the western end of the proposed area Old Aldridge Sawmill site is adjacent to the eastern

portion Sawmill Hiking Trail runs along almost entire length of the entire length of the proposed area and receives moderate use. District auto tour has one stop featuring Aldridge Sawmill Site Regenerated clearcuts are adjacent to about 1/2 of area Area is divided into two separate parts by private property Area shows no signs of timber management within the last 50 years

**Review Team's Recommendation:** Review team recommends RNA Status, while acknowledging the possible conflict with the Sawmill Hiking Trail. The team also recommends acquisition of a private tract east of Bouton Lake.

**Probable Objective for the Area:** Preserve relatively undisturbed area of bottomland hardwood forest covers; preserve and maintain genetic diversity, serve as reference area for study of succession, and serve as baseline area for measuring long-term ecological changes

**Cooperators to Pursue and Their Anticipated Role:** Rice University and Texas Academy of Science for continuing research



thinned approximately 20 years ago. Southern pine beetle infestations are becoming more frequent in these pine stands

**Review Team's Recommendation:** The review team recommends RNA status for the hardwood area adjacent to the former Angelina River channel.

**Probable Objective for the Area:** Preserve relatively undisturbed area of bottomland hardwood forest coverage. Preserve and maintain genetic diversity. Serve as baseline area for measuring long-term ecological changes

**Cooperators to Pursue and Their Anticipated Role:** Rice University and Texas Academy of Science, for continuing research

## Research Natural Areas - Exhibit 6

### Upper Colorow Creek RNA Candidate Information

**Candidate Name:** Upper Colorow Creek

**Date or Report:** 7/6/92

**Forest:** Sabine National Forest

**District:** Tenaha

**District:** Tenaha

**Assigned Scientist:** Margaret Devall

**Forest Coordinator:** Ron Haugen

**Candidate Proposed by:** Texas Organization for Endangered Species (TOES)

**Acres:** 360 (approx.)

**Hectares:** 144 (approx )

**Land Class:** 804, 500

**Major Cover Types:** Loblolly Pine Hardwood (SAF 82); White Oak, Black Oak, Northern Red Oak (SAF 52); and Beech Magnolia

**Unique Feature:** This is a relatively undisturbed area with some apparently relict vegetation. The upper stretches of Colorow Creek display interesting geological features, including significant stretches of exposed rock and a land bridge.

**T&E Species/Sensitive Species:** No Federally listed T&E species. See TNHP report for State Sensitive Species.

#### **Description/Comments (include land ownership concerns):**

This is a large, relatively undisturbed area of mature loblolly pine-hardwood forest cover. Tree species composition varies throughout, with pine dominating in some areas, white oak and other upland hardwoods dominating in other areas, and beech-magnolia forest cover prominent in isolated areas. Recreational use appears to be limited to deer and squirrel hunting. Terrain consists of fairly steep-sided ravines with flat ridgetops. See TNHP report for more details.

#### **List of Review Team Membership:**

Margaret Devall  
Ron Haugen  
Rob Evans  
Bill Carr  
Lynn McDonald

#### **Meeting Dates:**

7/1/92

**List of Interested Publics Not Part of Review Team:** Texas Organization for Endangered Species and Texas Nature Conservancy, TOES.

**Describe Current and Past Use/Management Activities:** There is little evidence of significant management activities. Scattered tree stumps indicate that there may have been a commercial thinning in the recent past. On several ridgetops, there are small, naturally regenerated mixed stands resulting from salvage of southern pine beetle spots approximately 6-10 years ago. Management activities apparently have not altered the area significantly.

**Review Team's Recommendation:** The review team recommends RNA status.

**Probable Objective for the Area:** Serve as reference area for study of succession and preserve and maintain genetic diversity.

**Cooperators to Pursue and Their Anticipated Role:** Stephen F. Austin State University, Texas Nature Conservancy, Texas Natural Heritage Program, Southern Forest Experiment Station, and TOES could cooperate in continuing research.

## Research Natural Areas - Exhibit 7

### Proposed Catahoula Barrens RNA Candidate Information

**Candidate Name:** Catahoula Barrens (three areas) **Date of Report:** 7/6/92

**Forest:** Angelina National Forest **District:** Angelina

**Forest Coordinator:** Ron Haugen **Assigned Scientist:** Margaret Devall

**Candidate Proposed by:** Texas Organization for Endangered Species (TOES)

**Acres:** 359, 12, 265 (approx.) **Hectares:** 144, 5, 106 ( approx )

**Land Class:** 500, 824

**Major Cover Types:** Longleaf pine-scrub oak (SAF 71) and Loblolly pine-hardwood (SAF 82).

**Unique Feature:** Catahoula formation barrens-woodlands complex

**T&E Species/Sensitive Species:** Red-cockaded woodpecker. See TNHP report for State sensitive species.

**Description/Comments (include land ownership concerns):** The candidate area consists of three separate areas. the Black Branch Barrens, Buck Branch Barrens, and Rocky Branch Barrens, which are collectively referred to as the Catahoula Barrens. The shallow, nutrient-poor soils are adverse to woody plant growth and have produced a barrens-woodlands complex. Low-quality pines and hardwoods are found, together with scattered natural, prairie-like openings. See TNHP report for more details.

**List of Review Team Membership: Meeting Dates:**

Margaret Devall	7/2/92
Ron Haugen	
Rob Evans	
Bill Carr	
Jerry Larson	
Alfredo Sanchez	
Glenn Donnahoe	

**List of Interested Publics Not Part of Review Team:** Texas Nature Conservancy, TOES.

**Describe Current and Past Use/Management Activities:** Commercial timber has been logged off much of these areas. Regeneration cuts were made on the Black Branch area as recently as 1970 and 1982. Rocky Branch was regeneration cut in 1972, and now supports a stand that includes seed trees. Unfavorable soils have generally caused attempts to regenerate pines and

produce timber to fail. Each of the barrens contains low-level roads or abandoned roads or both. There is some evidence of ATV use

**Review Team's Recommendation:** Because there have been significant disturbances, the review team does not recommend RNA status. However, the Catahoula Barrens have unique characteristics, and the team recommends that the candidate area be classified as a Botanical Area.

**Probable Objective for the Area:** Restore the areas to their presettlement conditions (Catahoula formation barrens-woodlands complex)

**Cooperators to Pursue and Their Anticipated Role:** Stephen F Austin State University, Texas A&M University, Texas Nature Conservancy, and Texas Natural Heritage Program to determine presettlement conditions and to propose management strategies for achieving and maintaining these conditions.

## Research Natural Areas - Exhibit 8

### Evaluation and Information of Existing Crosstimbers RNA

**Candidate Name:** Cross Timbers                      **Date of Report:** 2/25/93  
**Forest:** Caddo/LBJ National Grasslands              **District:** LBJ National Grasslands  
**Forest Coordinator:** Ron Haugen                      **Assigned Scientist:** Margaret Devall

**Candidate Proposed by:** This is an existing RNA

**Acres:** 370    **Hectares:** 148

**Land Class:** 330

**Major Cover Types:** Western Cross Timbers and Grand Prairie

**Unique Feature:** Relatively undisturbed example of these two cover types

**T&E Species/Sensitive Species:** See TNHP Report for State Sensitive Species.

**Description/Comments (include land ownership concerns):** This is a large, relatively undisturbed area consisting of transition between the Grand Prairie and Western Cross Timbers vegetative zones. The current evaluation was conducted to further define management objectives for this RNA. The evaluators also looked at a possible boundary adjustment to eliminate management conflicts.

<b>List of Review Team Membership:</b>	<b>Meeting Dates:</b>
Margaret Devall	7/29/92
Ron Haugen	
Karl Stoneking	
Ron Bertsch	
Ben Harbour	

**List of Interested Publics Not Part of Review Team:** Grazing permittee

**Describe Current and Past Use/Management Activities:** The area has been under passive RNA management since 1975. Dispersed recreational use has occurred within the RNA along the mesa rim since designation. There has been some confusion about the exact location of the southern boundary.

**Review Team's Recommendation:** Review team recommends adjusting the boundary as shown on the attached maps and also recommends rewriting the Establishment Report to provide more detailed management guidance.

**Probable Objective for the Area:** Preserve an example of the Grand Prairie and Western Cross Timbers and serve as a baseline area for measuring long-term ecological changes

**Cooperators to Pursue and Their Anticipated Role:** Not identified at this time

# Appendix H

## Vegetation and Natural Plant Communities

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### Introduction

Ecosystems may be the most basic units of nature (Tansley 1935), but vegetation is one of the best indicators of the total environment (Daubenmire 1976). Unfortunately, our ability to utilize vegetation as a tool for understanding the environment is limited by problems as basic as the difficulty of identifying individual species. Consider that east Texas understory plants alone constitute an "extremely complex association of forbs and brush species" (Correll and Johnston 1970). Even identification of the economically important pine trees, for which the "pineywoods" are named has been subject to great difficulty and confusion (Collier 1964). Adding complexity to the study of east Texas vegetation is the number of exotic and introduced species (Correll and Johnston 1970), the wide range of morphological variants, or phenotypes expressed in the area (Ajilvsgi 1979), the degree of human induced modifications in vegetation (Nixon 1985), and the variety of current and past climatic conditions (Jurney and others 1989, Ajilvsgi 1979, Kral 1966). Finally, no system of vegetation classification has been adopted universally, and the various systems in use employ somewhat different nomenclature. For example, the same area of east Texas forest could be designated as dry uplands (Nixon 1985, Ward 1984), upland longleaf pine savanna (Bridges and Orzell 1989), pine uplands (Gow 1904), upland pine forest (Marks and Harcombe 1981), longleaf pine-little bluestem series (Diamond and others 1987), natural pine-hardwood woodland (Fountain and Risner 1988), or southern evergreen forest (Braun 1950).

### SPATIAL VARIABILITY

The plant communities in and around the NFGT vary in composition and occurrence along many environmental gradients. Even when broadly defined, these communities are not evenly distributed across NFGT administrative units. For example, some communities are restricted to the National Grasslands and others to the National Forests. Although "forest" communities are found on the grasslands, these communities are dominated either by species that are generally absent from the National Forests (Ashe's juniper) or by species that generally occur in subdominant or midstory positions in east Texas forests (post oak). For a more detailed summary of plant communities found on the NF's and the NG's see table 1.

There are many subtle variations in vegetation from Forest to Forest and from Grassland to Grassland. These range from changes in the relative abundance or frequency of a species to the presence or absence of particular species or communities. For example, American beech (*Fagus grandifolia*) communities occur on all NF's in Texas except the DCNF. Moreover, beech communities on one forest (SNF) have a rich vernal understory flora that is absent from those on all other districts.

The east Texas pineywoods have been subdivided on the basis of the predominant pine species for more than 100 years (Collier 1964). Mohr (1987) and Bray (1906) were among the first to publish such classifications. They noted three primary, spatially distinct, forest regions: a shortleaf belt throughout much of northeast Texas, a longleaf belt in the southeast, and a loblolly belt, which was restricted to the southwest. These classifications implied that one species predominated in each region and that the remaining pine species occurred only as minor components. In addition, the vegetation typical of each pine belt differed in broad structure and appearance (Bray 1906, Tharp 1939).

These distribution patterns are the result of a complex set of interrelationships among social, physical, and biological systems. In many cases, the causes of these relationships are unknown. In order to develop basic information about these relationships, the FS has developed a hierarchical framework of ecological units. This system integrates associations of ecological factors at various geographic scales and, most importantly, identifies critical factors at each scale. This system is not yet fully developed, but existing work provides a framework for understanding the spatial dimension of plant communities. For a description of these ecological units see Plan Appendix A.

## **TEMPORAL VARIABILITY**

It is widely recognized that contemporary vegetation can be unrepresentative of vegetation that existed formerly and a poor indicator of potential vegetation (Braun 1950; Dyksterhuis 1948; Foster and others 1992). The management significance of this fact was recognized by Zon (1906), who stated that "a forester who mistakes . . . temporary forest growth for the original natural types, thus failing to understand the natural evolution of the forest, will always have nature against him."

## **HISTORICAL PATTERNS**

Typically, information about the original forests of east Texas is found in early diaries, journals, and survey records. This information is not quantifiable by today's research standards. Many of these observations apply only to very limited geographic areas. Ordinarily, though, early settlers found upland landscapes of almost pure stands of "southern yellow pine." They sometimes found dense hardwood stands in creek and river bottoms, or even canebrakes that made crossings difficult (see accounts in Truett and Lay 1984, and Walker and Baker 1983).

Early settlement, agriculture, and land-use patterns have produced lasting changes in the pineywoods vegetation (Collier 1964, Keller 1974).

They have blurred the differences between natural pine forest and pine-oak forest. Today we tend to classify all of east Texas as "pineywoods," "mixed hardwood-loblolly" (Arnold 1978), or "pine-hardwood forest" (Frye and others 1987), but the difference between the open, parklike stands of longleaf and the other forest types was distinct originally (Bray 1906, Foster and others 1917, Loughbridge 1880, Tharp 1939).

## LONGLEAF PINE

Although the smallest of the original pine belts, the longleaf region was probably the largest expanse of almost pure pine communities in the State (Bray 1906). The value of the longleaf belt was not overlooked by those who were lucky enough to view that resource: "The longleaf pine.. forms miles of dense forest of the cleanest, most uniform, and symmetrical body of pine to be found on the continent" (Bailey 1905). Hardwoods were probably less common in this region than in the shortleaf and loblolly regions. Although hardwood stems and clumps did occur with some frequency in presettlement longleaf stands (Harcombe and others 1994; Myers 1990; Schafale and Harcombe 1983) their abundance today is closely related to long periods of fire suppression or periodic winter burning practices (Boyer 1980; Bridges and Orzell 1989, Garren 1943)

Longleaf pine forests throughout Texas and the Southeast often had prairie-like under stories (Bartram 1766; Bray 1906, Tharp 1939). These conditions were maintained by lightning fires, possibly in combination with aboriginal burning. Frequent fires limited shrub and hardwood invasion and generally favored reproduction of longleaf pine over that of other pines. Several studies have confirmed the importance of frequent burning to eliminate hardwood and shrub invaders (Bruce 1947; Grano 1970; Harrington & Stephenson 1955; Heyward 1939, Lewis and Harshbarger 1976, Rebertus and others 1989; Streng and others 1994; Waldrop and others 1987). Longleaf pines have physical characteristics that confer a great degree of fire resistance (McCune 1988). Heyward (1939) observed that even longleaf seedlings tolerate fire "to a degree unequalled by any other indigenous tree species". These characteristics virtually assure longleaf a competitive advantage where fire is frequent. It has even been suggested that these characteristics actually facilitate fire (Mutch 1970, Platt and others 1988, Wells and Shunk 1928). Because the entire life cycle of longleaf is closely linked to fire and because longleaf's need for frequent fires is almost legendary (Myers 1990) the longleaf forest has been called "the forest that fire made" (Greene 1931).

Important groundcover dominants of longleaf forests, including bluestems (*Schizachyrium scoparium* and *Andropogon* spp), appear to increase after fires (Bruce 1947, Hodgkins 1958; Lemon 1949, Lewis and Harshbarger 1976). If such increases occur they may be related to shifts in abundance triggered by flowering and potential reproductive increases (Streng and others, 1994). Associated with these fire adapted grasses are many herbs, specialized orchids, carnivorous plants, and rare and

endemic plant species (Bridges and Orzell 1989, Hardin and White 1989) One sometimes finds more than 30 species per square meter (Frost and others 1986) or 50 or more species in several square meters (Clewell 1986) in these frequently burned understories Species richness values in these communities are among the highest in North America (Frost and others 1986) Fire is essential to maintain these species-rich understories (Walker and Peet 1983, Wells and Shunk 1928), and most of the characteristic species disappear after short periods of fire exclusion (Frost and others 1986) Vegetation changes that result from fire exclusion may also displace species of wildlife and invertebrates (Vogl 1973)

The incredible decline of longleaf pine communities is very well documented (Crocker 1987; Means and Grow 1985; Tebo 1985; Wahlenberg 1946) Across the Southeast, only 3 percent of historic longleaf land still supports longleaf (Myers 1990) In Texas, longleaf forests once occupied at least 5,000 square miles (Bray 1906, Loughbridge 1880, Sargent 1884) The greater part of these forests had been cut by 1917 (Foster and others 1917) However, an estimated 25,900 acres (in large tracts) persisted uncut into the late 1930's (Cruikshank and Eldredge 1939). More recently, longleaf made up a plurality of stocking on only 34 7 thousand acres (McWilliams and Lord 1988). Of this, almost 32,000 acres are in NF's (USFS 1994) Because areas of longleaf forest habitat have been lost and because much remaining habitat has been degraded (especially through alteration of fire regimes), longleaf forests have more threatened and endangered biota than do temperate or tropical rainforests (Simberloff in press 1994)

## **LOBLOLLY PINE**

The original loblolly belt occupied approximately 6,000 to 7,000 square miles in southeast Texas (Bray 1906) This apparently natural occurrence of a large loblolly pine region may be unique in the Southeast There is no corresponding loblolly region in Louisiana (Brown 1944, Delcourt 1976) or Florida (Myers 1990) The causal factors in the development of this belt are unknown.

The southeast Texas loblolly belt may be the "Big Thicket" of east Texas (Collier 1964) Forests in this area are thought to have been quite dense and junglelike, and a significant barrier to overland travel (Parks and Cory 1938). This description contrasts markedly with descriptions of other pine belts Pure pine stands in the loblolly region were rather limited in area, often restricted to deep sands (Zon 1904) More typically, loblolly seemed to grow in association with hardwood Zon (1904) wrote that "the half swampy flats grow a jungle of hardwood with some loblolly and that oaks are especially abundant and of excellent growth throughout the area "

These latter descriptions are fairly typical of loblolly pine communities today Of three recognized cover types containing loblolly, one explicitly includes hardwoods (USFS type 82), while the remaining USFS types

(80 and 81) are considered successional temporary (Crow 1980) or transient, and expected to gradually revert to an upland oak climax in the absence of fire or other disturbance. These descriptions imply fire regimes very different from those typically ascribed to longleaf or shortleaf forests. Fire is certainly an important ecological factor in these Loblolly forests. As the SAF descriptions recognize, fire retards succession from loblolly-dominated overstories to ones dominated by hardwood species (Crow 1980, Mann 1980). However, loblolly is not a fire-resistant species (McCune 1988), and fire frequency associated with occurrence is lower than that associated with the occurrence of most other southern pines (Landers 1989).

Schafale and Harcombe (1983) found evidence that a part of the original loblolly belt in Hardin County was mixed forest. They did not find evidence of a disturbance regime that would have accounted for the abundance of pine in the area, however. Some historical records indicate that portions of the loblolly belt may be more affected by infrequent inshore hurricanes than by fire (Collier 1964).

Today, loblolly is the most important species throughout much of the remaining forested area within the original loblolly belt (Thomlinson 1993). Loblolly is also dominant throughout the area originally classified as longleaf belt, and it now shares dominance in the former shortleaf pine region (McWilliams and Lord 1988). The increase of loblolly in these areas apparently began with massive waves of logging of the original types. Loblolly pine has "frequent and prolific seeding, rapid growth from the start, and comparative freedom from damage by hogs" (Zon 1904), in addition to greater seed dispersal distance and earlier reproductive age than longleaf pine (Landers 1989). These characteristics virtually assured that loblolly would replace longleaf on cutover land in a pattern also observed in North Carolina (Wells 1932, Zon 1904). Loblolly, also called old-field pine, has also invaded some natural shortleaf sites (Martin and Smith 1991, McWilliams and Lord 1988).

## **SHORTLEAF PINE**

The original shortleaf pine belt was the most extensive pine region in Texas, extending throughout much of northeast Texas (Bray 1906). Logging occurred earlier than in the other pine types, and virgin shortleaf was probably cleared before appreciable logging took place in other regions (Foster and others 1917). By the early 1900's, most of the area where shortleaf pine formed compact forests over many hundreds of square miles had been removed (Bray 1906). This area was more suitable for agriculture than were other pine regions. Earlier settlement and more complete agricultural clearing have relegated tree production to lower priority in northeast Texas (Collier 1964, Maxwell and Martin 1970).

Because the shortleaf forests were removed early and often completely, we have little knowledge of their character. It is believed that pure pine stands did occur, but that pine more often grew in association

with hardwoods (and especially with upland oaks and hickories) (Foster and others 1917). Remnant shortleaf-oak-hickory forests have been described by a number of authors (Martin and Smith 1991; Sullivan and Nixon 1971). It is possible that many areas once supported relatively pure shortleaf-bluestem communities

In some places, the pine component present today may be greater than that present in presettlement times (Keller 1974). In one portion of the shortleaf belt this is apparently the result of timber management practices (Bruseh and Moir 1987). Although shortleaf grows and develops rapidly, the site index for this species rarely exceeds that for loblolly pine (Walker and Wiant 1966). Loblolly's very rapid growth is one reason why loblolly is now so important throughout northeast Texas (McWilliams and Lord 1988). On the other hand, shortleaf is rather drought tolerant and is less seriously damaged by ice and sleet storms than is loblolly or longleaf. These characteristics probably explain why the native range of shortleaf extends farther north than those of loblolly and longleaf (Walker and Wiant 1966).

Shortleaf is adapted to survive relatively frequent fires. It can sprout prolifically after burns when young and is almost unaffected by growing-season headfires when its diameter breast height (d.b.h.) is greater than 4 inches (Walker and Wiant 1966). In a typical shortleaf fire regime, fire may be of moderate intensity and reoccur approximately every 10 years (Landers 1989). Shortleaf appears to require fire for reproduction. Litter accumulates and exposure of mineral soil declines with increased time since burning. These factors contribute to decreased seed germination, which drops to almost 0 percent after 3 years (Ferguson 1958).

## HARDWOODS

Presettlement forest composition varied greatly with east Texas location and plant community (Keller 1974). Not all areas were pine-dominated grasslands. Hardwoods were important components of both shortleaf and loblolly forests. If these forests were to persist "undisturbed" the relative importance of hardwoods would certainly increase. It has been said that "no serious ecologist entertains the concept of a pine climax in the Coastal Plain" (Quarterman and Keever 1962). This idea follows from many observations that natural succession on mesic sites tends to favor hardwood development over pine development in the Southeast (Blair and Burnett 1976; Garren 1943, McLeod 1972, Quarterman and Keever 1962).

One distinctive upland region, the Redlands, was originally dominated by hardwoods (Chambers 1941, Gow 1904; Hilgard 1884; Johnson 1931; Roberts 1893). Cruikshank and Eldredge (1939) considered that the Redlands exhibited the best development of upland hardwood forest in east Texas. This area is rather limited in size, occupying a narrow east-west band. Because the area's loamy soils are productive, much of this ground was cultivated long ago (Johnson 1931, Roberts 1881). Cultivation obliterated evidence of historical vegetation relationships.

Several authors described a scrubby forest of oaks (southern red, post, and blackjack), hickories, elms, and other hardwoods (Austin 1821, Roberts 1881), and even a "thick coat of grass" (Roberts 1893). Roberts (1881) considered this area to be the lower edge or extension of the "blackjack belt" Hilgard (1884) recognized "redlands" in Louisiana as part of the "oak-uplands region" and described the usual timber growth as oak and hickory that was almost always associated with shortleaf pine

Other important hardwood-dominated communities were found along major drainages dissecting uplands in the pine belts described above. Bottomland forests (and associated riparian vegetation) previously occupies more than 16 million acres in Texas (Frye 1987). Bottomland vegetation has been altered extensively over long periods of settlement. By the early part of this century, many of the more commercially valuable species had been removed (Fosters and others 1917). By 1980, when an extensive, detailed assessment of the status and quality of bottomland hardwood vegetation in Texas was completed, less than 6 million acres of such vegetation remained. More than 63 percent of the original forested bottoms have been lost, largely as a result of development of reservoirs on major watersheds (Frye 1987)

Some presettlement forests in east Texas were dominated by mesic species such as American beech and southern magnolia. Roberts described a magnolia belt approximately 20 miles wide running westward from the Sabine River. This area "was overgrown with a magnificent forest of mammoth white oaks, beech, sugar-tree, elm, water-oak and magnolia . . . presenting, even upon ridges, the appearance of a rich bottom, adjoining a river" (Roberts 1881)

American beech, southern magnolia, white oak, and loblolly pine may have been originally more common and widespread components of the Big Thicket community (McLeod 1972). The relative abundance and actual distribution of these species may never be known, but hardwood species have declined as a result of extensive girdling practices (McLeod 1972, Mize 1993). These practices may partially explain the increased abundance of pine on some sites in east Texas (Keller 1974). This shift in forest composition appears inconsistent with the tendency of natural succession on mesic sites across the southeast to favor hardwoods over pines (Blair & Burnett 1976, Garren 1943, McLeod 1972, Quarterman and Keever 1962). Although beech and magnolias have been described as dominant in late successional forests (Braun 1950; Delcourt and Delcourt 1974, 1977, Nixon and others 1978), it has also been suggested that their conspicuousness has led observers to ascribe exaggerated importance values to them (Quarterman and Keever 1962). Seedlings and saplings of these species are often poorly represented (Blaisdell and others 1974; Harcombe and Marks 1978, Kurz 1944, Nixon and others 1980).

## DISTURBANCE FACTORS

Both managers and researchers recognize that fire can mold landscapes. Fire was and is a very strong influence on the woodland, savanna, and prairie environments of east and north Texas (Jordan 1973).

Many variables affect fire regime and its effects on vegetation. In grasslands, temporal and spatial variations in climate, differential effects of fire on woody and other plant species, topographic influences on fire frequency, and burning by aboriginal peoples are important (Anderson 1990). Many of these same factors are also important in forested environments.

Plant communities typical of both forests and grasslands are associated with high natural fire frequencies, and many plant communities may have evolved in the presence of fire over long periods (Mutch 1970). Natural fires are usually ignited by summer lightning, which is very common in the southern United States (Komerak 1964; Orville 1991). In many cases the effects of lightning fire regimes may have been obscured by human activities (Delcourt 1976). For approximately 50 years, wildland fire policy has been to suppress lightning fires or to conduct burns primarily during the winter or both. This policy has been described as a "giant uncontrolled experiment" with unforeseen results (Platt 1993). In the long-needled pine types (like longleaf), wildland fire policy has reduced open, herbaceous-dominated cover and created a variety of forest health problems that affect our ability to ensure ecosystem sustainability (USFS 1993). Nevertheless, lightning fires have probably been frequent enough to have lasting effects on plant and animal communities (Komerak 1964).

Growing season fires tend to have greater ecological significance than those occurring during the winter dormant season. Actively photosynthesizing plants have low carbohydrate reserves and thus have increased susceptibility injury or death (Ferguson 1957, Waldrop and others 1987). In comparison with burns in the dormant season, growing-season burns topkill a higher percentage of stems, topkill larger stems, reduce resprouting, and increase complete kill (Robbins and Myers 1989). Fire frequency often interacts with seasonality to create unexpected vegetation patterns. For example, periodic winter, periodic summer, annual winter, and biennial summer burning treatments caused understory hardwood stems to proliferate to levels greater than in an unburned control (Waldrop and others 1987).

Wind, ice, drought, hurricanes, and insect and disease outbreaks also affected presettlement forests of east Texas. Among these factors, outbreaks of southern pine beetle (*Dendroctonus frontalis*), are probably the most widespread and important. Occurrence of this native pest was first documented in southern forests in the 1750's (Thatcher 1980). SPB populations reach epidemic level periodically. At these population levels SPB can damage pine timber severely. Unfortunately, there has been little study of SPB effects on plant communities or on the vast

majority of southern tree species (Leuschner 1980). It is known that various factors influence the dynamics of SPB populations. Of particular importance are tree species composition at stand and landscape levels, the spatial distribution of trees, and site factors. For example, it is well known that certain overstory species, especially longleaf pine, are resistant to SPB attacks (Belanger 1980) and that stands with hardwood components inhibit SPB spread (Belanger 1980). The presence of many longleaf pines or hardwoods or both tends to decrease the likelihood of SPB outbreak and subsequent spread.

## **EXISTING PLANT COMMUNITIES**

Although the USFS routinely collects vegetation data during silvicultural examinations, not all vegetational strata are inventoried. Areas of similar overstory composition are classified as "stands" in a system which follows the forest cover descriptions of the Society of American Foresters, at least 15 forest types are documented on the NFGT (USFS 1994). The first comprehensive plant community inventory work on the NFGT was completed by the Texas Natural Heritage Program (TNHP) in 1990. This inventory, which focused on late-seral areas, identified 17 exemplary plant communities on the NFGT (Orzell 1990). Four of these plant communities occur exclusively on the Grasslands and are characteristic of prairie or woodland savannas. The other 13 exemplary communities are more typical of traditional pineywoods habitat, and most are closely related to communities occurring north or east of Texas. Three additional plant communities may occur on NFGT.

The 20 community series of interest are listed in table 1, where they are classified Allard (1990). These community series are then described twice, first as by NFGT and then as by TNHP (Diamond and others 1987).

**Table 1 Major Vegetation Systems of the National Forests  
and Grasslands in Texas**

***PALUSTRINE***

*Forested Wetlands*

Cypress Swamp - Baldcypress - Water Tupelo Series

Floodplain Forest

- Overcup Oak Series
- Water Oak - Willow Oak Series
- Swamp Chestnut Oak - Willow Oak Series
- Pecan - Sugarberry Series
- Sugarberry - Elm Series

*Shrub Wetland*

Seepage Slope - Sweetbay Magnolia Series

*Herbaceous wetland*

Hillside Bog - Sphagnum-Beakrush Series

***TERRESTRIAL***

*Forests*

Upland Dry-Mesic Forest- Loblolly Pine-Oak Series

Mesic Forests

- American Beech-White Oak Series
- American Beech-So Magnolia Series

*Woodlands or Savannas*

- |                             |  |
|-----------------------------|--|
| Midwestern Oak Woodland     | - Post Oak - Blackjack Oak Series        |
|                             | - Post Oak - Black Hickory Series        |
|                             | - Shortleaf Pine - Oak Series            |
| Southern Pine-Oak Woodland  | - Bluejack Oak - Pine Series             |
|                             | - Longleaf Pine - Little Bluestem Series |
| Western Juniper Woodland    | - Ashe's Juniper Oak Series              |
| Western Upland Oak Woodland | - Texas Oak Series                       |

*Glades (Mixed Physiognomy)*

Sandstone Glade - Little Bluestem - Nuttall's Goldenrod Series

*Grasslands or Terrestrial Herbaceous Vegetation*

Tallgrass Prairie - Little Bluestem - Indiangrass Series

# Palustrine

## Forested Wetlands

### *Baldcypress - Water Tupelo Series (Cypress swamp)*

This community is often dense-canopied, and is dominated by baldcypress (*taxodium distichum*) and water tupelo (*Nyssa aquatica*). The understory is often sparse, but abundant microhabitats exist. These include buttressed trunks, root growths (including "knees"), and floating logs. Standing water is present for much of the year. Vines and epiphytes are common. Individual trees can reach the age of 1,000 years.

#### VEGETATION:

**DOMINANTS.** Baldcypress (*Taxodium distichum*), water tupelo *Nyssa aquatica*, green ash (*Fraxinus pennsylvanica*), red maple (*Acer rubrum*), water-elm (*Planera aquatica*), common lizardtail (*Saururus cernuus*).

**Overstory:** Almost exclusively baldcypress or water tupelo or both, but the properties each make up is variable. Common overstory associates (essentially subcanopy elements) may include red maple ashes water locust (*Gleditsia aquatica*), swamp tupes (*Nyssa sylvatica* var. *biflora*), and a few others. Spanish moss (*Tillandsia usneoides*) is often draped conspicuously in overstory trees.

**Midstory:** May include swamp-privet (*Forestiera acuminata*), Carolina ash (*F. caroliniana*), water-elm, black willow (*Salix nigra*), regenerating overstory species, and a few others.

**Understory:** May include Virginia sweetspire (*Itea virginica*), button-bush (*Cephalanthus occidentalis*), hollies (*Ilex spp.*), and other woody plants. Various herbs and ferns may be present on stumps, logs, and exposed root masses, but herbaceous understory is generally minimal because inundation periods are long. Herb species may include caric-sedges (*Carex spp.*), umbrella-sedges (*Cyperus spp.*), rushes (*Juncus spp.*), smallspike false nettle (*Boehmeria cylindrica*), cardinal flower (*Lobelia cardinalis*), smartweeds (*Polygonum spp.*), lance-leaved water-willow (*Justicia ovata*), St. John's worts (*Hypericum spp.*), and a few others. Various floating and submerged aquatic plants are often present. A diverse epiphytic cryptogam flora (mosses, liverworts, lichens) may be present on tree trunks and limbs. Many of these probably are habitat or site specific or both, but relatively little is known about the ecology of most cryptogams.

#### SPECIAL-INTEREST PLANTS.

*Triphora trianthophora* (may be present on logs, stumps, exposed root masses, and swamp edges)

## PHASES OR VARIATION:

Little variation in overall species composition, but considerable variation in percentage cover of baldcypress and water tupelo depending on site characteristics including land-use history, timing and depth of flooding, and nutrient availability

## IMPORTANT HABITAT ATTRIBUTES:

Old trees (age >300 years) present  
Trees of multiple age, size, and form classes present  
Snags and downed woody material common  
Hydrologic regime intact

## POTENTIAL PLANT INDICATORS:

*Taxodium distichum* – baldcypress  
*Nyssa aquatica* – water tupelo  
*N. sylvatica* – blackgum  
*Cephalanthus occidentalis* – buttonbush  
*Chiodecton sanguinea* (?)

### *Floodplain Forests*

Floodplain forests most typically occur in well-defined terraces along rivers and larger streams. In their natural state they are uneven-aged and with regeneration of most component tree species is confined principally to canopy gaps. Flood events, especially those of long duration, may induce widespread mortality of trees and shrubs. Although oaks are usually dominant, the woody species most common in floodplain forests in southeast Texas are green ash (*Fraxinus pennsylvanica*), possumhaw (*Ilex decidua*), overcup oak (*Quercus lyrata*), American elm (*Ulmus americana*), sugarberry (*Celtis laevigata*), common persimmon (*Diospyros virginiana*), water hickory (*Carya aquatica*), sweetgum (*Liquidambar styraciflua*), cedar elm (*Ulmus crassifolia*), water oak (*Q. nigra*), swamp privet (*Forestiera acuminata*), hawthorns (*Crataegus spp.*), and water-elm (*Planera aquatica*)

## PHASES OR VARIATION:

The composition of these forests varies considerably depending upon topographical, geographical, and historical factors. Some of this variation will be reflected in the following series

### **OVERCUP OAK SERIES**

(*Quercus lyrata*)

This phase may succeed the baldcypress - water tupelo series (and possibly other series) in backwater areas, including oxbows, as sedimentation progresses.

## VEGETATION:

**DOMINANTS** Overcup oak, water hickory (*Carya aquatica*), green ash (*Fraxinus pennsylvanica*), American elm, (*Ulmus americana*) (*Celtis laevigata*), red maple (*Acer rubrum*), buttonbush (*Cephalanthus occidentalis*), peppervine (*Ampelopsis arborea*)

**Overstory:** Overcup oak, water hickory, green ash, American elm, sugarberry, and red maple

Other spp. may include willow oak (*Q. phellos*), common persimmon (*Diospyros virginiana*), water-elm (*Planera aquatica*), cedar elm (*V. crassifolia*), Nuttalls oak, (*Q. nuttalli*) waterlocust (*Gleditsia aquatica*), baldcypress (*Taxodium distichum*), roughleaf dogwood (*Cornus drummondii*), swamp-privet (*Forestiera acuminata*), winged elm (*U. alata*), American buckwheat vine (*Brunnichia ovata*), common trumpet creeper (*Campsis radicans*), Alabama supplejack (*Berchemia scandens*), Carolina snailseed (*Cocculus carolinus*), riverbank grape (*Vitis riparia*), lance-leaved waterwillow (*Justicia ovata*)

## WATER OAK - WILLOW OAK SERIES

(*Quercus nigra* - *Q. phellos*)

This series is often quite similar in species composition to forests on the adjacent slopes (just above the floodplain). Hardwoods, many of which reach old ages, are dominant.

## VEGETATION:

**DOMINANTS** Willow oak, laurel oak (*Q. laurifolia*), water oak, Nuttalls oak (*Q. nuttalli*), sweetgum, hornbeam, possumhaw (*Ilex decidua*), Virginia sweetspire (*Itea virginica*), Alabama supplejack (*Berchemia scandens*), grapes (*Vitis* spp.), common greenbrier (*Smilax rotundifolia*).

**Overstory:** Commonly supports a diversity of hardwoods including white oak (*Q. alba*), swamp chestnut oak (*Q. michauxii*), water oak, laurel oak, cherrybark oak (*Q. pagodifolia*), Delta post oak (*Stellata* var *paludosa*), willow oak, Shumard oak (*Quercus shumardii*), American beech (*Fagus grandifolia*), southern magnolia (*Magnolia grandiflora*), sweetbay (*M. virginiana*), swamp blackgum (*Nyssa sylvatica*), sweetgum, sycamore (*Platanus occidentalis*), red maple (*Acer rubrum*), Florida maple (*A. barbatum*), chalk maple (*A. leucoderme*), river birch (*Betula nigra*), winged elm (*Ulmus alata*), slippery elm (*U. rubra*), white ash (*Fraxinus americana*), Carolina ash (*Fraxinus caroliniana*), pignut hickory (*Carya glabra*), bitternut hickory (*C. cordiformis*), shagbark hickory (*Carolina ovata*), basswood (*Tilia caroliniana*), yellow poplar (*Liriodendron tulipifera*), red mulberry (*Morus rubra*), and others. The forest usually contains loblolly pine (*Pinus taeda*) and may support shortleaf pine (*P. echinata*)

**Midstory:** Includes regenerating overstory species and may support a variety of small trees and shrubs including American hornbeam (*Carpinus caroliniana*), eastern hophornbeam (*Ostrya virginiana*), blueberries (*Vaccinium* spp), pawpaw (*Asimina triloba*), arrowwood (*Viburnum dentatum*), Virginia sweetspire (*Itea virginica*), maple-leaf viburnum (*V. acerifolium*), American snowbell (*Styrax americana*), bigleaf snowbell (*S. grandifolius*), two-wing silverbell (*Halesia diptera*), sweetleaf (*Symplocos tinctoria*), fringetree (*Chionanthus virginicus*), parsley hawthorn (*Crataegus marshallii*), hawthorns (*Crataegus* spp), possumhaw (*Ilex decidua*), American elder (*Sambucus canadensis*), and others Vines that may be present include greenbriers (*Smilax* spp), Alabama supplejack (*Berchemia saundersii*) wild grape (*Vitis* spp), common trumpetcreeper (*Campsis radicans*), poison-oak (*Toxicodendron radicans*), croosvine (*Bignonia capreolata*), American star jasmine (*Trachelospermum diffusum*), Virginia creeper (*Parthenocissus quinquefolia*), and wood-vamp (*Decumaria barbara*)

**Understory:** Herbaceous cover is often minimal because of flooding and canopy shade but may include a broad diversity of species. Patches of giant-cane (*Arundinaria gigantea*) are common. The forest may include species from adjacent nonflooded or rarelyflooded forests, especially near the annual flooded-nonflooded boundary and on elevated areas within the flood zone Herb species encountered may include basket selaginella (*Selaginella apoda*), ladyfern (*Athyrium filix-femina*), Christmasfern (*Polystichum acrostichoides*), broad beechfern (*Thelypteris hexagonoptera*), broadleaf woodoats (*Chasmanthium latifolium*), woodoats (*Chasmanthium* spp), common lizard tail (*Saururus cernuus*), partridge-berry (*Mitchella repens*), St Johns worts (*Hypericum* spp) golden alexanders (*Zizia aurea*), cardinal flower (*Lobelia cardinalis*), lance-leaved waterwillow (*Justicia ovata*), panicums (*Panicum* spp), umbrella-sedges (*Cyperus* spp), caric-sedges (*Carex* spp), rushes (*Juncus* spp), smallspike false-nettle (*Boehmeria cylindrica*), waterprimroses (*Ludwigia* spp), smartweeds (*Polygonum* spp), and a variety of others. The community usually supports a rich epiphytic constituent of mosses, lichens and liverworts Many of these are probably habitat or site specific or both, but relatively little is known about their ecology

## SPECIAL-INTEREST PLANTS

KNOWN to occur on NF TX

*Amsonia glaberrima*  
*Triphora trianthophora*  
*Prenanthes barbata*  
*Solidago auriculata* (calcareous)  
*Taenidia integerrima* (calcareous)  
*Erythronium rostratum*  
*Xanthorhiza simplicissima*

KNOWN to occur elsewhere in Texas

*Amsonia ludoviciana*

### SWAMP CHESTNUT OAK - WILLOW OAK SERIES

(*Quercus michauxii* - *Q Phellos*)

Generally very similar to water oak-willow oak series, with water oak (*Q nigra*) of lesser importance. This type occurs primarily on ridges of first bottom and thus is rarely flooded. This floodplain forest variant is often located farthest from the river and may adjoin the lower-slope upland communities.

#### VEGETATION:

**DOMINANTS:** Swamp chestnut oak, cherrybark oak (*Q falcata* var *pagodifolia*) paw paw (*Asimina triloba*), American hornbeam (*Carpinus caroliniana*), dwarf palmetto (*Sabal minor*), Alabama supplejack (*Berchemia scandens*), Virginia creeper (*Parthenocissus quinquefolia*), muscadine grape (*Vitis rotundifolia*), sedges (*Carex* spp.), poison-ivy (*Toxicodendron*)

**Overstory:** Swamp chestnut oak, laurel oak, (*Q. laurifolia*) water oak (*Q nigra*), willow oak (*Q phellos*), Shumard oak, cherrybark oak, southern red oak, white oak, sweetgum, white ash (*Fraxinus americana*), green ash (*F. pennsylvanica*), mockernut hickory (*Carya tomentosa*), bitternut hickory (*C. cordiformis*), nutmeg hickory (*C. myristiciformis*), shellbark hickory (*C. laciniosa*), swamp tupelo (*Nyssa sylvatica* var *biflora*), American elm (*Ulmus americana*), water hickory (*C. aquatica*), shagbark hickory (*C. ovata*), southern magnolia (*Magnolia grandiflora*), yellow-poplar (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), loblolly pine (*Pinus taeda*).

**Midstory:** Possumhaw (*Ilex decidua*), American holly (*I. opaca*), flowering dogwood (*Cornus florida*), dwarf palmetto (*Sabal minor*), American snowbell (*Styrax americanus*), devils-walkingstick (*Aralia spinosa*), eastern redbud (*Cercis canadensis*)

**Understory:** Giant-cane (*Arundinaria gigantea*), broadleaf woodoats (*Chasmanthium latifolium*), woodoats (*C. laxum*), violets (*Viola* spp.), smallspike false nettle (*Boehmeria cylindrica*)

## PECAN - SUGARBERRY SERIES

(*Carya illinoensis* - *Celtis reticulata*)

In our area, this type occurs only in the Grassland system (sometimes adjacent to Ashes juniper-oak series)

### VEGETATION:

Important species may include netleaf hackberry, cedar elm (*Ulmus crassifolia*), bur oak (*Quercus macrocarpa*), American elm (*V. americana*), Texas live oak (*Q. fusiformis*), Texas oak (*virginiana* var / *Q. shumardii* var *Texana*), black walnut (*Juglans nigra*), boxelder (*Acer negundo*), and ashes (*Fraxinus* spp).

## SUGARBERRY - ELM SERIES

(*Celtis* - *Ulmus*)

This type was not found on NF land during the Natural Heritage survey, but it may occur in the Grasslands. The series exhibits much variation and probably grades into water oak-willow oak series to the east.

### VEGETATION:

The following species may be important. cedar elm (*V. crassifolia*), American elm, (*U. americana*), pecan (*Carya illinoensis*), ashes (*Fraxinus berlandierana*, *F. pennsylvanica*, *F. texensis*), Texas oak, bur oak (*Q. macrocarpa*), chinkapin oak (*Q. muehlenbergii*), and sycamore (*Platanus occidentalis*).

## Shrub Wetland

### *Sweetbay Magnolia Series (Seepage Slope)*

(*Magnolia virginiana*)

This community, locally known to as "baygall," often appears as a dense evergreen shrub thicket. These areas are generally larger than hillside bogs and may occur adjacent to them. The water table is generally close to the surface for long periods, and deep standing pools are common. This series can develop along wet creek bottoms. Open water, woody growth forms (including cypress knees, and buttressed trunks) and organic knolls contribute important habitat diversity.

### VEGETATION:

**DOMINANTS:** Sweetbay, swamp tupelo (*Nyssa sylvatica* var. *biflora*), laurel oak (*Quercus laurifolia*), large gallberry (*Ilex coriacea*), red bay (*Persea borborea*), Carolina ash (*Fraxinus caroliniana*)

**Overstory:** True overstory is generally lacking when this type develops hillside bogs, where fire has been suppressed but may include

sweetbay, swamp tupelo, American holly (*Ilex opaca*), and red maple (*Acer rubrum*)

In stream bottoms where fire occurs rarely, the overstory becomes more developed. Sweetbay and swamp tupelo typically dominate, but the overstory may also contain American holly, red maple, laurel oak, southern magnolia (*Magnolia grandiflora*), loblolly pine (*Pinus taeda*), baldcypress (*Taxodium distichum*), and others.

**Midstory:** The midstory always includes numerous shrub species, many of which are evergreen, and may include large gallberry, southern bayberry (*Myrica cerifera*), evergreen bayberry (*Myrica heterophylla*), redbay (*Persea borbonia*), hazel alder (*Alnus serrulata*), poison-sumac (*Toxicodendron vernix*), possumhaw viburnum (*Viburnum nudum*), red choke-berry (*Aronia arbutifolia*), he-huckleberry (*Lyonia ligustrina*), Texas azalea (*Rhododendron oblongifolium*), and others. Laurel greenbrier (*Smilax laurifolia*) is usually quite conspicuous, climbing into and overtopping shrubs and small trees.

**Understory:** Typically includes a number of ferns, especially in stream bottoms. cinnamon fern (*Osmunda cinnamomea*), royal fern (*Osmunda regalis* var. *spectabilis*), chainfern (*Woodwardia areolata*), sensitive fern (*Onoclea sensibilis*), and Virginia chainfern (*Woodwardia virginica*) may be present. Sphagnum moss beds may be abundant, and other mosses and liverworts may be common. Various herbaceous species characteristic of hillside bogs may occur sporadically in openings, on edges, and suppressed in the understory. Other herbaceous species may include fingerorchids (*Platanthera* spp.), flatsedges (*Cyperus* spp.), and caric-sedges (*Carex* spp.). There is often increased structural development along streams. More woody debris (stumps and logs), root masses, and tree trunks, may be present, and these may provide microhabitat for mosses and liverworts.

#### SPECIAL-INTEREST PLANTS

KNOWN to occur on NF TX

*Apteria aphylla*  
*Burmannia biflora*  
*Bartonia texana*  
*Mayaca fluviatilis*  
*Prenanthes barbata*  
*Carex styloflexa*  
*Lilium michauxii*  
*Rudbeckia scabrifolia*

## PHASES OR VARIATION:

Composition and development vary with topography, geography, disturbance history, and other factors. Variation occurs along north-south, and topographic gradients. Some areas are completely surrounded by longleaf pine (*Pinus palustris*) forests, but others are entirely outside the longleaf range. Within the longleaf range, this series is often located on wetter ground adjacent to herbaceous bogs. The two series may exchange locations depending upon fire frequency.

## IMPORTANT HABITAT ATTRIBUTES:

Free from mechanical disturbance  
Ecotones and surrounding habitat in natural condition  
Drainage and recharge areas intact

## POTENTIAL PLANT INDICATORS:

*Ilex coriacea* - large gallberry  
*Alnus serrulata* - hazel alder  
*Osmunda* spp - cinnamon ferns  
*Sphagnum* spp - sphagnum mosses  
*Myrica heterophylla* - evergreen bayberry  
*Vaccinium* - corymbosum-Elliott's blueberry  
*Toxicodendron vernix* - poison sumac  
*Smilax laurifolia* - laurel greenbrier

## Herbaceous Wetland

### *Sphagnum* - Beakrush Series (Hillside Bog) (*Spagnum* - *Rhynchospora*)

These communities consist of predominantly graminoid cover, but wetland shrubs and occasional trees may be scattered about. More than 100 plant species may be found in a single bog (MacRoberts and MacRoberts 1988, Nixon and Ward 1986), and many of these species are exclusive to this habitat. Carnivorous flora are represented well. Sub-surface water percolation and frequent fires from surrounding uplands are important factors maintaining these habitats.

## VEGETATION:

**DOMINANTS** Beakrushes esp *R. oblonga*, *R. gracilentia*, *R. tu*, *R. glomerata*), bushy bluestem (*Andropogon glomeratus*), e bayberry (*Myrica heterophylla*), pitcherplant (*Sarracenia al* greenbrier (*Smilax laurifolia*), nutrush (*Scleria reticularis*)

**Overstory:** Generally lacking in frequently burned t (*Magnolia virginiana*) may attain large size, and long *palustris*) may be present, especially on the peripher

HERBACEOUS PLANTS Usually dominated by sedges, grasses, and beakrushes Pitcherplants and various species are usually present. Major graminoids include cutover muhly (*Muhlenbergia expansa*), panicums (*Panicum* spp.), threeawn grasses (*Aristida* spp.), silky scale grasses (*Anthaenantia* spp.), Rhynchospora latifolia and numerous other beakrushes, several yellow-eye-grasses (*Xyris* spp.), pipeworts (*Eriocaulon* spp, *Lachnocaulon* spp.), nutrushes (*Scleria* spp.), and umbrellagrasses (*Fuirena* spp.). Primary forbs include meadow beauties (*Rhexia* spp), milkworts (*Polygala* spp.), blazing-star (*Liatris pycnostachya*), coresopsis tickseed (*Coreopsis linifolia*), simple-leaf (*Eryngo integrifolium*), thorough-worts (*Eupatorium* spp.), and *Chaptalia tomentosa*. Additional carnivorous plants are sundews (*Drosera* spp.), small butterwort (*Pinguicula pumila*), and bladderworts (*Utricularia* spp.). Various orchids, especially *Calopogon*, *Pogonia*, and *Platanthera* spp., are often conspicuous. Clubmosses (*Lycopodium* spp.) are usually common and sphagnum moss (*Spagnum* spp.) is typically abundant beneath other herb cover

WOODY PLANTS: (see also Sweetbay Magnolia series). The following woody plants readily invade bogs and may come to dominate them without fire. large gallberry (*Ilex coriacea*), southern bayberry (*Myrica cerifera*), evergreen bayberry (*Myrica heterophylla*), redbay (*Persea borbonia*), poison sumac (*Toxicodendron vernix*), possumhaw viburnum (*Viburnum nudum*), red choke-berry (*Aronia arbutifolia*), laurel greenbrier (*Smilax laurifolia*), sweetbay (*Magnolia virginiana*), swamp tupelo (*Nyssa sylvatica* var. *biflora*), and red maple (*Acer rubrum*). Longleaf pine (*Pinus palustris*) may occur as scattered trees.

#### SPECIAL-INTEREST PLANTS

KNOWN to occur in NF TX bogs:

*Lycopodium cernuum*  
*Platanthera integra*  
*Rhynchospora macra*  
*Eriocaulon texense*  
*Xyris drummondii*  
*Xyris scabrifolia*  
*Rudbeckia scabrifolia*  
*Rudbeckia subtomentosa*  
*Calopogon tuberosus*  
*Pogonia ophroglossoides*

May occur in NF TX bogs:

*Lachnocaulon digynum*  
*Eulophia ecristata*  
*Sabatia macrophylla*

## PHASES OR VARIATION:

There are different kinds of hillside bogs. These range from seasonally moist areas along slopes with relatively few bog-associated species to bogs that are wet throughout the year and support a large array of bog-associated herbaceous species. The development of a seep depends primarily on five influences on water flow: (1) upslope surface and subsurface soil characteristics that govern soil infiltration and saturated flow rates, (2) size of the recharge area, (3) vegetation present in both recharge and seepage areas, (4) local topography, and (5) depth, gradient, and extent of the underlying impermeable layer (Platt and others 1990).

Woody plants may include hillside bogs as fire frequency decreases. Historically, such development was probably uncommon because surface fires occurred frequently in the surrounding longleaf pine forests. As fire frequency increases, some wooded areas may regain the open character of the hillside bog.

## IMPORTANT HABITAT ATTRIBUTES:

No evidence of mechanical disturbance within bog or recharge area  
Continuous herbaceous ground cover  
Adjacent habitat in relatively natural condition  
Open aspect (essentially free from shrub, hardwood, and pine invasion)  
Fires frequent, but ignited in surrounding uplands

## POTENTIAL PLANT INDICATORS:

*Sarracenia alata* – yellow pitcher plant  
*Xyris* sp. – yellow-eye-grasses  
*Pogonia ophioglossoides* – rose pogonia  
*Platanthera ciliaris* – yellow fingerorchid  
*Lycopodium* spp. – clubmosses  
*Rhexia* spp. – meadow beauties  
*Rhynchospora* spp. – beakrushes  
*Eryngium integrifolium* – simple-leaf eryngo  
*Eriocaulon* spp. – pipeworts  
*Drosera* spp. – sundews  
*Chaptalia tomentosa*  
*Coreopsis lunifolia* – coreopsis

# Terrestrial

## *Mesic Forests*

### Terrestrial Forests

These forests often occur on slopes in areas between uplands and stream bottoms, often in association with the Sabine uplift. These forests are in relatively natural condition, are mostly uneven-aged, and have many large trees. The forest may have a three-layered appearance with an essentially closed canopy and with scattered snags and small gaps. An open, parklike condition develops with age, but a variety of shrubs and regenerating trees are found even in parklike areas. Herbaceous cover is generally sparse. Typically, much downed woody material and thick hardwood leaf litter are present.

Although mature hardwood-dominated forests support relatively few herbaceous understory plant species, mesic, hardwood-dominated forests with closed canopies create special understory conditions that seem necessary for many herbaceous "rich woods" species. Those conditions include: (1) absence of or great reduction in direct sunlight, but much diffuse light, (2) modified ambient air temperature (reduced on warm or hot days), (3) increased ambient air humidity, (4) reduced direct physical effects of wind and rain, and (5) a deep, actively decaying leaf litter layer that produces a fertile, humus-rich topsoil.

#### VEGETATION:

**Overstory:** White oak (*Quercus alba*), American beech (*Fagus grandifolia*), southern magnolia (*Magnolia grandiflora*), swamp chestnut oak (*Q. michauxii*), cherrybark oak (*Q. pagodifolia*), black oak (*Q. velutina*), water oak (*Q. nigra*), loblolly pine (*Pinus taeda*), American holly (*Ilex opaca*), mockernut hickory (*Carya tomentosa*), bitternut hickory (*C. cordiformis*), shagbark hickory (*C. ovata*), black gum (*Nyssa sylvatica*), sweetgum (*Liquidambar styraciflua*), yellow-poplar (*Liriodendron tulipifera*), red maple (*Acer rubrum*), Florida maple (*A. barbatum*), winged elm (*Ulmus alata*), and others. The resurrection fern (*Polypodium polypodioides*) is common on hardwoods.

**Midstory:** Contains regenerating overstory species, and a variety of shrub species, and may include American hornbeam (*Carpinus caroliniana*), chalk maple (*A. leucoderme*), eastern hophornbeam (*Ostrya virginiana*), flowering dogwood (*Cornus florida*), bigleaf snowbell (*Styrax grandifolius*), witch-hazel (*Hamamelis virginiana*), southern arrow-wood (*Viburnum dentatum*), blueberries (*Vaccinium* spp. including *V. arboreum*, and *V. corymbosum*), sweet leaf (*Symplocos tinctoria*), brook enonymus (*Euonymus americanus*), fringetree (*Chionanthus virginicus*), Carolina buckthorn (*Rhamnus caroliniana*), parsley hawthorn (*Crataegus marshallii*), arrow-wood (*Viburnum acerifolium*), rusty blackhaw (*V. rufidulum*), downy serviceberry (*Amei-lanchier arborea*), azalea (*Rhododendron canescens*), Carolina holly

(*Ilex ambigua*), American beautyberry (*Callicarpa americana*), southeastern coralbean (*Erythrina herbacea*), and others. Vines commonly present include grapes (*Vitis* spp), greenbriers (*Smilax* spp), Virginia creeper (*Parthenocissus quinquefolia*), cross vine (*Bignonia capreolata*), poison-oak (*Toxicodendron radicans*), Alabama supplejack (*Berchemia scandens*), and trumpet honeysuckle (*Lonicera sempervirens*)

**Understory:** In addition to regenerating overstory and midstory species, usually supports a variety of "rich woods" herbaceous species. These may include Christmasfern (*Polystichum acrostichoides*), wouthern ladyfern (*Athyrium filix-femina* var *asplenoides*), broadfern fern (*Thelypteris hexagonoptera*), grapeferns (*Botrychium* spp.), rattlesnake root (*Prenanthes altissima*), woodland pinkroot (*Spigelia marilandica*), goldenrods (*Solidago* spp), beechdrops (*Epifagus virginiana*), woods bedstraw (*Galium circaezans*), bare-stem tickclover (*Desmodium nudiflorum*), great solomon's seal (*Polygonatum biflorum*), blue hound's tongue (*Cynoglossum virginianum*), sanicles (*Sanicula* spp), Jack-in-the-pulpit (*Arisaema triphyllum*), Walter violet (*Viola walteri*), partridge-berry (*Mitchella repens*), trilliums (*Trillium gracile*), mayapple (*Podophyllum peltatum*), carrion flower (*Smilax herbacea*), Dutchman's pipes (*Aristolochia* spp), sweet-william phlox (*Phlox divaricata*), crane fly orchid (*Tipularia discolor*), Carolina lily (*Lilium michauxii*), giant cane (*Arundinaria gigantea*), and twoflower melic (*Melica nutica*)

There is usually a rich assemblage of lichens, mosses, and liverworts on soil, fallen logs, stumps, shrubs, and trees. Many of these probably are habitat or site-specific, but relatively little is known about the ecology of most.

#### SPECIAL-INTEREST PLANTS

KNOWN to occur on NF TX

*Brachyelytrum erectum*  
*Cypripedium kentuckiense*  
*Dentaria laciniata*  
*Erythronium rostratum*  
*Isotria verticillata*  
*Lilium michauxii*  
*Lithospermum tuberosum*  
*Prenanthes barbata*  
*Sanguinaria canadensis*  
*Taenidia integerrima*  
*Thaspium barbinode*  
*Thaspium trifoliatum*  
*Triphora trianthophora*  
*Trillium gracile*  
*Uvularia perfoliata*

KNOWN to occur outside NF TX

*Dodecatheon media*  
*Cheilanthes lanosa*  
*Monotropa hypopithys*  
*Maianthemum racemosum* ssp *amplexicanle*

**IMPORTANT HABITAT ATTRIBUTES:**

Trees of various ages, sizes, and forms present  
Specimens more than 200 years old present  
Snags, cavities, canopy gaps, and downed wood common  
Hardwood species dominant (loblolly pine only a minor associate)  
Well developed litter layer  
Multilayered structure

**POTENTIAL PLANT INDICATORS:**

*Fagus grandifolia* – American beech  
*Quercus alba* – white oak  
*Magnolia grandiflora* – southern magnolia  
*Acer barbatum*  
*Ilex opaca* – American holly  
*Ostrya virginiana* – eastern hophornbeam  
*Styrax grandifolius* – bigleaf snowbell  
*Vaccinium* – Elliott's blueberry  
*Symplocos tinctoria* – sweetleaf  
*Trillium* spp – trilliums  
*Viola walteri* – Walter violet  
*Sanicula* spp. – sanicles  
*Tipularia discolor* – cranefly orchid  
*Epifagus virginiana* – Virginia beechdrops  
*Polypodium polypodioides* – resurrection fern  
*Tillandsia usneoides* – Spanish moss

**OTHER COMMENTS:**

These mesic hardwood communities are very similar to some loblolly pine - oak forests, but are typically more mesic, with less loblolly pine and more consistent hardwood components. Two variations that have been recognized are as follows

**PHASES OR VARIATION:**

**AMERICAN BEECH - SOUTHERN MAGNOLIA SERIES**

*(Fagus grandifolia - Magnolia grandiflora)*

This primarily hardwood-dominated series generally occurs on mesic slopes or in shallow creek bottoms. American beech and southern magnolia attain large sizes and make up much of the basal area of these forests. Loblolly pine (*Pinus taeda*) is often present. Its importance depends of site history.

## AMERICAN BEECH - WHITE OAK SERIES

(*Fagus grandifolia* - *Quercus alba*)

This series occupies ravines and ridges within creek bottoms, especially on steep slopes. Southern magnolia (*Magnolia grandiflora*) is generally absent, and calciphilic species are more common.

### *Upland Dry-Mesic Forest*

## LOBLOLLY PINE - OAK SERIES

(*Pinus taeda* - *Quercus*)

A highly variable community. In mature and relatively natural condition, loblolly-oak forests are mostly uneven-aged and moderately to densely stocked with various hardwoods, with loblolly pine as a primary associate. Older individual trees may reach large sizes. There may be scattered canopy gaps and snags. Where overstory trees form a closed canopy, an open, parklike understory often develops. However, a variety of shrubs and small trees are often present. The cover of understory herbaceous plants can be sparse, however in some areas wood oats may be abundant. Downed woody material in the form of fallen logs and limbs is often conspicuous, floor and hardwood leaf litter forms a thick carpet in practically all cases.

### VEGETATION:

**Overstory:** Some commonly observed species include white oak (*Q. alba*), loblolly pine, American beech (*Fagus grandifolia*), southern red oak (*Q. falcata*), post oak (*Q. stellata*), southern magnolia (*Magnolia grandiflora*), swamp chestnut oak (*Q. michauxii*), black oak (*Q. velutina*), water oak (*Q. nigra*), laurel oak (*Q. laurifolia*), cherrybark oak (*Q. falcata* var. *pagodifolia*), blackjack oak (*Q. marilandica*), American holly (*Ilex opaca*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), blackgum (*Nyssa sylvatica*), mockernut hickory (*Carya tomentosa*), black hickory (*C. texana*), bitternut hickory (*C. cordiformis*), winged elm (*Ulmus alata*), shortleaf pine (*P. echinata*), and others. The epiphytes mistletoe (*Phoradendron* spp.), Spanish moss (*Tillandsia usneoides*), and resurrection fern (*Polypodium polypodioides*) may be common on hardwoods.

**Midstory:** In addition to regenerating overstory species, the community may contain a variety of shrub species such as American hornbeam (*Carpinus caroliniana*), eastern hophornbeam (*Ostrya virginiana*), flowering dogwood (*Cornus florida*), bigleaf snowbell (*Styrax grandifolius*), witch-hazel (*Hamamelis virginiana*), brook euonymus (*Euonymus americanus*), southern arrow-wood (*Viburnum dentatum*), arrow-wood (*V. acerifolium*), rusty blackhaw (*V. rufidulum*), blueberries

(*Vaccinium* spp , including *V.amoenum*, and *V corymbosum*), sweet-leaf (*Symplocos tinctoria*), fringetree (*Chionanthus virginicus*), Carolina buckthorn (*Rhamnus caroliniana*), parsley hawthorn (*Crataegus marshallii*), other hawthorns (*Crataegus* spp ), downy serviceberry (*Amelanchier arborea*), azalea (*Rhododendron canescens*), Carolina holly (*I ambigua*), American beautyberry (*Callicarpa americana*), southeastern coralbean (*Erythrina herbacea*), and others. Vines commonly present include grapes (*Vitis* spp.), greenbriers (*Smilax* spp.), Virginia creeper (*Parthenocissus quinquefolia*), poison oak (*Toxicodendron radicans*), Alabama supplejack (*Berchemia scandens*), and trumpet honeysuckle (*Lonicera sempervirens*)

**Understory:** In addition to regenerating overstory and midstory species, usually supports a variety of herbaceous species. However, ground cover is typically sparse. Herbaceous species present may include Christmasfern (*Polystichum acrostichoides*), ladyfern (*Athyrium filix-femina*), broad beechfern (*Thelypteris hexagonoptera*), grapeferns (*Botrychium* spp ), rattlesnake root (*Prenanthes altissima*), woodland pinkroot (*Spigelia marilandica*), goldenrods (*Solidago* spp ), poor Robins plantain (*Erigeron pulchellus*), Virginia beechdrops (*Epifagus virginiana*), violets (*Viola* spp ), woods bedstraw (*Gahum circaezans*), woods vetch (*Vicia alba*), bare-stem tickclover (*Desmodium nudiflorum*), great Solomon's seal (*Polygonatum biflorum*), blue hound's tongue (*Cynoglossum virginianum*), sanicles (*Sanicula* spp.), Jack-in-the-pulpit (*Arisaema triphyllum*), partridge-berry (*Mitchella repens*), trilliums (*Trillium* spp.), mayapple (*Podophyllum peltatum*), carrion flower (*Smilax herbacea*), Dutchman's pipes (*Aristolochia* spp ), sweet William phlox (*Phlox divaricata*), cranefly orchid (*Tipularia discolor*), Carolina lily (*Lilium carolinianum*), woodoats (*Chasmanthium* spp ), and twoflower melic (*Melica nutica*).

There is usually a rich assemblage of lichens, mosses, and liverworts on soil, fallen logs, stumps, shrubs, and trees. Many of these probably are habitat or site-specific, but relatively little is known about the ecology of most.

## SPECIAL-INTEREST PLANTS:

KNOWN to occur In NF TX

*Amsonia glaberrima*  
*Cypripedium kentuckiense*  
*Erythronium rostratum*  
*Hexalectris spicata*  
*Prenanthes barbata*  
*Trillium gracile*  
*Triphora trianthophora*

KNOWN to occur elsewhere in Texas

*Dodecatheon meadia*  
*Monotropa hypopithys*  
*Maranthemum racemosum* spp *amplexicanle*  
*Cheilanthes lanosa* (on sandstone rocks of Catahoula Formation)  
*Quercus boyntonii stellata* var. *margaretta*

## IMPORTANT HABITAT ATTRIBUTES:

Large variety of hardwood species present in overstory along with loblolly pine

Trees of various age, size, and forms present

Multilayered canopy, with numerous gaps

Snags and downed wood common

Many of the loblolly pines and hardwoods present are more than 100 years old.

## POTENTIAL PLANT INDICATORS:

*Pinus taeda* – loblolly pine  
*Quercus alba* – white oak  
*Quercus michauxii* – swamp chestnut oak  
*Ilex opaca* – American holly  
*Hamamelis virginiana* – witch hazel  
*Styrax grandifolius* – bigleaf snowbell  
*Trillium* spp. – trilliums  
*Viola walteri* – Walter violet  
*Sanicula* spp – sanicles  
Ferns

## PHASES OR VARIATION:

Most commonly on middle and lower slopes between uplands and stream bottoms, but also occurs on ridges and upper slopes in areas topographically isolated from fire-prone uplands

Cover percentages of component species are highly variable depending on topographic position, and consequent moisture regime. Drier phases tends to be dominated by southern red oak, white oak, post oak, loblolly pine, water oak, blackjack oak, blackgum, sweetgum, mockernut hickory, black hickory, and shortleaf pine. Mesic phases tend to be dominated by white oak American beech, loblolly pine, southern magnolia sweetgum, water oak, swamp chestnut oak and red maple. Understory associates vary significantly within these moisture regimes.

#### OTHER COMMENTS:

Very similar to and often adjacent to beech-white oak forests. Perhaps the most notable difference is the greater variability of loblolly-oak forest in relative composition and cover percentages of component species. This greater variability is the consequence of the greater variety of topographic positions in which the loblolly pine-oak community occurs.

### *Midwestern Oak Woodland*

#### SHORTLEAF PINE - OAK SERIES

(*Pinus echinata* - *Quercus*)

#### Terrestrial Woodlands and Savannas

Relatively mature, natural examples of this forest are open-canopied, mostly uneven aged, and moderately to fairly densely stocked with shortleaf pine and hardwoods of variable size. Various shrubs and regenerating overstory species may be in the midstory and understory, especially where fire has been infrequent or absent. Herbaceous ground cover, important in natural upland examples of this series, may exist only as remnant grassy patches where fire has not occurred.

#### VEGETATION:

**Overstory:** The most important species in the presettlement forest probably included shortleaf pine post oak (*Q. stellata*), blackjack oak (*Q. marilandica*), and southern red oak (*Q. falcata*). Overstory species in existing examples of the series may also include black oak (*Q. velutina*), white oak (*Q. alba*), common persimmon (*Diospyros virginiana*), winged elm (*Ulmus alata*), black cherry (*Prunus serotina*), blackgum (*Nyssa sylvatica*), mockernut hickory (*Carya tomentosa*), and black hickory (*C. texana*). Many of these species have probably increased in size and abundance because of reduced fire frequency.

These fire-suppressed forests often contain loblolly pine (*P. taeda*), sweetgum (*Liquidambar styraciflua*), and red maple (*Acer rubrum*). The epiphytes mistletoe (*Phoradendron* spp.), Spanish moss (*Tillandsia usneoides*), and resurrection fern (*Polypodium polypodioides*) may be common on hardwoods.

**Midstory:** In addition to regenerating overstory species, the midstory contains a diversity of shrubs including blueberries (*Vaccinium* spp , including *V arboreum*, *V corymbosum*, and *V stamineum*), yaupon (*Ilex vomitoria*), flowering dogwood (*Cornus florida*), gum bumelia (*Bumelia lanuginosa*), rusty blackhaw (*Viburnum rufidulum*), southern arrow-wood (*V dentatum*), parsley hawthorn (*Crataegus marshali*), other hawthorns (*Crataegus* spp ), red buckeye (*Aesculus pavia*), American beautyberry (*Callicarpa americana*), fringetree (*Chionanthus virginicus*), Mexican plum (*Prunus mexicana*), shining sumac (*Rhus copallina*), and others. Vines commonly present include grapes (*Vitis* spp ), Virginia creeper (*Parthenocissus quinquefolia*), greenbriers (*Smilax* spp ), yellow jessamine (*Gelsemium sempervirens*), and poison-oak (*Toxicodendron radicans*)

**Understory:** Often contains a variety of grasses, composites, legumes, and other forbs, but is not nearly as rich as in longleaf pine (*P palustris*) forests. Species present may include little bluestem (*Schizachyrium scoparium*), bluestems (*Andropogon* spp.), woodoats (*Chasmanthium* spp.), panicums (*Panicum* spp.), threeawn grasses (*Aristida* spp), paspalum grasses (*Paspalum* spp.). tickclovers (*Desmodium* spp.), wild indigos (*Baptisia* spp ), bushclovers (*Lespedeza* spp ), hoarypeas (*Tephrosia* spp ), butterfly pea (*Centrosema virginianum*), prairie senna chamaerista (*fasciculata*), largeleaf pussytoes (*Antennaria parlinii* ssp *fallox*), asters (*Aster* spp.), Gronovins hawkweed (*Hieracium gronovi*), sunflowers (*Helianthus* spp ), gayfeathers (*Liatris* spp ), goldenrods (*Solidago* spp ), Missouri ironweed (*Vernonia missurica*), partridgeberry (*Mitchella repens*), milkweeds (*Asclepias* spp ), and others.

There is usually a rich assemblage of lichens, mosses, and liverworts on soil, fallen logs, stumps, shrubs, and trees. Many of these probably are habitat or site-specific, but relatively little is known about the ecology of most.

#### SPECIAL-INTEREST PLANTS

KNOWN to occur on NF TX

*Tetragonotheca ludoviciana*  
*Cyperus grayioides*

KNOWN to occur elsewhere in Texas

*Crataegus warneri*  
*Leavenworthia texana*  
*Lesquerella pallida*  
*Mirabilis collina*  
*Trillium texanum*  
*Coreopsis intermedia*

## IMPORTANT HABITAT ATTRIBUTES:

Canopy (primarily shortleaf pine) moderately open  
Large, shortleaf pine and hardwoods more than 150 years old are present  
Areas are large enough to maintain habitat integrity  
Surrounding habitat in natural condition  
Evidence of frequent fires (herbaceous understory, few fire-tender species)

## POTENTIAL PLANT INDICATORS:

*Pinus echinata* – shortleaf pine  
*Quercus stellata* – post oak  
*Quercus falcata* – southern red oak  
*Carya tomentosa* – mockernut hickory  
*Carya texana* – black hickory  
*Callicarpa americana* – American beautyberry  
*Baptisia* spp. – wild indigo species

## PHASES OR VARIATION:

As noted above, this series can vary depending upon disturbance history. Poorly understood but probably important variation exists depending upon topographic and geographic position. This series occurs primarily on middle upper slopes within the longleaf pine (*P. palustris*) range (with more species typical of mesic hardwood forests), and on uplands and sideslopes outside the native longleaf pine range. Associated species in all areas vary with soil moisture, texture, and pH and with slope position. In general, drier sites support more shortleaf pine.

## OTHER COMMENTS:

Fire limits hardwood development, but it also favors certain species by excluding more fire-tender hardwoods such as American beech, sweetgum, and white oak. In the total absence of fire, post oak, southern red oak, and blackjack oak tend to be replaced by white oak, sweetgum, various other hardwoods, and loblolly pine.

Ecotones between shortleaf pine-oak woodlands and upland longleaf pine - little bluestem forests were probably variable.

### POST OAK - BLACKJACK OAK SERIES

(*Quercus Stellata* - *Q. Marilandica*)

In natural condition, this series is an oak woodland or savanna with mid and tall grasses in the understory. Continuous overgrazing and infrequent fire have caused oaks to thicken and the high-quality grasses to thin (Ressel 1989).

Dead plant material and bare ground are common. Canopy closure varies with soils and disturbance history.

## VEGETATION:

**Overstory:** The dominants in this type are invariably some combination of post oak and blackjack oak, which often compose from 15 to 50 percent of the areas. Occasional individual netleaf hackberry (*Celtis reticulata*), American elm (*Ulmus americana*), and eastern redcedar (*Juniperus virginiana*) are usually present. Eastern redcedar, although not usually dominant, is often important, especially on fire-suppressed sites.

**Understory:** A variety of tallgrass, midgrass, and forb species similar to those found in the little bluestem-indiangrass series are understory elements. Other species may include coralberry (*Symphoricarpos orbiculatus*), poison oak (*Toxicodendron radicans*), pricklypear (*Opuntia humifusa*), largeleaf pussytoes (*Antennaria parlinii* ssp. *falcata*), hairy sunflower (*Helianthus hirsutus*), goldenrod (*Solidago* spp.), sedges (*Carex* spp.), broadleaf woodoats (*Chasmanthium latifolium*), catclaw sensitive briar (*Schrankia nuttallii*), saw greenbrier (*Smilax bona-nox*), Virginia creeper (*Parthenocissus quinquefolia*).

## SPECIAL INTEREST PLANTS

KNOWN to occur on NF TX

*Cyperus grayoides*  
*Gratiola flava*  
*Schoenolirion wrightii*  
*Spiranthes parksii*  
*Tetragonotheca ludoviciana*

KNOWN to occur elsewhere in Texas

*Abronia macrocarpa*  
*Coreopsis intermedia*  
*Crataegus warneri*  
*Dalea reverchonii*  
*Hymenopappus carrizoanus*  
*Polygonella parksii*

## SOUTHERN PINE SAVANNA

### LONGLEAF PINE - LITTLE BLUESTEM SERIES

(*Pinus palustris* - *Schizachyrium scoparium*)

Where in relatively natural condition (burning must occur frequently), pine stands are open and almost pure. Open canopies and frequent fires favor the development of thick grass cover and limit hardwood and shrub species to slope positions, wet depressions, and creek and river

bottoms The density of longleaf stands varies with local conditions and site history. Growth is relatively dense in some areas and much more open in others Many hardwoods have become established under altered fire regimes and are more common in today's forests Deliberate retention of hardwoods for wildlife purposes has also increased the hardwood component in these forests In high-quality examples of this series, the herbaceous ground high-quality occurrences, the herbaceous ground cover of native grasses and forbs is diverse and continuous

Frequent light surface fires are essential to the perpetuation of this community type Without fire, open longleaf forests are readily invaded by other pines [notably loblolly (*P taeda*) and shortleaf], and many types of hardwoods and shrubs These invaders eventually supplant both the rich herb layer and the longleaf pines themselves The great majority of hardwoods, shrubs, and other pines native to the general area could not tolerate frequent lightning-generated growing-season surface fires and were thus restricted to less frequently burned areas A few species of hardwoods endured the frequent fires but were largely confined to the ground cover as continually resprouting stems

The frequent fires and the open character of the forests combined to encourage a tremendous diversity of prairie-like herbaceous vegetation to develop in the ground layer Both historical accounts and recent research indicate clearly that the natural character of the forest is generally uneven aged, with regenerating even-aged patches (each typically only a few hundred square feet in area) of various ages embedded within the matrix of older trees. Trees older than 100 years are usually the best seed producers, and individual trees may approach 500 years in age

Natural mortality of adult longleaf pines usually results from lightning or windthrow. Both causes generally kill more than 150 years old, and the mortality rate increases with age (Platt and others 1988)

#### VEGETATION:

**Overstory:** Where in relatively natural condition and frequently burned, the forest is almost pure longleaf pine, perhaps with some shortleaf or loblolly A variety of other species are often present today These include post oak (*Q stellata*), southern red oak (*Q. falcata*), blackjack oak (*Q. marilandica*), bluejack oak (*Q. incana*), upland laurel oak (*Q laurifolia*), water oak (*Q nigra*), mockernut hickory (*Carya tomentosa*), black hickory (*C texana*), sweet gum (*Liquidambar styraciflua*), blackgum (*Nyssa sylvatica*), black cherry (*Prunus serotina*), and others

**Midstory:** Primary shrubs include yaupon (*Ilex vomitoria*), sweetgum, blueberries (*Vaccinium* spp), American beautyberry (*Callicarpa americana*), southern bayberry (*Myrica cerifera*), and shining sumac (*Rhus copallina*)

**Understory:** Very rich, dominated by grasses, composites, legumes, and a wide assortment of other forbs

**Grasses:** Usually dominated by little bluestem and *Andropogon* spp , including *A. gerardii*, *A. virginicus*, *A. ternarius*, and *A. gyrans*, but other primary grasses include slender bluestem (*Schizachyrium*), yellow indian grass (*Sorghastrum nutans*), threeawn grasses (*Aristida* spp.), lovegrasses (*Eragrostis* spp.), panicums (*Panicum* spp.), Florida paspalum (*Paspalum floridanum*), drop-seeds (*Sporobolus* spp ), bearded skeletongrass (*Gymnopogon ambiguus*), and bristlegrasses (*Setaria* spp.)

**Composites:** Include several asters (*Aster* spp ), goldenasters (*Heterotheca* spp ), silk-grass (*Pityopsis graminifolia*), elephantfoots (*Elephantopus* spp.), *Eupatorium* spp., cudweeds (*Gnaphalium* spp ), lance coreopsis (*Coreopsis lanceolata*), pale echinacea (*Echinacea pallida*), coneflowers (*Rudbeckia* spp.), gayfeathers (*Liatris* spp ), rosinweeds (*Silphium* spp.), goldenrods (*Solidago* spp ), ironweeds (*Vernonia*-spp.), and others.

**Legumes:** Legumes may include tickleclovers (*Desmodium* spp ), bush-clovers (*Lespedeza* spp ), wild indigos (*Baptisia* spp ), partridge-peas (*Cassia* spp ), hoary peas (*Tephrosia* spp ), crotalarias (*Crotalaria* spp.), pencilflower (*Stylosanthes biflora*), snoutbeans (*Rhynchosia* spp.), butterfly pea (*Centrosema virginianum*), and milkpeas (*Galactia* spp.).

**Others:** Other forbs frequently present include rose-gentians (*Sabatia* spp.), evening primroses (*Oenothera* spp ), ruellias (*Ruellia* spp.), milkworts (*Polygala* spp.), butterfly milkweed (*Asclepias tuberosa*), other milkweeds (*Asclepias* spp.), blue sage (*Salvia azurea*), common goldstar (*Hypoxis hirsuta*), downy phlox (*Phlox* spp *pilosa*), gerardia (*Agalinis* spp ), meadow beauties (*Rhexia* spp ), and flowering spurge (*Euphorbia corollata*) Large colonies of bracken-fern (*Pteridium* spp ) are often conspicuous. Fruticose ground lichens may be common in dryer areas

#### SPECIAL-INTEREST PLANTS.

KNOWN to occur on NF TX

*Agrimonia incisa*

*Silene subciliata*

*Amorpha canescens*

*Galactia erecta*

*Liatris tenuis*

*Selaginella arenicola* ssp *riddelli*

(Other spp. listed for bluejack oak - pine series may be found)

KNOWN to occur elsewhere in Texas

*Cheilanthes lanosa* (on sandstone boulders)

*Eulophia ecristata*

*Gaillardia aestivalis* var *winkleri*

*Phlox nivalis* ssp *texensis*

#### **PHASES OR VARIATION:**

There are distinct phases of upland longleaf pine forest, depending primarily on topographically, and soils. Generally the phases grade from xeric types on steep topography and extremely well-drained deep sands to moderately dry or moderately mesic types on gently rolling or fairly dissected topography and well-drained sandy loams to mesic types on gently rolling topography and sandy loams and silt loams. In each of these basic phases there are distinct assemblages of associated plant species in the ground cover, apparently as a result of associated moisture regimes.

#### **IMPORTANT HABITAT ATTRIBUTES:**

Open aspect

Continuous cover of herbaceous vegetation

Evidence of frequent fire (few shrubs and trees other than longleaf pine)

Trees of many age, size, and form classes

Trees older than 200 years well represented

Patches of regeneration common

Snags and downed wood fairly common

Natural ecotones with surrounding and inclusional habitats

#### **POTENTIAL PLANT INDICATORS:**

*Pinus palustris* - longleaf pine

*Schizachyrium scoparium* - little bluestem

*Andropogon gerardii* - big bluestem

*Andropogon gyrans* - Elliott bluestem

*Tripsacum dactyloides* - eastern gammagrass

*Liatris* spp - gayfeathers

*Echinacea pallida* - Pale echinacea

*Baptisia* spp. - wild indigos

*Rudbeckia* spp - conefloweres

*Tephrosia* spp - hoary pea

*Rhynchosia* spp - snoutbeans

#### **OTHER COMMENTS:**

The extent of this community type has been reduced by more than 90 percent since presettlement times

### ***Southern Pine - Oak Woodland***

## BLUEJACK OAK - PINE SERIES

(*Quercus incana* - *Pinus*)

This series occurs primarily on extremely well-drained ridgetops and upper slopes on deep sands but may also be found on low, relatively flat stream terraces with deep sands. It may appear as thick shrubby scrub woodland, often with stunted trees because of xeric site conditions. Small openings may be scattered about. Scrub oaks make up the only overstory, but scattered pine are present. This condition probably results from past logging of pines as component scrub oaks were probably not of commercial value. The herbaceous ground cover is usually sparse and discontinuous, and much sand is exposed. Fruticose ground lichens are very conspicuous and may form large patches.

Examples on xeric hilltops and upper slopes do not appear as thick and scrubby, but are generally more open and may have a mixed pine overstory of variable but usually low to intermediate stocking. On these sites the understory usually contains few herbaceous plants, and ground lichens, although common, may be less abundant. Fire frequency is an important factor in the development and dynamics of this series.

Xeric soil conditions almost certainly contribute to the distribution of scattered overstory trees, and surely are a major cause of the sparseness of the herb layer in sunny settings that would normally support a thick growth of herbaceous plants. Trees can grow exceedingly slowly on these sites.

### VEGETATION:

**Overstory:** Open woodlands with low overstory density and basal area. Bluejack oak, post oak (*Q. stellata*), southern red oak (*Q. falcata* var. *falcata*), black hickory (*Carya texana*), shortleaf pine (*P. echinata*), longleaf pine (*P. palustris*)

**Midstory:** Usually contains numerous oaks of species listed above (resprouting after fire is common). May also include, laurel oak (*Q. laurifolia*), sand post oak (*Q. stellata* var. *margaretta*), blackjack oak (*Q. marilandica*), tree sparkleberry (*Vaccinium arboreum*), and flowering dogwood (*Cornus florida*).

**Understory:** Herb layer cover is generally sparse. much sand is exposed and many specialized drought-tolerant species are present. Species often present include prickly pear (*Opuntia humifusa*), Texas bullnettle (*Cnidocolus texanus*), Florida snakecotton (*Froehchia floridana* var. *floridana*), threeawn grasses (*Aristida* spp., especially *A. desmantha*), milkweeds (*Asclepias* spp.), bluestems (*Andropogon* spp.), noseburns (*Tragia* spp.), panicums (*Panicum* spp.), purple sandgrass (*Triplasis purpurea*), sarsaparilla vine (*Smilax pumila*), spiderworts (*Tradescantia* spp.), post oak grape (*Vitis aestivalis-lincecumii*), heartleaf euphorbia (*Euphorbia cordifolia*), bigpod bonamia (*Styhsma pickeringii* var.

*pattersonii*), Georgia sunrose (*Helianthemum georgianum*), Carolina groomwell (*Lithospermum carolinense*), poison-oak (*Rhus toxicodendron*), and numerous State-rare species (see PETS). Fruticose ground lichens, and especially *Cladonia* lichens, may occur in profusion

#### SPECIAL-INTEREST PLANTS

KNOWN to occur on NF TX

*Cyperus grayioides*  
*Eriogonum longifolium*  
*E. multiflorum*  
*Paronychia drummondii*  
*Penstemon murrayanus*  
*Polanisia erosa*  
*Polygonella americana*  
*P. polygama*  
*Selaginella arenicola* var *raddellii*  
*Tetragonotheca ludoviciana*  
*Zornia bracteata*  
*Pediomelum subulatum*

KNOWN to occur elsewhere in Texas

*Coreopsis intermedia*  
*Mirabilis collina*

#### IMPORTANT HABITAT ATTRIBUTES:

Xeric oak species abundant with only scattered pines  
Trees of many ages, sizes, and forms present  
Areas of exposed sand numerous  
Ground cover lichens abundant

#### POTENTIAL INDICATOR SPECIES:

*Quercus incana* – bluejack oak  
*Vaccinium arboreum* – tree sparkleberry  
*Q. stellata* var. *margaretta* – sand post oak  
*Carya texana* – black hickory  
*Stillingia sylvatica* – Queen's delight  
*Aristida desmantha* – curly threeawn  
*Gymnopogon ambiguus* – bearded skeltongrass  
*Berlandiera betonicifolia* – hairy greeneyes  
*Tradescantia reverchonii* – Reverchon spiderwort  
*Helianthemum georgianum* – Georgia sunrose  
*Stylisma pickeringii* var *pattersonii* – bigpod bonamia  
*Froelichia floridana* – Florida snakecotton  
*Polypremum procumbens* – juniperleaf

## PHASES OR VARIATION:

The xeric hilltop variant grades into xeric-phase upland longleaf pine forest and the two are very similar if not actually the same thing.

### LITTLE BLUESTEM-NUTTALL'S RAYLESS GOLDENROD SERIES

(*Schizachyrium scoparium*-*Bigelovia nuttallii*)

#### Terrestrial Mixed Physiognomy

This predominantly herbaceous community occurs as inclusions in a woodland complex of oak forests, which in turn are inclusional in pine-dominated forests. The shallow soils and associated Catahoula geology produce conditions limiting to woody plant growth and provide specialized habitat for a variety of herbaceous species. These open, irregularly shaped, sparsely vegetated, prairie-like communities are generally surrounded by oak forests with scattered, stunted trees. Eroded soil is often eroded soil exposures, rock outcrops and lichen growth are common.

#### VEGETATION:

**Overstory:** Generally lacking, but scattered individual trees or clumps of trees or both may be present. May include longleaf pine (*Pinus palustris*), shortleaf pine (*P. echinata*), loblolly pine (*P. taeda*), post oak (*Quercus stellata*), and blackjack oak (*Q. marilandica*).

**Midstory:** The series is generally quite open. Where midstory woody vegetation is present, it usually occurs as scattered clumps. Species may include privet forestiera (*Forestiera ligustrina*), parsley hawthorn (*Crataegus marshallii*), littlehip hawthorn (*C. spathulata*), tree sparkleberry (*Vaccinium arboreum*), yaupon (*Ilex vomitoria*), and possumhaw (*Ilex decidua*).

#### Understory:

**DOMINANTS:** slender bigelovia threeawn (*Aristida longespica*), little bluestem, narrowleaf rushfoil (*Crotonopsis linearis*), and Silveus dropseed (*Sporobolus silveanus*) (Marietta and Nixon, 1984).

Other important species include rosette grass (*Dichanthelium aciculare*), common goldstar (*Hypoxis hirsuta*), narrowleaf pin weed (*Lechea tenuifolia*), globe beakrush (*Rhynchospora globularis*), and tenpetal anemone (*Anemone berlandieri*). Also includes many species that occur only infrequently, are sporadically distributed, or are restricted to Catahoula exposures (Orzell, 1991). Drummond sandwort (*Minuartia drummondii*), Barbara's-buttons (*Marshallia caespitosa*), common leastdaisy (*Chaetopappa asteroides*), San Saba pin weed (*Lechea sanabeanae*), Nuttall milkvetch (*Astragalus nuttallianus* var. *nuttallianus*),

western dwarf dandelion (*Krigia occidentalis*), Texas saxifrage (*Saxifraga texana*), smooth phacelia (*Phacelia glabra*), prairie flameflower (*Talium parviflorum*), and Texas sunnybell (*Schoenolirion wrightii*).

**SPECIAL INTEREST PLANTS:**

*Saxifraga texana*  
*Gratiola flava*  
*Liatris tenuis*  
*Phacelia glabra*  
*Schoenolirion wrightii*  
*Talium parviflorum*  
*Selaginella arenicola* var. *riddellii*  
*Sporobolus silveanus*

**IMPORTANT HABITAT ATTRIBUTES:**

Open aspect  
Essentially treeless  
Mosses and lichens common  
Herbaceous groundcover dominant with interspersed soil exposures  
No evidence of recent mechanical disturbance  
Varying degrees of erosion evident  
Adjacent habitat in essentially natural condition  
Natural ecotones found between surrounding habitats

**POTENTIAL INDICATOR SPECIES:**

*Bigelovia nuttallii* – slender bigelovia  
*Schizachyrium scoparium* – little bluestem  
*Silphium laciniatum* – compass-plant  
*Cladonia* spp. – Cladonia mosses

**OTHER COMMENTS:**

These areas are generally smaller than 100 acres and isolated from one another. The surrounding landscape was historically open longleaf pine forest. The effects of logging and altered fire regimes are evidenced in all known examples, possibly contributing to increased erosion and definitely altering species composition and forest structure.

*Tallgrass Prairie*

**LITTLE BLUESTEM - INDIANGRASS SERIES**  
(*Schizachyrium scoparium* - *Sorghastrum nutans*)

**Terrestrial  
Grassland**

Natural grasslands occur when soils, climate, and disturbance factors interact to perpetuate this dynamic ecosystem. They generally occur

where rainfall is intermediate between that of desert lands and that of forest lands. Grasses are the dominant plants, and forbs are often important. Both trees and shrubs also occur in grasslands as scattered individuals or clumps or in belts or groups along streams and watercourses. Human and human-related activity such as cultivation, overgrazing, and control or elimination of fire has often changed the vegetation of this ecosystem. Human activity has generally caused an increase in the distribution and density of brush and tree species on natural grasslands including the National Grasslands in Texas.

The Cross Timbers and prairie regions of north Texas were selected for settlement because they offered both open prairie and timber in nearby bottoms. However, the grassland areas of north Texas slowly changed as a result of fire control and agriculture. Early historical descriptions of the eastern and western Cross Timbers describe a canopy of post oak (*Quercus stellata*) and blackjack (*Q. marilandica*) with a dense undergrowth of oak saplings, woody vines, and greenbriers (*Smilax* spp.). The contrast between the prairies and Cross Timbers was a prominent landmark for Native Americans and for early explorers. The Spaniards described the Cross Timbers "as a guide even to the most inexperienced as it is constantly on the right as one proceeds north from the Brazos."

Present-day plant communities of the National Grasslands are usually dominated by grasses or consist of post oak savanna or riparian forests. The Caddo Grasslands have somewhat denser post oak savanna (eastern Cross Timbers) with brushy upland prairies that extend into the deciduous forest of the Red River Valley. Most of the LBJ National Grasslands are within the western Cross Timbers. The surface geology of environmental zone consists of weathered sandstones and shales. Differential erosion has produced rolling and hilly topography, and the landscape is more broken to the west.

The Ladonia Unit of the Caddo Grasslands and as small areas on the LBJ falls within the Blackland Prairie. Most soils of the Blackland Prairie are dark calcareous clays derived from the underlying clay, marl, shale, chalky limestone and other bedrock. Low permeability of Blackland clay soils has inhibited tree growth except along the many streams. The Blackland Prairie has been called a part of the Tallgrass Prairie, the Coastal Prairie, and the True Prairie.

This series is an upland tallgrass grassland that once occurred extensively in Texas. Present-day distribution is greatly diminished, and many remaining examples have been altered by land management.

#### **VEGETATION:**

Consists primarily of grasses (approximately 90 percent wheat), with several conspicuous for species and only very little woody plant growth.

**Grasses:** Little bluestem, yellow indiagrass, big bluestem (*Andropogon gerardii*), and switchgrass (*Panicum virgatum*) are dominant under natural conditions. Other short to midgrass species may be found, especially as grazing pressure increases. These can include dropseeds (*Sporobolus* spp.), silver bluestem (*Bothriocloa laguroides* ssp. *torreyana*), hairy grama (*Bouteloua hirsuta*), white tridens (*Tridens albescens*), buffalograss (*Buchloe dactyloides*), wildryes (*Elymus* spp.), Texas winter-grass (*Stipa leucotricha*), sideoats grama (*Bouteloua curtipendula*), seep Muhly (*Muhlenbergia reverchonii*), Texas cupgrass (*Eriochloa sericea*), and Florida paspalum (*Paspalum floridanum*).

Forbs may include Engelmann daisy (*Engelmannia pinnatifida*), Maximilian sunflower (*Helianthus maximiliani*), gaura (*Guara* spp.), health aster (*Aster ericoides*), gayfeathers (*Liatris* spp.), and black-eyed Susan.

#### **SPECIAL-INTEREST PLANTS:**

*Dalea tenuis*

#### **IMPORTANT HABITAT ATTRIBUTES:**

Open in aspect

Tree and shrub species of limited development and present only in limited areas

Continuous layer of herbaceous vegetation present

No exotic plant species and minimal populations of native weeds

Minimal erosion, soil free from mechanical soil disturbance

Dominant plant species (listed above) well represented

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# Appendix I

## Biological Assessment and USFWS Biological Opinion

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This appendix includes a cover letter from the Regional Forester requesting a biological opinion on the biological assessment prepared for the National Forests and Grasslands in Texas (NFGT), the completed Biological Assessment for NFGT Plan, and the USFWS Response and Biological Opinion

### Summary

The Biological Assessment and corresponding Biological Opinion from the USFWS identify the “Determination of Affect Statements” that are applicable for twelve threatened or endangered species that occur or could occur within the NFGT planning area. Included within the Biological Opinion are “Reasonable and Prudent Measures” directed by the USFWS for NFGT to incorporate as standards in the Revised Plan implementation process

United States  
Department of  
Agriculture

Forest  
Service

Southern  
Region

1720 Peachtree Road, NW  
Atlanta, Georgia 30367

File Code: 2670

Date: February 1

Mr. Robert M. Short  
Field Supervisor  
US Fish and Wildlife Service  
711 Stadium Drive East, Suite 252  
Arlington, TX 76011

Dear Mr. Short:

After coordination with Fish and Wildlife Service personnel, we have completed a Biological Assessment of the effects to threatened and endangered species of implementing proposed Revised Land and Resource Management Plan direction on the National Forests and Grasslands in Texas.

Under Section 7 of the Endangered Species Act, we would like to request that formal consultation be initiated due to the "may affect - likely to adversely affect" determination for the red-cockaded woodpecker (RCW) that has been made in the Biological Assessment (enclosed). In addition to the Biological Assessment, copies of our proposed Revised Land and Resource Management Plan and the proposed Final Environmental Impact Statement that it is based on are being made available to Jeff Reid at his office in Lufkin.

As you are aware, this is a new request for formal consultation on this subject, and follows our January 10, 1996, letter asking that a previous formal consultation request be suspended, pending analysis of new information, changes to our proposal, and preparation of a new biological assessment.

The Biological Assessment has made a "may affect - not likely to adversely affect" determination for eleven other threatened or endangered species. We request FWS concurrence with these determinations of effects.

The Revised Plan is consistent with the "Record of Decision and Final Environmental Impact Statement for the Management of the Red-cockaded Woodpecker and its Habitat on National Forests in the Southern Region" (RCW Strategy). The RCW Strategy determined wilderness RCW groups to be non-essential to RCW recovery, and directed individual National Forests to identify to what extent it is appropriate to manage both their wilderness and non-wilderness habitats for RCW groups. The National Forests and Grasslands in Texas have proposed to not manage habitat in designated wilderness for RCW groups. They believe that RCW recovery objectives can be more easily and quickly achieved in habitats outside of designated wilderness areas.

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Mr. Robert M. Short

Page 2

The Biological Assessment identified that implementation of Revised Plan direction would have numerous beneficial effects to the red-cockaded woodpecker. It also identified that not actively managing some wilderness habitat for RCW would likely adversely affect some wilderness RCW cluster habitats and birds over time. Because of the "may affect - likely to adversely affect" determination for RCW, formal consultation is requested. We request incidental take authorization for a total of 16 RCW: from three active clusters in Little Lake Creek Wilderness, and from one active cluster in Upland Island Wilderness.

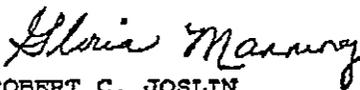
To expedite the consultation process, we believe our review of a draft biological opinion would be very useful, and therefore request that you provide us with a draft biological opinion.

If there are any further requests for information regarding this consultation please contact Bill Bartush (409-639-8518) in Texas or Marc Bosch (404-347-4085) of my staff.

Please inform us when you determine that you have the necessary information to begin formal consultation. We of course will be happy to clarify any points during the consultation.

We appreciate your patience and the close coordination between our agency personnel on this important management decision.

Sincerely,

  
for ROBERT C. JOSLIN  
Regional Forester

Enclosure

cc:  
Jeff Reid, FWS, Lufkin  
NFs in Texas  
Planning Unit, RO

**SUMMARY**

Biological Assessment for  
National Forests and Grasslands in Texas  
Revised Land and Resource Management Plan

**Purpose:**

This Biological Assessment is documentation of anticipated potential effects on 12 federally listed threatened or endangered species of the proposed 1996 Land and Resource Management Plan for the National Forests and Grasslands in Texas

**Location:**

The planning area includes all or portions of 15 counties in north and east Texas. These are Angelina, Fannin, Jasper, Houston, Montague, Montgomery, Nacogdoches, Newton, Sabine, San Augustine, San Jacinto, Shelby, Trinity, Walker and Wise Counties.

**Species of Concern and Affects Determination:**

Eight federally endangered and four threatened species occur or could occur within the administrative boundaries of the National Forests and Grasslands in Texas. No critical habitat for any of the species has been designated or proposed within the planning area; however, the Western Gulf Coastal Plain of Texas red-cockaded woodpecker (RCW) recovery population is identified as the Sam Houston National Forest.

**Species That Occur On NFGT**

red-cockaded woodpecker	May Affect-Likely to Adversely Affect
Navasota ladies'-tresses	May Affect-Not Likely to Adversely Affect
bald eagle	May Affect-Not Likely to Adversely Affect
American alligator	May Affect-Not Likely to Adversely Affect

**Species That Could Occur On NFGT**

peregrine falcon	May Affect-Not Likely to Adversely Affect
black-capped vireo	May Affect-Not Likely to Adversely Affect
Houston toad	May Affect-Not Likely to Adversely Affect
American burying beetle	May Affect-Not Likely to Adversely Affect
white bladderpod	May Affect-Not Likely to Adversely Affect
American chaffseed	May Affect-Not Likely to Adversely Affect
Louisiana black bear	May Affect-Not Likely to Adversely Affect
Texas trailing phlox	May Affect-Not Likely to Adversely Affect

**Incidental Take:**

**Up to 16 red-cockaded woodpeckers**

Incidental take is likely due to secondary effects from the Revised Plan decision to identify RCW clusters occurring within designated wilderness areas as "non-essential to recovery of the species." Under non-essential designation, wilderness RCW habitat is likely to deteriorate due to lack of certain habitat management practices. This action directly effects four active RCW clusters that currently occur in two wilderness areas.

Amended 3/8/96

**BIOLOGICAL ASSESSMENT**  
**THE LAND AND RESOURCE MANAGEMENT PLAN**  
**NATIONAL FORESTS AND GRASSLANDS IN TEXAS**  
Revised 12/25/95

**PART I - INTRODUCTION**

The purpose of this analysis document is to identify, review and describe effects on federally listed species that occur or could occur within the planning area or could be affected by management proposed in the Revised Land and Resource Management Plan (Revised Plan) for the National Forests and Grasslands in Texas (NFGT). The NFGT planning area includes all federal land managed by the NFGT in 15 counties of north and east Texas (approximately 675,000 acres). This document is a Programmatic Biological Assessment (BA) that evaluates the effects of management under the Revised Plan on federally-listed threatened and endangered flora and fauna species (T&E) that occur or could occur on the NFGT. Project-specific analysis at the time of a project proposal will determine site-specific effects.

The Revised Plan and associated Environmental Impact Statement (EIS) incorporates by reference all management standards from the Record of Decision (ROD) of the "Final Environmental Impact Statement for the Red-cockaded Woodpecker (Regional RCW Strategy) and its habitat on National Forests in the Southern Region, 1995". The NFGT Revised Plan/EIS and this BA also tier to the effects analysis described in the Regional RCW Strategy and BA, as well as the subsequent Biological Opinion (BO) written by the U S Fish and Wildlife Service (USFWS) for that document (see Revised Plan/EIS ROD).

This BA recognizes the court-ordered management (1-85-69-CA, of 10-20-1988) of 1200-meter zones around RCW active and inactive clusters is still in effect. The BA also recognizes that a Comprehensive Plan developed to meet the 1988 court order was found by the USFWS as "likely to jeopardize" the continued existence of the RCW since long-term viability of the species was not assured. The Revised Plan was drafted and a review of this draft Plan was completed by USFWS; this advice was factored into the Revised Plan. (See USFWS letter ref. ER-94/755 Date 12-19-94)

The objectives of this BA are to:

1. Document the occurrence or possibility of occurrence of federally listed species within the planning area of the NFGT Revised Plan.
2. Determine what the effects of implementing the Revised Plan direction will have on federally listed species at the programmatic level

This BA was prepared in accordance with Forest Service Manual 2671.44 and 2672.42 and regulations set forth in Section 7(a)(2) of the Endangered Species Act. Determinations of effect by species are made based on best available

information. As significant new information becomes available through inventory, monitoring and research, a revision of this assessment will be done through consultation with the USFWS as appropriate.

## **PART II - CONSULTATION TO DATE**

Informal consultation with the USFWS has been continuous and ongoing since the NFGT Plan Revision was formally announced in the Federal Register on October 23, 1990. U.S. Fish and Wildlife personnel at the Clear Lake, Arlington and Austin, Texas offices were consulted on all aspects of the planning process that involved wildlife species and their habitats. U.S. Fish and Wildlife personnel participated on the NFGT Interdisciplinary Planning Team (IDT) during alternative development and discussion of management actions, management area allocations and development of management standards and guidelines.

The USFWS provided written comments on the Draft Plan Revision in a letter dated December 19, 1994. An October 3, 1995 letter to the USFWS from Regional Forester Robert C. Joslin requested formal consultation on the Revised Plan for the selected Alternative 8. Formal consultation did not begin, however, since additional data was gathered and used to incorporate into the Revised Plan. Refinement of management objectives, standards, guidelines, management area allocations and monitoring actions were made with USFWS participation through informal consultation up to the date of this BA. The analysis in this BA incorporates all information gathered and concerns raised to date regarding the proposals within the NFGT Revised Plan.

## **PART III - PAST & CURRENT MANAGEMENT DIRECTION**

Prior to 1987, the RCW was the only known threatened or endangered species documented on the NFGT. The 1987 Plan for the NFGT recognized three federally listed species: the endangered red-cockaded woodpecker, endangered bald eagle, and the threatened American alligator. The 1987 Plan described general guidance for T&E species, but addressed specific management only for RCW.

The 1987 NFGT Plan stated:

"The Federal [Register] listing will be used as the official source of species qualified as rare and endangered species of plants and animals. Suggestions and recommendations regarding any species not on the Federal [Register] list will be referred to the Texas Natural Heritage Commission (Program) for their recommendations on recognition and management; those recommendations will be considered in management decisions".

Since the 1987 Plan was implemented, a cooperative agreement with the Texas Parks and Wildlife Department (TPWD) was initiated to inventory NFGT lands for endangered, threatened, or management sensitive plant species and exemplary communities. This inventory added a number of additional species to consider; however, the 1987 Plan was never amended to incorporate these additional species. The Navasota ladies'-tresses orchid, a federally endangered plant,

was discovered on the Angelina National Forest in 1988. Several eagle nests have been discovered on the NFGT between 1987 and 1995. Since 1987, NFGT specialists have reviewed habitat requirements, known distribution patterns and other information to identify other T&E that could occur in the planning area. These eight species include: peregrine falcon; black-capped vireo, Houston toad; American burying beetle; white bladderpod; American chaffseed; Louisiana black bear; and the Texas trailing phlox.

Currently all eight of these additional species, Navasota ladies'-tresses, RCW, American alligator and bald eagle are addressed in biological evaluations. These biological evaluations accompany any site-specific or project level analysis where suitable habitat for any or all of these particular species may exist. Through the biological evaluation process, all management actions include consideration for these 12 species. Forest Service Handbook direction has been used in lieu of a 1987 Plan amendment to ensure proper management of these species. Current direction for bald eagle management can be found in Chapter 418 of the Forest Service Handbook 2609.23R, Chapter 418.11 and in the 1987 USFWS "Habitat Management Guidelines for the Bald Eagle in the South East Region." The threatened (by similarity of appearance) American alligator depends upon water for food and protection and is commonly associated with bottomland swamps, ponds, sloughs, marshes and slow moving streams. It rarely is of concern in management actions on the NFGT, with direction and management described in Forest Service Handbook 2609.23R, Chapter 422.11.

The 1987 Plan was found to be deficient in management direction for the RCW and was subsequently remanded on that basis. The 1988 court's order directs management for the RCW on the NFGT at this time. The NFGT Plan Revision "5-Year Review and Analysis of the Management Situation" (1992), identified in more detail the 1987 Plan improvements needed and opportunities that would enhance management, protection and recovery for RCW and the other T&E species.

#### **PART IV - PROPOSED ACTION**

The NFGT proposes to implement a Plan which revises direction that was established in the NFGT 1987 Land and Resource Management Plan. The Revised Plan for the NFGT is needed to fulfill 36 Code of Federal Regulations (CFR) 219.10(g) requirement to revise plans on a 10-year cycle, or at least every 15 years. The Revised Plan incorporates suggested actions and will direct management affecting not only RCW and its habitat, but all existing or future T&E species and their habitat that could occur on or nearby the NFGT.

#### Planning Area and General Forest Plan Decisions

The NFGT Revised Plan will guide all natural resource management activities for the Angelina, Davy Crockett, Sam Houston, and Sabine National Forests, and the Caddo and Lyndon B. Johnson (LBJ) National Grasslands, and specifically establishes:

- \* The forest-wide multiple-use goals, objectives, and desired future condition for the Forests and Grasslands (including estimates of habitat and certain population increases expected).
- \* The management area prescriptions, including associated standards and guidelines, and probable proposed practices to maintain, enhance, or restore natural ecosystems.
- \* The identification of land suitable for timber production and the allowable sale quantity (ASQ) for timber, and the other resource outputs and values from that land (including T&E species recovery).
- \* The quality control checks through monitoring and evaluations that are needed to determine how well standards and guidelines are working, and whether goals remain appropriate throughout the Plan period.
- \* The preservation, protection or enhancement of appropriate important historical, cultural and natural aspects of the National heritage.

#### NFGT Revised Plan Goals

The Revised Plan also states specifically that it is: "To maintain, improve or restore healthy and naturally diverse ecosystems which sustain those resources and values that contribute to the ecological, social, and economic needs of the public". With this responsibility, the Revised Plan also states the NFGT will:

Manage for long-term sustainability of diverse ecological systems, to include native and desirable non-native species plants and animals, which occur in the planning area;

Direct management through application of the processes that sustain ecosystems and provide multiple resources for the future;

Identify and manage for some ecosystems which are unique and recognized as declining within east and north Texas;

Use an ecological approach to management through the use of an Ecological Classification System (ECS) which provides improved resource capabilities and considerations; and

Enhance threatened, endangered, or sensitive (TES) species through restoration of the processes and habitats these populations require.

#### NFGT Revised Plan Objectives

Goals establish direction for objective development of specific resources. The Revised Plan calls for the enhancement of habitat for T&E by using an ecological approach towards management. The established objectives related to T&E species include both statements and numerical targets which include

Enhance threatened, endangered, or sensitive species through restoration of the processes and habitats these populations require,

Protect and improve habitat for threatened, endangered, and sensitive species,

Develop habitat for threatened, endangered, or sensitive species not provided on privately owned forest and grasslands;

Maintain, improve or restore unique ecosystems using Ecological Classification System (ECS) information for restoration of ecological processes emphasizing the fire-dependent longleaf and shortleaf pine ecosystems.

#### Population and Habitat Objectives

<u>Species/Habitat/Area</u>	<u>(Status)</u>	<u>Objective</u>
RCW Sam Houston Population	(153)	525 active clusters
Davy Crockett Population	(39)	330 active clusters
Angelina/Sabine Population	(49)	<u>510</u> active clusters
RCW TOTAL	(241)	1365 active clusters
Navasota ladies'-tresses	(1)	5 populations
Longleaf pine ecosystem	(21,000)	96,000 acres
Shortleaf pine ecosystem	(150,000)	170,000 acres
Herbaceous wetlands (bogs)	(150)	300 acres
Bay-Shrub wetlands (baygalls)	(250)	400 acres
Mesic Forests (beech-white oak)	(2,500)	3,500 acres
Bottomlands - Streamsides	(25,000)	60,000 acres
Tallgrass prairie	(15,000)	25,000 acres

#### Management and Coordination Actions

This BA displays overall effects of the Revised Plan direction to T&E species. In addition to goals and objectives described above, the Revised Plan directs during implementation a second level of analysis for each action that is proposed on the NFGT Site-specific actions or projects that will be proposed will have further, more detailed biological evaluations and environmental analysis for each particular site. Site-specific actions could include, but are not limited to: timber harvest; road construction, reconstruction, management and maintenance; prescribed burning, erosion control; fish and

wildlife habitat improvement, grazing, mineral development, utility corridor maintenance and construction, pesticide use, recreational facilities construction, management and maintenance; and dispersed recreation use management.

Potential effects of the proposed actions could be detrimental or beneficial to the species, depending upon individual species' biology, habitat relationships, implementation measures, and mitigation. Specific timing and location of proposed actions that could off-set potential adverse effects or provide beneficial effects will be incorporated into alternatives of project level or site-specific actions.

Other actions include five timber sales under contract, or which will be under contract, and were not evaluated in the BA and supplement to the BA for the Regional RCW Strategy. These timber sales are outside of the NFGT Tentative Habitat Management Area (HMA) described within the Regional RCW Strategy, but they are within the HMA established as Management Area 2 for the NFGT. These Tentative HMAs for NFGT are published in the "Final Environmental Impact Statement for Management of the Red-cockaded Woodpecker and Its Habitat on National Forests in the Southern Region". These timber sales meet most guidelines for HMA management as described in the Regional RCW Strategy ROD, but exceed maximum opening size of 25 acres on most stands harvested. More discussion of these timber sales is found within the "Ongoing Timber Sales" section of this document (see Effects of Plan Implementation on RCW). Refer to the Revised Plan and EIS for programmatic descriptions, proposed actions, and general effects of actions on the NFGT.

#### **PART V - EXISTING ENVIRONMENT AND SPECIES EVALUATED**

The NFGT Revised Plan incorporates an ecological approach to management. The Revised Plan describes ecological units that have been defined from a number of social, physical and biological components; these are defined from both the existing and historical conditions. The Revised Plan directs restoration of habitats and communities that are globally threatened, primarily the longleaf pine-little bluestem plant community or series, and associated inclusional communities (bogs, baygalls and barrens).

During the planning process, a list of over 170 species that included proposed, endangered, threatened, and sensitive species (PETS) that occur or could occur on the NFGT was developed. This list includes plant communities of special concern and "watch" species. Preparation of the list was a two-year process that looked at all available literature, field reports, species habitat requirements, reasons for species decline, and existing habitat conditions. This list has been reviewed by many interested agencies, universities, and private individuals, including TPWD and USFWS. At present, the list contains 8 endangered and 4 threatened species. Of these 12 species, 2 endangered and 2 threatened species occur on the NFGT. The other eight species occur or could occur within the administrative boundaries of the NFGT. The remaining species (of the original 170 species) are discussed and evaluated in the Revised Plan EIS and Biological Evaluation.

The common names of the 12 T&E species that are evaluated in this BA, their scientific name and current federal listing status is as follows.

<u>Common Name</u>	<u>Scientific Name</u>	<u>Federal Status</u>
<b>Species that may occur on NFGT</b>		
Louisiana black bear	<u>Ursus americanus luteolus</u>	T
peregrine falcon	<u>Falco peregrinus anatum</u>	E
black-capped vireo	<u>Vireo atricapillus</u>	E
Houston toad	<u>Bufo houstonensis</u>	E
American burying beetle	<u>Nicrophorus americanus</u>	E
white bladderpod	<u>Lesquerella pallida</u>	E
American chaffseed	<u>Schwalbea americana</u>	E
Texas trailing phlox	<u>Phlox nivalis texensis</u>	T

**Species with confirmed occurrence on NFGT**

red-cockaded woodpecker	<u>Picoides borealis</u>	E
bald eagle	<u>Haliaeetus leucocephalus</u>	T
American alligator	<u>Alligator mississippiensis</u>	T-similarity appearance
Navasota ladies'-tresses	<u>Spiranthes parksii</u>	E

The Revised Plan directs the development of additional protection measures and management actions for all of the 12 federally listed species that occur or could occur (or other T&E species if found or newly listed) on the NFGT. Other species with similar habitat requirements to these 12 federally listed species will also be protected through management goals, objectives, standards, guidelines and monitoring actions. The management applications prescribed in the NFGT Revised Plan conform to specific concerns and direction described in existing recovery plans, handbook guidelines, USFWS direction, and/or Plan amendments.

**PEREGRINE FALCON**

There are two subspecies of Peregrine Falcon in Texas, Falco peregrinus anatum (American) and Falco peregrinus tundrius (Arctic). The American peregrine falcon nests in west Texas, 600 miles from the forest, but may be found statewide. The Arctic peregrine falcon occurs statewide during the fall and spring migrations, with a few wintering along the gulf coast. No wintering sites have been recorded on any of the National Forests or Grasslands

**BLACK-CAPPED VIREO**

This species breeds from central Oklahoma, through the Edward's Plateau and Big Bend region of Texas, and into central Mexico. Although an historic (pre-1900) record exists for Montague County no recent records exist for Montague, Wise or Fannin Counties. There are no records of sightings on either the Caddo or LBJ National Grasslands.

#### **HOUSTON TOAD**

Distribution is presently one county west of the Davy Crockett and Sam Houston National Forests. Habitat exists on these forests, but attempts to locate individuals or populations on NFGT have been unsuccessful.

#### **AMERICAN BURYING BEETLE**

Present distribution maps have the beetle with its possible range extending as far south as the Red River in Oklahoma, just north of the National Grasslands. Ongoing surveys have found no beetles on the Grasslands

#### **WHITE BLADDERPOD**

All known locations of this narrow endemic occur within the "redlands" ecological region, and all are in San Augustine County. The plant typically grows in open areas associated with outcrops of the Weches geological formation. This geologic formation does not occur on the Angelina National Forest, but occurs in limited areas of the central Sabine National Forest. Recent surveys have located several outcrops with the potential for white bladderpod

#### **AMERICAN CHAFFSEED**

Although this plant has been reported to occur in Texas, the county location is unknown, and no herbarium specimens for the species have been located. The plant was also reported from Louisiana but this report is thought to be erroneous. Elsewhere in the southeastern United States, American chaffseed grows in open pine savannas, forest edges, and road right-of-ways. This habitat type exists in several NFGT locations, but no plants have been located.

#### **LOUISIANA BLACK BEAR**

The National Forests in east Texas are on the extreme western edge of the Louisiana black bear's range. Sightings of black bear have increased over the last few years, but none have been confirmed to be Louisiana black bear

#### **TEXAS TRAILING PHLOX**

Texas trailing phlox has been recorded in three southeast Texas counties. Habitat for the plant is generally open, herbaceous-dominated longleaf pine savanna. Although NFGT provides several excellent examples of frequently burned longleaf pine savanna, the known distribution for the plant lies in "wetland pine savanna" regions (south of NFGT). If the plant does occur on NFGT the most likely locations would be the southern Angelina or Sabine National Forests.

#### **NAVASOTA LADIES'-TRESSES**

A population of Navasota ladies'-tresses was documented on the Angelina National Forest in 1989 (Orzell 1991). This one population is disjunct from the nearest known site by over 170 miles; Navasota ladies'-tresses typically

occurs in the post oak belt of central Texas. The Angelina National Forest site, called the Catahoula Barrens, occurs on an unusual soil type for the NFGT. Shallow alfisols with rock outcroppings and shrink-swell subsurfaces create harsh growing conditions. Commercial pine species (site index 50-60) are usually stunted, post oak and black hickory usually dominate, and open herbaceous patches of vegetation are common. The only known NFGT sites with similar soil conditions (and vegetative physiognomy) occur nearby on the Angelina National Forest. There is a remote chance this plant could occur on the Sabine and/or Sam Houston National Forests.

The selected alternative in the Revised Plan designates the known ladies'-tresses location (Catahoula Barrens micro-site) as a part of the "Longleaf Ridge" Special Management Area 6 (MA-6). A long-term objective is to establish up to five separate populations of this species in Longleaf Ridge. This objective incorporates the possibility of future reintroductions or introductions to suitable habitat on present or newly acquired sites, or it may result from locating currently unknown populations through aggressive inventory and monitoring of these sites. Specific management activities within barrens will be identified and applied to ensure protection of this plant and associated species. Due to annual fluctuations in flowering phenology this plant is extremely difficult to monitor. No formal monitoring plan has been adopted, but the Revised Plan directs the establishment of monitoring actions and protection measures for these micro-sites. Monitoring protocol will be proposed, reviewed and directed during implementation of the Revised Plan.

#### **BALD EAGLE**

Bald Eagles have increased in the planning area since 1987. At least 15 nest and roost sites are located on the Forests along Sam Rayburn Reservoir, Toledo Bend Reservoir and Lake Conroe. Winter sightings are documented annually on the NFGT through TPWD mid-winter surveys. The Revised Plan incorporates the direction in the "Southern States Bald Eagle Recovery Plan". As directed by the Recovery Plan, all known nest and roost sites are protected by a 1500-foot radius no-action zone, and a one-mile radius restricted action zone. Monitoring of eagle activity will continue, with a formal monitoring plan developed for this species upon implementation of the Revised Plan. Nest monitoring is conducted annually by TPWD.

#### **AMERICAN ALLIGATOR**

American alligators have increased in the planning area since 1987. Occurrence is documented for the four National Forests. The Revised Plan provides habitat enhancement for alligators (bottomlands and riparian areas identified in Management Area 4) through protection, management standards and conservation measures. Texas Parks & Wildlife Department (TPWD) considers alligator populations stable, allowing annual harvest on the species in certain counties within the planning area. Monitoring is performed by TPWD.

## RED-COCKADED WOODPECKER

Efforts by the U.S. Forest Service to improve habitat and management for this species on southern forests is described in detail within the Regional RCW Strategy. The situation for the NFGT is also discussed in the Regional RCW Strategy, but complete documentation related to the status of the red-cockaded woodpecker in east Texas is detailed in the 1987 NFGT Plan 5-Year Review and Analysis of the Management Situation (1992). Current indications are that the NFGT RCW populations declined from the 1980's through 1990, some forest populations then appeared to stabilize, with some increase noted between 1991 to 1993 on the Angelina, Davy Crockett and Sabine National Forests (Conner et al 1995). The Sam Houston National Forest did not stabilize until 1993 with some increase evident in 1994.

These recent upward trends of RCW populations on NFGT were attributed to aggressive midstory hardwood removal and installation of artificial cavity inserts and translocation of juvenile RCW; but conclusive evidence to assess trends will take several more years of monitoring. There is evidence that current populations could fluctuate or decline if aggressive management is not continued. The Revised Plan will implement guidelines and management standards from the Regional RCW Strategy ROD that include monitoring, midstory vegetation management, translocation and cavity enhancement. The USFWS has supported the Regional RCW Strategy in the accompanying BO for that document, but at this writing the Fifth Circuit Court has not changed its order for specific management protocols in 1200-meter zones around each cluster.

## PART VI - EFFECTS OF REVISED PLAN IMPLEMENTATION

For those species that could occur on the NFGT, but have no confirmed record to verify their use of NFGT habitat, no major effect is anticipated. These species include the peregrine falcon, black-capped vireo, Houston toad, American burying beetle, white bladderpod, American chaffseed, Louisiana black bear and the Texas trailing phlox. For these eight species the NFGT Revised Plan promotes and improves habitat for these species with the following effects anticipated.

Direct Effects - None.

Indirect Effects - Beneficial habitat development will occur for white bladderpod, American chaffseed, Texas trailing phlox and Louisiana black bear; habitat could also be improved for the other species

Four species are confirmed as occurring on the NFGT and habitat will be directly affected by the Revised Plan. The Revised Plan directs habitat improvement for all four species, and in some cases direct population management. The four species and effects determinations will be described individually as follows

## **BALD EAGLE**

Direct Effects - None.

Indirect Effects - Bald eagle populations have increased in east Texas since 1987. This increase occurred despite the many private inholdings that experienced higher timber harvest, increased recreation and construction activity, adding to fragmentation of habitat and, in some cases, limited nest protection. Many of these activities that occurred will continue on private lands within and around the planning area; but conservation strategies in the Revised Plan should continue to promote bald eagle expansion. Larger contiguous areas of nest site protection along the three major reservoirs, older forest habitat objectives (Plan Chapter IV & V) and scenic/visual quality enhancement along lake corridors will benefit eagle populations in Texas. Increased use of shelterwood harvests and seedtrees with reserves as proposed in the 250,000 acre MA-2 or HMA, will provide substantial eagle habitat.

## **AMERICAN ALLIGATOR**

Direct Effects - None.

Indirect Effects - The Revised Plan doubles the acres in stream management zones and adds three special riparian areas. These land allocations, all of which increase alligator habitat management and protection, provide the potential for increases in the NFGT alligator population.

## **NAVASOTA LADIES'-TRESSES**

Direct Effects - The implementation of the Revised Plan will increase NFGT populations from one to as many as five locations.

Indirect Effects - The Revised Plan increases the protection of habitat for Navasota ladies'-tresses, through designation of a Special Management Area. The Revised Plan objectives for this special area include management objectives which may contribute to increased populations of Navasota ladies'-tresses. If new populations are found outside the Special Management Areas, they will be provided direct protection and management developed in cooperation with the USFWS. The Revised Plan objective to increase the longleaf pine ecosystem will have positive effects for the Navasota ladies'-tresses. The open longleaf pine woodlands and frequent burning regimes to maintain that ecosystem will greatly improve conditions on micro-sites that could still have residual populations of Navasota ladies'-tresses.

## **RED-COCKADED WOODPECKER**

Direct Effects - The Revised Plan accelerates actions to promote both the quantity and quality of RCW habitat. Red-cockaded woodpeckers respond favorably to direct habitat management that is being proposed. The objective is to increase populations from the existing 242 active clusters to 1,365 active clusters. It is anticipated that the RCW population increase would be between one and five percent per year.

The Revised Plan also designates RCW clusters occurring within congressionally designated wilderness areas of NFGT as non-essential to recovery of the species. This decision was made because of historic difficulty in the management of RCW within wilderness areas. No direct habitat management favoring the RCW will be done in wilderness areas, so habitat may deteriorate. This proposal directly effects four active RCW clusters: three on the Sam Houston National Forest within Little Lake Creek Wilderness, and one cluster within Upland Island Wilderness of the Angelina National Forest. The large, expected increase of RCW from the current 241 to 1,365 active clusters outside of wilderness, would more than off-set the loss of four wilderness clusters.

Indirect Effects - The Regional RCW Strategy and ROD allows southern National Forests the flexibility to establish Habitat Management Areas (HMAs) for each population that are sufficient to support recovery objectives. The NFGT HMA allocations (Management Area 2 of Revised Plan) provide slightly larger areas than identified in the Regional RCW Strategy. These HMAs will not conflict with the court-ordered management. Inside the 1200-meter zones ordered by the court, management techniques are more restrictive than those in the Regional RCW Strategy ROD. The court did not rule on management outside the 1200-meter zones; therefore, RCW management in the Revised Plan outside of the 1200-meter zones is appropriate and will not require court review.

The Revised Plan establishes an objective to increase RCW active clusters on NFGT to 1,365 active RCW clusters. This population size is predicted through careful review of NFGT existing RCW clusters and the Regional RCW Strategy. The Regional RCW Strategy estimated a potential for the HMAs to provide up to one cluster per 200 acres of habitat within the Southern Region Coastal Plain habitats. The NFGT utilized this figure in its projections, and verified this potential density through actual density on several areas of the NFGT that already met or exceeded the cluster per 200 acre density.

NFGT has four forests and four distinct RCW populations (Conner et al 1995); however, due to the close proximity of the Angelina and Sabine National Forests, and a known population of at least 12 active RCW clusters between these two forests, the Revised Plan designates the Angelina and Sabine Forests as one population.

For each forest, the current RCW population was fully analyzed. The analysis of each population included informal consultation with USFWS personnel and with a number of USFS personnel. A number of considerations, concerns and recommendations for each forest was made during this consultation. The following summary provides details of the actions formulated and concerns discussed, which were fully incorporated into the Revised Plan and effects determination. Population situation and the effects analysis for that population are described as follows.

#### **RCW EFFECTS - SAM HOUSTON**

The Sam Houston RCW population is the designated recovery population for NFGT and for Texas due to its large population and contiguous RCW habitat. The selected alternative as proposed in the Revised Plan includes acreage from a

recent land exchange that provides approximately 300 more acres of suitable habitat in Management Area 2 (MA-2) than in the Regional RCW Strategy HMA for the Sam Houston. The MA-2 allocation and pine/pine hardwood habitat analysis is as follows.

Gross Acres in MA-2	<u>111,418 ac</u>
Total Pine/Pine Hardwood Acres in MA-2	<u>108,412 ac</u>
Regional RCW Strategy Pine/Pine Hardwood Acres	<u>105,194 ac</u>
Net Difference Pine/Pine Hardwood acres (Tentative RCW HMA EIS and MA-2)	<u>3,218 ac</u>
Current RCW Population (active clusters)	<u>153</u>
Expected RCW Density (acres/cluster)	<u>200</u>
RCW HMA RCW Population Objective (new)	<u>525</u>

One major effect of the HMA delineation and MA-2 designation for the Sam Houston National Forest is the identification of Little Lake Creek Wilderness (LLCW) RCW clusters as "non-essential." The 3,800 acre LLCW is primarily upland loblolly pine, older aged and with a history of severe southern pine beetle outbreaks (see Exhibit 1). After 1992, intensive RCW habitat improvements were made along the perimeter of LLCW to provide habitat in wilderness for RCW clusters that were experiencing deteriorating habitat conditions. The number of clusters in LLCW has declined from six to three, with a loss of 13 to 5 known individual RCW. It is speculated that some of these birds may be utilizing habitat outside of Little Lake Creek, but that cannot be substantiated. This situation and obvious loss of wilderness habitat provided support to declare these RCW clusters in Little Lake Creek as non-essential in the Revised Plan.

A foraging analysis was conducted to better quantify the effects of the habitat conditions and to better analyze the non-essential designation. The RCW foraging habitat analyzed in this BA involved LLCW and the area within 1/2 mile of the wilderness perimeter. This area includes compartments 7, 9, 10, 11, 12, 13, 14, 15, and 32 of the Sam Houston National Forest (see Exhibit 2). The foraging requirement for RCW is calculated easily when clusters are well dispersed. The clusters in, adjacent to, and within one-half mile of Little Lake Creek are relatively dense, making assessment of foraging very difficult due to overlapping clusters. Thirty-two (32) inactive and active RCW clusters are found within this analysis area, three of which are completely within and three clusters both in and just outside the wilderness area. In analyzing the foraging available for these 32 clusters, certain assumptions and definitions were used:

**Amended 3/8/96**

- (a) A category "excluding LLCW" describes exclusive foraging acres for each cluster. Stems and basal area (ba) were not shared between overlapping clusters (no acres were double counted);
- (b) Only live trees in an area were included as foraging habitat; and
- (c) A category "current" describes shared foraging acres for each cluster. Stems and ba were shared between overlapping clusters

The LLCW provides substantial foraging for numerous clusters outside of the wilderness. In the analysis it became evident that 12 clusters (compartments 7,9,11,12) on the southwest side of Little Lake Creek have insufficient foraging habitat (see Exhibit 3). It is highly probable that due to establishing Little Lake Creek as non-essential, this area will be unable to support the existing 12 clusters. It seems more likely that the area would stabilize at some 1/3 to 1/2 fewer clusters for a maximum of six to eight active clusters (loss of four to six clusters).

The loss of habitat management capability within LLCW may, in some respects isolate or fragment a large contiguous area of upland pine, with dense RCW populations, from the rest of the Sam Houston HMA. The value of this 3,800 acre wilderness habitat is significant. After careful analysis of the Little Lake Creek Wilderness RCW situation, the NFGT supplemented the HMA configuration for MA-2 to include an additional three compartments (25, 113, 114), totalling 2,909 acres of pine and pine hardwood. This additional acreage is appropriately positioned to provide contiguous pine and pine/hardwood habitat for better movement between active clusters, and to allow RCW expansion into critical areas. These additional acres are as follows:

SUPPLEMENTAL ACRES

#1 Compartment	25	pine/pine hardwood	1,488 acres
#2 Compartment	113		627 acres
#3 Compartment	114		<u>794 acres</u>
		total	2,909

In this analysis of the Sam Houston RCW HMA, it was also determined more direction was required to successfully offset the loss of Little Lake Creek as RCW habitat. Between 1992 and 1995 the Little Lake Creek RCW population declined from six active clusters (13 RCW) to three active clusters (6 RCW), one of which is a single male RCW Cluster. This rapid decline is expected to continue, so immediate and targeted actions are needed to negate this anticipated loss. The NFGT proposes to: (1) Continue intensive habitat improvement in areas adjacent to Little Lake Creek; (2) Slow the decline by hand removal of midstory in Little Lake Creek within 50 to 100 feet of active clusters; (3) Initiate an intensive reintroduction effort into one or more areas of the Sam Houston (12 new clusters within 3 to 5 years of Revised Plan implementation).

RCW density on the Sam Houston is also a concern. As discussed previously, an average density of one active cluster per 200 acres was used in developing the HMA target populations. Actual density in compartments on the northeast side of Lake Conroe on the Sam Houston National Forest exceeds one cluster/190 acres. This density may be difficult to attain over the entire Sam Houston and perhaps other forests due to natural hardwood composition in loblolly/shortleaf dominated ecological units. Further monitoring and evaluation will be directed at determining the appropriate density to use as an objective by NFGT.

**RCW EFFECTS - DAVY CROCKETT**

The Davy Crockett RCW population is primarily found on the northern half of the forest. A small sub-population (four active clusters) exists in the southeastern portion of the forest on what is described as Alabama Creek. The Revised Plan proposes to establish a slightly larger HMA than the Regional RCW Strategy with the addition of 1,744 acres of habitat. The new RCW population objective will increase by 5 active clusters to 330 total clusters.

Gross Acres in MA-2	<u>67,263 ac</u>
Total Pine/Pine Hardwood acres in MA-2	<u>66,245 ac</u>
Regional RCW Strategy Pine/Pine Hardwood acres in MA-2	<u>65,016 ac</u>
Net Difference (Pine/Pine Hardwood acres) (Tentative Regional RCW Strategy HMA and MA-2)	<u>1,744 ac</u>
Current RCW Population (active clusters)	<u>39</u>
Expected RCW Density (acres/cluster)	<u>200</u>
RCW HMA RCW Population Objective	<u>330</u>

The spatial separation of the Alabama Creek sub-population (4 active clusters) from the remainder of the Davy Crockett RCW population is a concern. The NFGT Revised Plan will direct monitoring protocol and develop an accelerated augmentation and reintroduction program in the Alabama Creek area. Upon implementation of the Revised Plan, additional RCW activity outside the established HMA (MA-2) is expected. Historic clusters and quality habitat in compartments 60 through 62, 70 through 74, 108 and 110 that are spatially located between the two Davy Crockett sub-populations may develop RCW activity. The NFGT will monitor this situation.

Presently no active RCW clusters occur in Big Slough Wilderness on the Davy Crockett. One active cluster was abandoned prior to the 1987 NFGT Plan. It is possible RCW activity could re-occur in Big Slough Wilderness due to its close proximity to other active RCW Clusters. Any future wilderness clusters in Big Slough would be considered non-essential.

**RCW EFFECTS - SABINE**

The Revised Plan proposed to establish a significantly larger HMA on the Sabine National Forest as compared to the Regional RCW Strategy Tentative HMA. All of the additional area within the HMA is in the southern portion of the forest where most active RCW clusters and much of the longleaf pine habitat is located. The Revised Plan proposes 52,578 acres of RCW habitat (an increase of 16,093 acres) with a population objective of 260 active clusters. A complete summary of the proposal is as follows:

Gross acres in MA-2	<u>54,721 ac</u>
Total Pine/Pine Hardwood acres in MA-2	<u>52,578 ac</u>
Regional RCW Strategy Pine/Pine Hardwood	<u>36,485 ac</u>
Net Difference Pine/Pine Hardwood acres (Tentative RCW HMA and MA-2)	<u>16,093 ac</u>
Current RCW Population (active clusters)	<u>20</u>
Expected RCW Density (acres/cluster)	<u>200</u>
RCW HMA RCW Population Objective	<u>260</u>

The Sabine National Forest RCW population declined rapidly during the 1980's. It is currently stabilized or slightly increasing with 23 active clusters, of which only six occur in the northern sub-population. Close monitoring and population augmentation is planned for the northern sub-population, which is separated spatially from the southern sub-population by much private land and Indian Mounds Wilderness. No active clusters occur in the Indian Mounds Wilderness, and due to a southern pine beetle epidemic in recent years, little habitat remains and no RCW are expected to utilize that area for many years. The southern Sabine RCW population currently has 17 active clusters. These clusters and the proposed HMA were analyzed for any relationship and potential linkages with RCW clusters on nearby private lands. It was determined that approximately 15 additional active clusters exist within five miles (south) of the forest on private land. Initial review of the Tentative Sabine HMA for the Regional RCW Strategy did not take into consideration these clusters on private lands. For the Revised Plan, several key areas were added to the HMA to ensure all potential habitat between the RCW clusters on private land and the forest were available. These supplemental acres added to the HMA on the southwest part of the forest included.

#1 Compartment	121	Pine/pine hardwood	615 acres
#2 Compartment	122		675 acres
#3 Compartment	123		524 acres
#4 Compartment	124		<u>600 acres</u>
		total	2,413 acres

Amended 3/8/96

An additional 2,644 acres in compartments 124, 125, 126 would not be available due to the Big Thicket Land Exchange.

The southeastern portion of the Sabine National Forest is not part of the Revised Plan HMA, though it contains significant longleaf pine habitat and five inactive RCW Clusters. A portion of the Stark Tract will be managed as a special area, and the longleaf pine habitat will be managed in such a way that RCW could re-establish active clusters in the near future. Monitoring actions have been prescribed to evaluate the RCW situation on the Stark Tract annually.

Another concern on the Sabine National Forest involved a historically active cluster (1986-87) on the northernmost compartment. This cluster in compartment 1 was not included in the HMA due to its distance (approximately 18 miles) from the existing active clusters in the Revised Plan HMA. Technically this cluster should have been included within the HMA according to the Regional RCW Strategy HMA development process; however, the distance and amount of forest acres included in this HMA configuration were substantial, and the NFGT's ability and cost expected to manage these acres and re-establish active clusters were prohibitive.

No known active clusters exist within 18 miles of compartment 1, therefore a determination was made to exclude this cluster from the HMA proposal. The Revised Plan, in contrast, will develop and enhance RCW habitat in the southern portion of the Sabine National Forest. The northern sub-population will be increased via re-introductions to supplement the existing six clusters and monitor the results closely. This action is expected to offset the loss of the cluster in compartment 1. It was determined that the forest area described as Boles Field that connects compartment 1 to the northern HMA would take considerable resources to develop into suitable RCW habitat, and more positive results would be achieved with aggressive management on the southern Sabine National Forest.

#### **RCW EFFECTS - ANGELINA**

The Angelina National Forest has the most potential (of any of the four National Forests in Texas) for longleaf pine restoration; this will significantly benefit RCW habitat development and promote an aggressive prescribed fire program. The HMA proposed in the Revised Plan is contained both in MA-2 and MA-6 (Longleaf Ridge), and contains substantial contiguous areas of upland pine that is less than 70 years old and is not occupied by RCW. Both landownership pattern and inherent management capability make the Angelina National Forest a very important component of RCW management in the West Gulf Coastal Plain. The total area proposed as HMA is 20,801 acres larger than the Tentative HMA described in the Regional RCW Strategy. The population objective is 250 active clusters. The basic summary for the Angelina National Forest is as follows:

Gross acres in MA-2	<u>51,164 ac</u>
Total Pine/Pine Hardwood acres in MA-2	<u>50,611 ac</u>
Regional RCW Strategy Pine/Pine Hardwood acres	<u>29,801 ac</u>
Net Difference Pine/Pine Hardwood acres (Tentative Regional RCW Strategy HMA and MA-2)	<u>20,810 ac</u>
Current RCW Population (active clusters)	<u>27</u>
Expected RCW Density (acres/cluster)	<u>200</u>
RCW HMA RCW Population Objective	<u>250</u>

The Angelina National Forest will develop significant, high quality longleaf pine habitat for both RCW and many other sensitive plant and animal species associated with this habitat. Specific actions for the Angelina will be to clearly define, locate and monitor RCW cavity inserts and drilled start holes for success. The development of an Upland Island Wilderness prescribed fire program will substantially improve conditions for RCW. This will make it necessary to continue monitoring wilderness clusters even though declared non-essential

The Revised Plan also identifies the Upland Island Wilderness clusters as "non-essential" for RCW recovery. Habitat has been and will continue to be improved along the wilderness perimeter to induce the birds to move out of wilderness. Habitat in the wilderness may be improved or maintained indirectly through prescribed fire for fuel reduction and ecosystem management, which will no doubt have secondary benefits for the RCW. Upland Island Wilderness has 1 of 29 active clusters on the Angelina Forest; if fire within the wilderness improves the upland pine system in Upland Island, it is expected that continued use of the wilderness by RCW will continue. The Upland Island cluster will not affect the development of larger HMAs on the other areas of the Angelina National Forest, except to supplement the potential population through natural and artificial dispersal of individual RCW.

#### **NFGT RCW Summary**

In summary, the Revised Plan provides additional RCW habitat for both the recovery population on the Sam Houston and the other three support populations on the Davy Crockett, Angelina and Sabine Forests. These populations will be managed through prescribed burning, thinning, regeneration, augmentation and cavity replacement techniques. The Revised Plan also provides for cluster expansion outside HMA, through 1200-meter zone protection. The Revised Plan's standards and guidelines for clusters directs that monitoring will be according to the Regional RCW Strategy. These populations will probably increase to the objective established for each forest, which is over 1,000 more RCW active clusters than currently exists.

**Amended 3/8/96**

The Sam Houston Forest recovery population has the most active RCW clusters and highest densities; though this forest is on the extreme southwestern edge of the RCW's range, a number of compartments have densities of approximately one active cluster per 190 acres. The Sam Houston National Forest is in ecological landtypes that consist of loblolly, shortleaf and pine/hardwood habitat. Much of the NFGT also has a broken land ownership/use pattern. These concerns indicate that these population objectives may be optimistic, regardless of existing high densities (some exceed one active cluster per 200 acres). Research is in progress to determine the actual carrying capacity of the forests and will take several years to complete. With intensive monitoring, continuing habitat improvement, augmentation, and cavity replacement techniques, the existing population will remain stable or most likely improve. Any adjustments to population objectives or HMA boundaries found to be necessary can be accomplished through Plan amendments in five years or less.

#### Wilderness Clusters

Other concerns with identifying wilderness clusters as non-essential for RCW recovery are based on evidence that wilderness habitat conditions are likely to decline without vegetation management, primarily through the use of prescribed fire and midstory removal. Informal consultation with the USFWS indicates that this approach would lead to a take situation. Take will primarily be limited to male birds, their offspring and possibly some adult females that will not abandon their territory even if the habitat deteriorates to a point where it will no longer support a pair of birds.

The "non-essential" designation for wilderness clusters is a valid approach due to the limited ability of the forests to maintain or improve the habitat within the wilderness and a much better opportunity to manage RCW and habitat outside of wilderness areas. The Revised Plan will continue to provide enough habitat on the edge of wilderness through management, essentially attracting birds from wilderness. On page 125 of the BO for the Regional RCW Strategy, it states, ". . .advances and success in artificial cavity provisioning and RCW translocations have decreased the importance of the few remaining wilderness RCW groups to the point where they are no longer considered 'essential' to recovery from a southern pine beetle suppression perspective".

The BO for the Regional RCW Strategy agreed with a taking of non-essential RCW in Texas wilderness areas based upon Section 7 consultation analysis. The NFGT anticipates that the three active clusters remaining in Little Lake Creek and one active cluster in Upland Island may be lost due to subsequent habitat deterioration resulting from the "non-essential" designation. In addition, this lack of active management may adversely effect up to six active clusters in the HMA, adjacent to but outside Little Lake Creek due to reduced foraging habitat. The USFWS authorization for incidental take of up to 16 birds over the next three to five years, due to anticipated RCW losses expected upon Revised Plan implementation, should be requested.

In efforts to minimize this "take" situation, special efforts will be made to relocate and establish 12 or more clusters in the Big Woods area of the Sam Houston National Forest. The Revised Plan allows limited actions in wilderness; such actions may be needed if RCW habitat deteriorates prior to

the establishment of new clusters Management Standards within the Revised Plan direction for wilderness (Management Area 7) are consistent with that concept for RCW and to related T&E enhancement. These actions would be strictly limited, allowing the clusters to persist, while not altering the natural processes that ensure the wilderness character. It would include limited enhancement of active cavity trees and augmentation of single bird clusters. Close monitoring will continue in these wilderness clusters by forest biologists in accordance with the Regional RCW Strategy.

#### Effects of Five Ongoing Timber Sales

These actions include five timber sales that are under contract, or will be under contract, and were not evaluated in the BA and supplement to the BA for the Regional RCW Strategy. These timber sales are outside of the Tentative Habitat Management Areas (HMA) for NFGT that were identified in the Regional RCW Strategy, but they are within the HMA as established as Management Area 2 or 6 of the Revised Plan. These Tentative HMAs for NFGT are published in the "Final Environmental Impact Statement for Management of the Red-cockaded Woodpecker and Its Habitat on National Forests in the Southern Region." These timber sales meet most guidelines for HMA management as described in the Regional RCW Strategy, but exceed maximum opening size of 25 acres on most stands regenerated. All of the timber sales are approximately 1.5 miles or more from any active RCW cluster, are not expected to effect RCW habitat or foraging needs for at least five years and are in compartments that were added to supplement the Tentative HMA described in the Regional RCW Strategy. The additional acres added to each forest HMA in the Revised Plan, add substantial acreage to the Tentative HMA acreages. These additional HMA acres are reflected as pine and pine/hardwood habitat that strategically includes corridor areas, potential expansions areas and areas with high potential for longleaf pine restoration; these additional acres greatly enhance NFGT ability to achieve RCW population objectives in 5 to 10 years.

The five sales were sold or marked to be sold when the changes to the HMAs were made between the 1994 draft and the development of the selected alternative (Alternative 8). Each sale has a biological evaluation completed. No concurrence from USFWS was needed because they were outside the Tentative HMA and had a "no effect" determination on T&E species.

The sales are:

Angelina N.F. - Compartment 66 & 67 - Ongoing sale - This sale includes 231 total acres to clearcut slash pine for restoration to longleaf pine (residual longleaf pine was left standing on site.) The five restoration sites range from 31 to 65 acres. An additional 209 acres is in four seedtree harvests, ranging in size from 28 to 68 acres. The decision for this sale was signed prior to completion of the Regional RCW Strategy, and before development of the Revised Plan (Alternative 8). It is anticipated that overall effects for longleaf pine habitat and RCW would be beneficial.

- Angelina N.F. - Compartment 65 & 59 - Ongoing Sale - This sale is only partially in the Revised Plan HMA; compartment 59 will be outside Longleaf Ridge (MA-6) and will not be managed according to the Regional RCW Strategy. Compartment 65 will be managed as Longleaf Ridge (MA-6) and in concert with the Regional RCW Strategy. Compartment 65 includes seedtree harvests (216 acres) ranging in size from 39 to 73 acres. These four seedtree cuts are in loblolly pine dominated sites and restoration to longleaf or shortleaf pine was not considered appropriate. An additional 95 acres of thinning will also occur within this sale in compartment 65. The decision for this sale was signed prior to completion of the Regional RCW Strategy, and before development of the Revised Plan (Alternative 8). No adverse effects to RCW are anticipated.
- Sam Houston N.F. - Compartment 22 - Signed Decision - This area proposes 511 acres of thinning for RCW 1200-meter zone and other thinning outside 1200 meters for SPB risk reduction. The project included an additional 174 total acres of seedtree harvests. Both the thinning activity and regeneration will not reduce foraging requirements for RCW within 1.5 miles of active clusters in MA-2. Thinnings will reduce SPB risk and regeneration will promote the dominance of shortleaf pine, resulting in long term improvement of RCW habitat. Overall effects for RCW would be beneficial.
- Sam Houston N.F. - Compartment 23 - Ongoing sale - This sale includes 174 total acres of seedtree harvests on four sites. These sales will not effect foraging requirements for RCW in the HMA and will promote the dominance of shortleaf pine on some sites. The overall effect of this sale for shortleaf pine restoration and RCW would be beneficial.
- Sam Houston N.F. - Compartment 113 - Ongoing sale - This sale includes 380 acres of thinning for SPB risk reduction, and an additional 185 acres of plantation thinning. The original project included an additional four seedtree harvests totalling 70 acres. Both the ongoing sale and deferred regeneration will not reduce foraging requirements for RCW within 1.5 miles of active clusters in MA-2. Thinnings will reduce SPB risk and regeneration will promote future habitat availability for RCW. Effects for RCW would be beneficial.

#### **PART VII - DETERMINATIONS OF EFFECT**

Based on the goals, objectives and management actions proposed in the Revised Plan, significant beneficial effects are anticipated for the 12 T&E species evaluated. Upon Revised Plan implementation, habitat development is expected to improve population potential for each species. The Revised Plan clearly

states direction for management standards and guidelines, existing and continuing inventories, research and monitoring actions; this is further assured during future site-specific project development and review for T&E species recovery.

It is also expected that habitat improvements through longleaf and shortleaf pine restoration, riparian area protection and special area designations could provide more sites for species like the Texas trailing phlox, American chaffseed, white bladderpod and Louisiana black bear.

The determination of effects for the proposed actions of the Revised Plan for the NFGT is "may affect-not likely to adversely affect" the American Bald eagle, American alligator, Navasota ladies'-tresses; as well as peregrine falcon, black-capped vireo, Houston toad, American burying beetle, white bladderpod, American chaffseed, Louisiana black bear, and the Texas trailing phlox.

Non-management of RCW wilderness clusters will likely lead to a loss of some RCW. Therefore, a determination of "may affect-likely to adversely affect" is made for RCW. However, such adverse effects to individuals that are found in the four wilderness clusters at present will be far outweighed by numerous beneficial effects of management for the 1,365 active cluster population objective outside of wilderness. The possible loss of wilderness clusters will not significantly affect meeting the stated RCW recovery objectives. Formal consultation with the USFWS will be requested due to this determination for RCW and an incidental take authorization of up to 16 RCW should be requested.

This determination of effects is rendered only on the basis that additional project-level site-specific analysis and biological evaluation documentation, appropriate consultation with USFWS as prescribed by Section 7 of the Endangered Species Act, and subsequent determination of effects will be conducted for all proposed projects.

#### **PART VIII - MANAGEMENT RECOMMENDATIONS AND SECTION 7 CONSULTATION TO DATE**

No management recommendations accompany this BA. Concerns and management recommendations have been discussed during the consultation process and have been fully incorporated into the Revised Plan and EIS standards, guidelines and monitoring actions for T&E species that occur or could occur on the NFGT.

Future management actions that involve T&E species or their habitat will require additional project-level site-specific analysis, biological evaluation documentation and subsequent determination of effects for all proposed projects. Appropriate consultation with USFWS as prescribed by Section 7 of the Endangered Species Act and in the subsequent BO for this BA will be coordinated during the proposal of these future management actions.

Amended 3/8/96

**PART IX - LITERATURE CITED**

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**EXHIBITS**

- (1) Wilderness White Paper, Forest Health Update and Texas Media Guide.
- (2) Compartment Map Composite - Little Lake Creek
- (3) Foraging Analysis for Little Lake Creek and Adjacent Clusters



WILLIAM S. BARTUSH  
Planning Team Leader  
Certified Wildlife Biologist

2/1/96  
DATE

# **EXHIBIT 1**

- 1) Wilderness White Paper - 3/92
- 2) Forest Health Update Volume 1.2 - 4/95
- 3) Texas Media Guide - 11/95

## WILDERNESS MANAGEMENT

While the Wilderness Act of 1964 emphasizes the protection of pristine areas, it also recognizes recreational values of benefit to contemporary Americans. Wilderness areas provide *"outstanding opportunities for solitude for primitive and unconfined type of recreation"* Nationwide, recreational time spent in wilderness areas stabilized in the 1980's but the number of visits of shorter duration increased (USDA Forest Service 1990). As stated in the 1989 RPA Assessment (Cordell et al.), *"recreational use is only one use of wilderness. Other nonrecreational uses, such as education, science, habitat preservation, and ecosystem preservation, are growing in importance and recognition"* Values, such as maintenance of species diversity, protection of threatened and endangered species, protection of watersheds, scientific research, and social values, are attributable to wilderness As stated in the 1990 Long Term Strategic Plan *"There is an increasing recognition of the need for management guidelines to protect nonrecreational values of wilderness."* (USDA Forest Service 1990)

Wilderness user research supports the conclusion that greater consideration should be given to off-site and nonrecreational uses (Roggenbuck and Watson 1989). Nonrecreational uses of wilderness are widespread throughout the National Wilderness Preservation System For example in 1988, 75 percent of wilderness areas had identified prehistoric or historic cultural sites. One-half were home to one or more federally or state-listed threatened or endangered plant or animal species. One-third were used for scientific research, environmental education, or livestock grazing. One-sixth had known spiritual sites, human development programs, subsistence resources, or water storage reservoirs. Because little detailed research has been conducted on the extent of these nonrecreational uses of wilderness, the general public has not always been aware of their value

Most of the benefits of wilderness are not as easily measured or valued as those of timber, water, forage, mining, or even recreation As a result, many important and valuable aspects of wilderness typically have not been included in the forest planning process Several noncommodity values have been identified for the preservation of wilderness including "option," "bequest," and "existence" values (Walsh, R.G.; Loomis, J.B. 1989). Option value refers to the value derived by individuals who desire wilderness because they want the option of visiting at some time in the future. Bequest value refers to value derived from wilderness by individuals who want wilderness so their kids (or future generations) can visit. Existence value refers to the value derived from wilderness by those individuals who want wilderness "just to know it's out there."

## BACKGROUND

The Secretary of Agriculture's Rule and Regulations (36 CFR 219) for National Forest Land and Resource Management Planning (NFMA Regulations) contain direction for determining management direction in wilderness (§219.18):

*"Forest planning shall provide direction for the management of designated wilderness and primitive areas in accordance with the provisions of 36 CFR Part 293 In particular, plans shall—*

*(a) Provide for limiting and distributing visitor use of specific areas in accord with periodic estimates of the maximum levels of use that allow natural process to operate freely and that do not impair the values for which wilderness areas were created; and*

*(b) Evaluate the extent to which wildfire, insect, and disease control measures may be desirable for protection of either the wilderness or adjacent areas and provide for such measures when appropriate."*

## CHAPTER 4 - SPECIAL MANAGEMENT AREAS

### Wilderness Management

March 1992

36 CFR 293 2, 293.3, 293 6 thru 293.8 and 293 10 thru 293 15 provide direction on objectives, control of uses, commercial uses, grazing, permanent structures, wildlife and fish, water rights, access to surrounded property, access to valid occupancies, mineral leases and permits, and gathering information.

Forest Service Manual (FSM) 2322 also contains some direction on what needs to be in a Forest Plan in terms of wilderness direction:

*\*1 Management direction for each wilderness must be stated in the forest plan as management area prescriptions with associated standards and guidelines. Each wilderness is unique as established by law therefore, each will be identified as a separate management area.*

*2. The wilderness component of the forest plan shall include, as a minimum, the following:*

*a. Management direction in accordance with 36 CFR 219 and 36 CFR 293.*

*b Display of the relationships and coordination between the wilderness resource and other resources and activities present in the wilderness, as well as activities outside of wilderness that affect the management of the wilderness. Resources and other elements to be addressed include: recreation (including visitor education), forest cover, forage, fish and wildlife, federally listed threatened or endangered flora or fauna, domestic livestock, soil and water (including weather modification), minerals, historical and cultural resources, fire, land ownership, insect and diseases, air quality, other agency use, the trail system (including trailheads), signing, communication and research*

*c. Monitoring requirements for determining whether prescriptions, standards, and guidelines are met "*

The Land and Resource Management Planning Handbook (FSH 1909 12) provides specific direction on where management direction needs to be placed in a Forest Plan:

*\*4 24 - Chapter 4 - Forest Management Direction This chapter presents the management goals, objectives, standards and guidelines that constitute direction for resource management covered by the plan Ensure that appendices prepared do not include direction, but supplement, clarify, and support forest management direction "*

Conflicting direction within the Forest Service Manual System in terms of determining management areas for wildernesses. FSM 2322.03 (amended 4/86) states:

*"Management direction for each wilderness must be stated in the forest plan as management area prescriptions with associated standards and guidelines. Each wilderness is unique as established by law; therefore, each will be identified as a separate management area "*

New direction in the FSH 1909 19, section 4 24e(6) published in the Federal Register on July 15, 1988 states:

*" .. Existing ...special areas [including wildernesses] may be defined as individual management areas, as parts of other management areas, or as a combination of several management areas when they are very large and when internal management needs vary significantly from location to location. Direction for existing special areas may be incorporated by reference, indicating the process by which the existing direction was developed "*

The objective of wilderness management is stated in the Forest Service Manual (FSM) 2320, section 02:

*\*1. Ensure that wilderness resource is fully integrated into the Forest Land and Resource Management Plan*

*2 Ensure that other resources and activities within each wilderness are coordinated and in harmony with the wilderness resource."*

Implementation of the forest plan is accomplished through development of implementation schedules that include projects and activities designed to achieve and comply with the management standards and guidelines established for the designated wilderness. Implementation schedules are addressed in 2322.1.

*"Implementation schedules should be prepared to ensure that direction and objectives established in the forest plan are met (FSM 1922.5). They include coordination of the work done on all resources and activities within each wilderness and are normally revised annually. Implementation schedules contain*

- 1. Specific action needed to follow forest plan direction and accomplish forest plan objectives.*
- 2. General prioritization of action items.*
- 3. Unit or individual responsibilities*
- 4. Target dates for completion of the actions."*

#### **REGIONAL DIRECTION ON WILDERNESS MANAGEMENT**

In a January 18, 1989 letter, the Regional Forester provided direction on the need for adequate "wilderness management direction" within Forest Plans. (This letter and attachments are on file in the process records in Land Management Planning in the Forest Supervisor's office). The Regional Office Interdisciplinary Team identified the following areas where specific wilderness management direction was needed (where applicable) in a Forest Plan:

- Wilderness Resource
- Recreation
- Access Management
- Signing (including information and education efforts)
- Threatened, Endangered & Sensitive Species
- Fish and Wildlife
- Range
- Vegetation
- Minerals and Mining
- Lands (private inholdings)
- Water
- Soils
- Air
- Collection of Resource and Use Information
- Scientific Study
- Cultural and Historic
- Fire
- Insects and Disease
- Motorized Equipment or Mechanical Transport
- Structures and Improvements
- Visual Resource

Attachments to the January 18 letter include an example of management direction needed in a Forest Plan to manage wilderness; general direction and standards and guidelines are given for various wilderness activities.

## CURRENT SITUATION

On May 20, 1987, the Regional Forester signed the Decision Notice for the Final Environmental Impact Statement and Land and Resource Management Plan for the National Forests and Grasslands in Texas. This Plan specified standards and guides for management of wilderness in Texas for a ten-year period.

**Table 1: Five Wilderness Areas on the NFGT, 1990**

Area	Acreage <sup>1</sup>
Big Slough	3,639
Indian Mounds	11,037
Little Lake Creek	3,810
Turkey Hill	5,286
Upland Island	13,390
Total	37,162

SOURCE National Forests and Grasslands in Texas, 1990

All five wilderness areas are completely on the National Forests and Grasslands in Texas and are under the administrative responsibility of the Forest Supervisor for the NFGT. As stated in the current Forest Plan, *"The five wilderness areas: Turkey Hill, Little Lake Creek, Big Slough, Upland Island and Indian Mounds will be managed in context with the Texas Wilderness Act of 1984"*

### STANDARDS AND GUIDELINES FOR WILDERNESS AREAS

The five wilderness areas are in Management area #1. The standards and guidelines for wilderness are as follows:

- \* The five wilderness areas will be managed in accordance with the provisions of: (1) Wilderness Act of 1964 (P.L. 88-577), (2) Texas Wilderness Act of 1984 (3) Secretary of Agriculture Regulation, (4) Executive Orders, (5) Department of Agriculture Policy Statements, (6) Forest Service Manual 2320, and (7) Wilderness management direction.
- \* If use should exceed two RVD's/acre/year, methods may be necessary to control the amount of use (i.e. permit system).
- \* Evaluate potentially significant sites
- Nominate significant sites that qualify to the National Register.
- \* There will be no timber management activities.
- Take action to prevent ORV use.
- \* Conduct wildlife surveys and monitoring. Known populations of red-cockaded woodpecker exist in the designated wilderness areas. Specific management of these areas may provide for protection of the species and its habitat. See FSM 2323.31b for guidelines for manipulation of wildlife habitat in wilderness areas.
- \* Control of SPB in wilderness areas will follow directions spelled out in the Record of Decision, Appendix N, Section VI
- \* All insect and disease infestation control methods will be considered. The method selected will be the method that most effectively controls the infestation and protects the wilderness resource. (See SPB-FEIS Record of Decision, Appendix N)

- \* Maintain wilderness trail system at maintenance level 1 as prescribed by Forest Service Manual (2350) and Trails South guide.
- \* Monitor wilderness use by voluntary registration, trail counters or double sampling procedures. Restrict use where unacceptable resource damage is occurring or where the amount of use hampers opportunities for solitude.
- \* Educate and inform public on wilderness ethic through personal and group contacts.
- \* Manage visual resource as preservation.
- \* Coordinate search and rescue operations through local enforcement agencies.
- \* Damage resulting from fire suppression efforts will be obliterated or repaired, as a cost of the fire, in a manner that allow the wilderness to heal rapidly.
- \* Appropriate suppression action, in accordance with standards and guidelines established for other National Forest lands, will be utilized for fires adjacent to wilderness.
- \* Watershed improvement projects will be accomplished using handtools and natural material.
- \* The use of mechanical, motorized equipment or aircraft for fire suppression shall have the concurrence of the Regional Forester.
- \* Acquire by exchange or by purchase from willing sellers, lands inside designated wilderness.
- \* There will be no disposals of wilderness lands.
- \* Subject only to valid existing rights, surface activities related to minerals exploration and development will not be authorized.
  - As provided by law, no new leases of U.S. mineral rights will be issued.
  - Where the proposal will create a lasting impact, prior to approval of permits for exercise of valid existing mineral rights the Forest Service will offer to exchange these rights for those of equal value outside the wilderness.
  - Appropriate protective measures, subject to valid existing rights, will be required in the event of proposals to explore and/or develop currently leased U.S. mineral rights and private rights. See Management Area 5, Standards and Guidelines.
  - New special use authorizations will be limited to honoring of valid, existing rights such as access to private property, utilities under permit, etc.
  - Where possible, and with the concurrence of the permittee, existing land use authorizations will be terminated.
- \* Close existing roads (subject to valid existing rights).
- \* See Management area #4 (Standards and Guidelines) for supplemental Standards and Guidelines for all lands and mineral activities.
  - Develop four access parking areas per wilderness.
- \* Post regulations on use of firewood.
- \* No prescribed burning is scheduled in wilderness during the life of the Plan, however, should the need arise, a site specific analysis must be made prior to implementation of prescribed burning.
- \* Coordinate with Texas Parks and Wildlife for enforcement of state fish and game regulations.

#### **STANDARDS AND GUIDELINES FOR SOUTHERN PINE BEETLE IN WILDERNESS**

Appendix N in the current Forest Plan addresses the management requirement guidelines for SPB in the general forest area, wilderness (general), wilderness protection of essential RCW colonies, wilderness (protection of adjacent lands), general forest area and wilderness (RCW colony site protection), general forest area and wilderness (general). In general, no SPB control action will be taken in wilderness unless an infestation threatens an essential RCW colony or occurs within 1/4 mile of susceptible host on State and private land or high value forest resources on Federal land and is predicted to spread onto that land causing unacceptable damage on that land.

#### **Southern Pine Beetle Infestations in Wilderness**

Southern pine beetle infestation has been and continues to be one of the most controversial issues associated with Texas Wilderness. On April 6, 1987, the Regional Forester signed the Decision Notice for the Final Environmental Impact Statement for the Suppression of the Southern Pine Beetle (USDA Forest Service

**CHAPTER 4 - SPECIAL MANAGEMENT AREAS**

**Wilderness Management**

March 1992

1987) This direction affected the type and intensity of control measures in wilderness and prescribed monitoring of infestations not meeting control criteria. The SPB EIS documented the results of an environmental analysis of six alternatives developed for possible suppression of SPB on Federal land including wilderness areas. The preferred alternative was Action in Wilderness to Protect Essential Red-Cockaded Woodpecker Colonies Site and Foraging Area; Integrated Pest Management in General Forest Area.

Numerous southern pine beetle (SPB) outbreaks have occurred in wilderness areas. The years 1985 and 1986 recorded the heaviest (SPB) activity in wilderness areas in the National Forests and Grasslands in Texas. In 1986, there were 147 SPB spots located in the five wilderness areas, Little Lake Creek having 61, Indian Mounds 33, Turkey Hill 24, Upland Island 23, and Big Slough 6. Thirty-three spots were treated with cut-and-leave method, 15 with cut-and-remove method, and 99 spots were monitored. Control measures were again necessary on 11 spots in Little Lake Creek Wilderness in FY90 and 2 spots in FY91 in order to protect red-cockaded woodpecker colonies in and adjacent to Little Lake Creek. Control measures stopped the spread of SPB infestation and saved at least one active red-cockaded woodpecker colony. These actions have been controversial because of their impact on wilderness, but are required under the Endangered Species Act. More information on the SPB spots in wilderness in Fiscal Year 1990 and 1991 is listed in Table 2.

**Table 2: Southern Pine Beetle Spots, Active Spots, Control, and Acres Infested, FY90-91**

	Wilderness Area									
	Upland Island		Turkey Hill		Indian Mounds		Big Slough		Little Lake Creek	
	Fiscal Year	1990	1991	1990	1991	1990	1991	1990	1991	1990
Total Spots	48	44	14	24	63	60	22	4	36	27
Monitored Spots	29	17	6	19	48	21	0	4	7	15
Spots Requiring Control	0	0	0	0	0	0	0	0	11	2
Total Infested Acres	72	64	5	4	374	392	46	0.5	2.9	26
Acres Inactive	10	61	4	0.7	13	242	46	0	36	6

Source: Wilderness Area SPB biweekly status report 9/21/90 and 9/09/91.

**RESEARCH CONDUCTED IN WILDERNESS AREAS**

Wilderness offers a unique environment for scientific research. Three separate research projects have been conducted in the Upland Island Wilderness area and one project has been conducted on the Turkey Hill Wilderness Area.

The Intermountain Research Station in Missoula, Montana, has completed a recreation visitor survey of the Upland Island Wilderness Area. The USDA Southern Forest Experiment Station at Nacogdoches, Texas has been conducting red-cockaded woodpecker reproduction research in Upland Island and Turkey Hill Wilderness Areas. In 1989, the Texas Forest Service conducted some research on active SPB spots in Upland Island Wilderness.

**CHANGE IN WILDERNESS ACREAGE**

Findings from the Monitoring and Evaluation of the Land and Resource Management Plan FY 1987 through July, 1990 indicate the area of wilderness (37,162 acres) exceeds the objective listed in the Forest Plan (35,176 acres). All wilderness is being managed in accordance with established law and policy, to the extent present budgeting will allow. Boundaries are well defined and marked. The changes in acreage are summarized in Table 3.

**Table 3: Changes in Wilderness Since Approval of the Forest Plan**

Wilderness Area	FY86 Acreage	Changes	Current Acreage
Big Slough	3,136	448 <sup>1</sup> , 55 <sup>2</sup>	3,639
Indian Mounds	10,695	227 <sup>1</sup> , 120 <sup>3</sup>	11,037
Little Lake Creek	3,671	139 <sup>1</sup>	3,810
Turkey Hill	5,251	35 <sup>1</sup>	5,286
Upland Island	12,423	227 <sup>1</sup> , 740 <sup>4</sup>	13,390
<b>Total</b>	<b>35,176</b>	<b>1,986</b>	<b>37,162</b>

- <sup>1</sup> Added through boundary adjustment in FY87 (Public Law 99-584)
- <sup>2</sup> Land purchase completed in FY87
- <sup>3</sup> Land exchange completed in FY87
- <sup>4</sup> Land exchange completed in FY88

In addition to the exchanges and purchases listed above, an exchange is currently being reviewed by Congress which would add additional acres to the Upland Island Wilderness. Approval by Congress will complete the acquisition of all privately owned land within the proclaimed wilderness boundaries. It is important to note that additional acreage could be acquired that is technically excluded from the wilderness boundaries but is totally surrounded by wilderness.

**VISITOR USE OF WILDERNESS**

According to the FY 87-90 Monitoring and Evaluation Report (National Forests and Grasslands in Texas 1990) registration, monitoring, and site inspections indicate that overall use is well within established carrying capacities (see Table 4). The carrying capacity of wilderness is 2.0 RVD's per acre. This capacity is based on management toward a primitive ROS opportunity. Current use is only 1/10th of the potential use of the existing 37,162 acres of wilderness.

As stated in the current Forest Plan standards and guidelines, "If use should exceed two RVD's/acre/year, methods may be necessary to control the amount of use (i.e. permit system) "

**Table 4: Estimated Visitor Use in Wilderness Areas, 1987 - 1991<sup>1</sup>**

	1987	1988	1989	1990	1991
Use (RVDs)	5,800	6,400	7,400	7,400	10,900
Density (RVDs/Acre)	0.164	0.181	0.199	0.199	0.293

<sup>1</sup> SOURCE USDA Forest Service RIM data 1987-1991

Use in some small localities (e.g. in Little Lake Creek near the southern pine beetle treatment sites) has greatly exceeded 2 RVD's per acre due to the interest in the treatments. Despite this, the wilderness resource is not being degraded by excessive impact on vegetation, soil, and water.

In September of 1989, as part of the Forest's activities to celebrate the 25th anniversary of the Wilderness System, certificates were printed to be given to persons who had traversed the wilderness areas in the National Forests in Texas. A shoulder patch was also developed to be given to anyone who provided proof that they had hiked or canoed through two of the wilderness areas in Texas.

Visitor registration and visual observation indicate that wilderness use is relatively light, mostly day-use and primarily associated with hunting.

#### **Upland Island Visitors Study**

A study of visitor use in the Upland Island Wilderness Area was initiated on October 6, 1989, and completed on February 25, 1990 (Watson, et al 1990). The study was done in cooperation with the Wilderness Management Research Unit in Missoula, Montana.

The study of visitors to the Upland Island Wilderness was conducted for two reasons. As stated by the authors, *"First, there was interest in obtaining some input from visitors regarding their preferences for naturalness and social conditions in the wilderness. This information was seen as important input to selection of indicators and establishing management standards for social condition and naturalness objectives. Second, there was interest in a better understanding of who visits the Upland Island and their relationship to this resource"* The goal of the second objective was stated by the authors as *"to describe use and user characteristics in terms of the meanings customers attach to the resource"* "...in consumer behavior research, investigators have increasingly recognized that the meanings of and attachments to possessions are important aspects of satisfaction"

The objective of the Upland Island study was not specifically to determine level and type of use, although this type of data was collected. The problem with using the results of this study to determine level and type of use lies in the design of the experiment. If the research question had involved level and type of use the survey would have been distributed throughout the year to determine level and type of use during the various seasons.

If the results of the Upland Island study are used to infer level and type of use, the conclusions one would draw indicate that wilderness use was relatively light, was mostly day-use, and was primarily associated with hunting during the 65 sample days conducted from October 6, 1989 to February 25, 1990. These conclusions are in general agreement with the observations of the Forest managers.

### **Visitor Interpretation and Education (Including Trails)**

The wilderness boundaries are all well defined and properly marked on the ground. Trail head parking areas have been established at Big Slough, Little Lake Creek, Upland Island, and Turkey Hill Wilderness Areas. Trailhead areas are in the process of being developed at Indian Mounds Wilderness Area. The trailhead areas provide off-road parking for several vehicles, an information board, and a visitor registration station.

Two wilderness areas have developed hiking trails that existed prior to designation. They are in Little Lake Creek Wilderness Area (Lone Star Hiking Trail) and Big Slough Wilderness Area (4Cs Hiking Trail). These are actually small portions of the trails which continue on through and outside of the wilderness areas. None of the other wilderness areas have developed, designated hiking trails. The other wilderness areas, contain old closed roads which are being used as hiking and/or horse trails. The old roads have been indicated as trails on the wilderness maps. There are no plans at this time to develop any designated trails in wilderness. There are some who feel that a developed trail system in wilderness would be contrary to the wilderness ethic and the purposes for which wilderness is designated.

Wilderness brochures have been developed for Indian Mounds, Upland Island, and Turkey Hill Wilderness Areas. Brochures are in the process of being developed for Big Slough and Little Lake Creek.

### **Outfitter and Guide Services**

Prior to 1989, there had been no history of outfitter and guide use sanctioned on the NFGT. In 1989, the Angelina and Yellowpine Ranger Districts each received applications for permits to provide outfitter/guide services in wilderness areas. These applications raised the following questions:

- Is there a public need (demand) for such services?
- What are the adverse impacts to wilderness?
- How much use can be accommodated in wilderness without causing unacceptable impact?

The Forest issued an interim policy regarding these and any subsequent outfitter/guide applications. Two permits were to be allowed under this policy. These permits were to be monitored in order to be able to answer the questions above. No other permits were to be issued in wilderness areas. This policy was proposed and instituted through a 2720 NFGT memo dated August 3, 1989 (copy is maintained in the Planning Records in the Supervisor's Office). This policy was to remain in effect until the Forest Plan was revised.

In response to issuance of this policy, one outfitter/guide permit in Upland Island Wilderness Area was issued in FY90. During the November and December, 1989, operating season, use was reported at 127 use-days. This use generated about \$240.00 in receipts to the U.S. Treasury. This permit was not reissued in FY91 due to failure of the permittee to obtain adequate liability insurance (a national permit requirement).

### *RANGE USE*

In 1987 there were nine grazing permittees in the Upland Island Wilderness (Mary Lovett, personal communication September 21, 1991). Currently three grazing permittees are active in Texas wilderness areas. There is one active permit in Little Lake Creek and two in Indian Mounds.

### *OFF-ROAD VEHICLE USE*

According to the current Forest Plan, wilderness areas are closed to off-road vehicle (ORV) use. Despite this, some ORV use has occurred in the wilderness areas. During the period from October 1988 through June 1990, twenty incidents of ORV use in wilderness were documented. Only three violators were apprehended and issued citations. Despite this misuse of wilderness, no significant for long-term impairment of wilderness has resulted (National Forests and Grasslands in Texas 1990). During FY 1990, twelve incidents of ORV use

## CHAPTER 4 - SPECIAL MANAGEMENT AREAS

### Wilderness Management

March 1992

in wilderness were documented. Only one of these incidents resulted in a ticket being issued (National Forests and Grasslands in Texas 1991).

### MINERALS

As in the rest of the State of Texas, U.S. land ownership of wilderness does not always include U.S. ownership of mineral rights. On the Big Slough and Little Lake Creek Wilderness Areas all mineral ownership is in U.S. hands. On the remaining three wilderness areas, some of the mineral rights are not in U.S. ownership. Mineral rights on the Upland Island Wilderness are mostly in private ownership held in perpetuity (will not revert to U.S. ownership). On the Turkey Hill Wilderness, there is a small amount of U.S. mineral ownership but most is in private ownership in perpetuity. On the Indian Mounds Wilderness, most mineral ownership reverted to the U.S. in 1985 and 1990, the remainder is in shared U.S. and private ownership and in private ownership held in perpetuity.

According to the current Forest Plan:

*"Special areas such as scenic and wilderness areas are subject to special limitations on minerals activities." "The wording of the wilderness legislation and the expressed intention of the legislators, as documented in the Congressional Record and Committee Reports, will control the exploration for development of minerals in wilderness areas. In the case of the Texas Wilderness Bill, valid existing rights may be exercised by the owner of the rights. Valid existing rights include U.S. leases in effect and reserved/outstanding rights. Under existing law no new leases may be issued. The Texas Wilderness Bill provides that before permitting activities of an impacting nature on valid existing rights, the U.S. will attempt to exchange minerals ownership with the proponent"*

The mineral ownerships in Indian Mounds Wilderness Area that created the flurry of oil well drilling in 1983 and 1984, have reverted to U.S. ownership. This reversion affected all areas within one-half mile radius circles from wells which had been producing on the previous reversion date of January 1, 1985. All of the eighteen oil wells drilled in Indian Mounds Wilderness Area had been plugged by December 1986. Restoration of the well sites was completed in 1987.

### INTERNAL COMMENTS, ISSUES AND CONCERNS

In addition to the comments listed in the appendix under the issue of wilderness management, several comments included in other issues may also have relevance. These include comments pertaining to control of southern pine beetle (SPB), control of ORV use, and the use of prescribed fire. The following discussion from Duane Strock, Forest Recreation Specialist, describes the wilderness issue.

*"The issue of wilderness in East Texas has been and continues to be an emotional issue as the public scoping letters indicate. It all appears to be an issue of cutting timber or not cutting timber more so than an actual desire for more wilderness. Wilderness seems to be the vehicle to eliminate cutting timber. Existing wilderness use is low, even below expected use. Additional wilderness from the standpoint of recreation use or attracting tourism, appears unwarranted in this planning period. I would rather see the administrative designation of a representative quantity of land to a Special Management Area(s). A Special Management Area designated for recreation and/or wildlife would have a separate management plan written specifically for that area. A Special Management Area could allow the same kinds of access as the general Forest areas, but could limit any timber cutting to that necessary to satisfy the recreation and/or wildlife needs. Development of facilities to meet public demand or needs could still be accomplished. In fact, specialized needs, such as those necessary to provide access to the physically impaired, could be installed to give similar experiences as to being in wilderness. Giving access to physically impaired to hunt deer or squirrel could also be provided."*

### Southern Pine Beetle

Control of southern pine beetle (SPB) is a general issue on the Forest but many people object specifically to SPB control in wilderness areas because it is thought to conflict with objectives of wilderness.

The southern pine beetle continues to be a major problem in Texas wilderness. Existing stands of mature pine timber are prime targets for the beetle. Beetle populations tend to build up within the wilderness, sometimes over winter, and then threaten the general forest area and adjacent private land pine stands. The cutting of the SPB spots has been met with much objection from environmental groups. When SPB threatens red-cockaded woodpecker colonies, the Endangered Species Act mandates action in order to prevent loss of colonies which are considered essential to the recovery of the species.

### Off-Road Vehicle Use

ORV use is a general issue on the Forest, it is of special interest in wilderness because it is one area where ORV use is not permitted.

### Fire

Use of fire to protect and preserve natural communities and to maintain habitat for the endangered RCW are general issues on the Forest (see discussion of disturbance regimes in Natural Values part of Biodiversity chapter). These issues are relevant to wilderness management because some of these natural communities and some RCW habitat occurs in wilderness. According to the current Forest Plan:

*"No prescribed burning is scheduled in wilderness during the life of this Plan; however, should the need arise, a site specific analysis must be made prior to implementation of prescribed burning."*

The Natural Heritage Report (NFGT 1990) recommends management practices for certain areas where sensitive plants occur. In some cases it is recommended these plants and communities be protected from silvicultural treatment such as prescribed burning and in other cases prescribed burning is recommended. The Stark Tract, a RARE II evaluation area for proposed wilderness (see Wilderness Allocation part of this chapter), is recommended for prescribed burning to maintain the upland longleaf pine community (Natural Heritage Report, pg. 398). The Upland Island (Graham Creek) Wilderness Area is recommended for prescribed burning (Natural Heritage Report, pg. 419) to perpetuate longleaf pine reproduction and inhibit woody invasion in the savannas, bogs, and barrens; prescribed and naturally occurring fires should be allowed to burn uninterrupted across the landscape and naturally extinguish in the more fire resistant community types.

The interim guides for managing RCW also call for the use of prescribed fire in managing the habitat for this endangered species. For more detailed information, refer to Chapter 6 of this document.

Wildfire has occurred in several instances. Present management plans call for putting out all fires by handtools unless the intensity of the fire and fire weather conditions indicate that control of the fire is not possible by handtools methods. When this occurs, then mechanical means, to the extent necessary to control the fire with the least amount of damage, are utilized. If mechanical methods are used, then restoration of firelines and any other evidence of mechanical use are usually carried out after the fire is out (see Fire part of Resource Sustainability chapter).

Prescribed burning is not presently a management tool in Texas wilderness. However, prescribed burning may be needed to maintain "natural conditions", especially to maintain fire dependent ecosystems (i.e. longleaf pine and bogs). Prescribed burning needs to be considered as "natural fire" in order to maintain an ecological balance within wilderness. Catastrophic wildfire may be considered natural, but with extensive private land and developments around or near our wilderness areas, it would endanger private lands and property and would have to be subdued. Prescribed natural fire would reduce fuel and the risk of a catastrophic wildfire (see Fire part of Chapter 12).

## AREAS WHERE CHANGE MAY BE NEEDED

- 1 CHANGE Consider separate management areas and standards and guidelines for each wilderness area that are found to be sufficiently different.

REASON: Management direction for determining management areas for wildernesses are broad. According to FSM 2322, *"Each wilderness is unique as established by law therefore, each will be identified as a separate management area."*

New direction in the FSH 1909.19 Section 4.24e(6) published in the Federal Register on July 15, 1988 states:

*"Existing . special area [including wildernesses] may be defined as individual management areas, as parts of other management areas, or as a combination of several management areas when they are very large and when internal management needs vary significantly for location to location. Direction for existing special areas may be incorporated by reference, indicating the process by which the existing direction was developed."*

The five wilderness areas are different with respect to: inholdings, vegetation type, presence of threatened and endangered plant and animal species, size, acreage in various ROS classes, and distance from large urban areas. These differences may merit additional or different standards and guidelines. Wilderness areas found to have fire-dependent vegetation may require different standards and guidelines regarding prescribed burning. Wilderness areas close to urban areas may have a different type of visitor with a different duration of stay, may require more first time visitor information, may experience more violations such as off-road vehicle use, these differences may necessitate more emphasis on visitor information and education, signing or other methods of visitor management.

- 2 CHANGE: Acquire where possible all inholdings or properties that have or will require special-use permits into or through wilderness to gain access by owners.

REASON. FSM 2326, section 13 addresses access to surrounded State and private land.

*"Ensure adequate access to States or persons, and their successors in interest, who own land completely surrounded by wilderness." (Adequate access is defined in 36 CFR 293.12 and FSM 2320 Section .05 as the combination of routes and modes of travel that the Forest Service has determined will have the least-lasting impact on the wilderness resource and, at the same time, will serve the reasonable purposes for which State or private land or rights is held or used). "Prevent unauthorized road construction or motorized transport across wilderness. The Regional Forester may provide these landowners with written permission to use wilderness routes or motorized modes of travel not available to the general public. When the exercise of these rights of access to surrounded land would be detrimental to wilderness values, attempt to acquire the land by purchase or exchange or donation before granting access."*

3. CHANGE: Establish a wilderness specialist on each District with wilderness in order to concentrate management efforts.

REASON: A R-8 2320 memo dated July 17, 1990, (on file in the Planning Records in the Supervisor's Office) listing jobs that should be done for all Southern Region Wildernesses lists this as the number one priority job. This specialist is needed to write implementation plans, inventory trails, monitor campsites, update photo points, monitor trail registration stations, contact visitors to promote "no trace" camping, and to plan for and supervise volunteer work crews as well as paid seasonal crews.

4. CHANGE: Improve methods of estimating visitor use and types of activities occurring on each wilderness

REASON: According to FSH 2320.2, one of the objectives of wilderness management is to *"Gather information and carry out research in a manner compatible with preserving the wilderness environment to increase understanding of wilderness ecology, wilderness uses, management opportunities, and visitor behavior"*

Wilderness areas provide *"outstanding opportunities for solitude for primitive and unconfined type of recreation"* (Wilderness Act of 1964). The RPA Assessment stated, *"Nationwide, recreational time spent in wilderness areas stabilized in the 1980's but the number of visits of shorter duration increased"* Without accurate information on wilderness recreation users, the types of recreation activities occurring on wilderness and the duration of the visit, it is difficult to develop interpretive and educational material, brochures, and signing to assist the visitor and improve the quality of the wilderness experience.

5. CHANGE: Add standards and guidelines for prescribed burning in order to maintain fire dependent species, important habitat for endangered wildlife (RCW), and to simulate natural fire (Prescribed Natural Fire)

REASON. According to CFR 219 18 (b), Plans shall *"evaluate the extent to which wildfire,....control measures may be desirable for protection of either the wilderness or adjacent areas and provide for such measures when appropriate"*

Prescribed burning is necessary to maintain certain fire dependent plant communities that occur on certain wilderness areas. The Natural Heritage Report has identified Upland Island Wilderness as an area where prescribed burning should occur to *"to perpetuate longleaf pine reproduction and inhibit woody invasion in the savannas, bogs, and barrens."* In addition, the Interim Guides for managing RCW call for the use of prescribed fire to aid in maintenance of habitat.

- 6 CHANGE. Review needs at each trailhead for information, wilderness ethics, etc

REASON: As stated in FSM 2323 Section 12 *"Use information, interpretation, and education as the primary tools for management of wilderness visitors"* Brochures, maps or other materials provided at trail heads can be used to provide information on trails, direction on waste management, and visitor management information to guide use away from over-used areas

- 7 CHANGE: Update the wilderness acreage in the Forest Plan.

REASON: The acreage currently shown in the Forest Plan is incorrect

- 8 CHANGE: Consider addressing the following list of management actions compiled from Regional direction in the revision of the Forest Plan

Develop education material, inventory wilderness resource conditions, list non-compatible uses, inventory fisheries habitat, perform wildlife population surveys, develop and post firewood regulations, establish and monitor photo-points, monitor SPB activities, establish water quality monitoring program, determine limits of acceptable change (LAC) for water quality, determine LAC for soils and inventory campsites and heavy use areas, prepare and maintain PETS inventory, develop LAC for visitor usage and monitor use, determine whether or not an area trail system is needed and plan if needed, prepare a fire management plan, determine and document Forest history, monitor insect and disease activity, control insect and disease activity if warranted, prepare an updated range allotment plan, add a part time wilderness technician to District staff if budget and ceilings allow, determine area radio coverage, determine a system to monitor area use, define emergency access routes, maintain all signs, develop

a sign plan, coordinate with the State Highway department to install highway signs, maintain parking and information areas, develop a slide or VHS program, update a master copy of the wilderness map as needed to keep information current and develop a research needs plan

- 9 CHANGE Review the standards and guides and remove those that are administrative (e.g. coordinate search and rescue) or implementation schedule (e.g. make brochures, parking areas, etc.).

REASON: These are administrative and/or project level decisions not within the scope of a programmatic Forest Plan. As such they are not appropriate in the Plan.

10. CHANGE: Clearly identify whether new and/or existing trails should be located within wilderness areas

REASON. There is some debate as to whether or not developed trails belong in wilderness. This should be resolved so that trail planning and implementation can proceed.

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## SOUTHERN PINE BEETLE IN WILDERNESS

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## Historical Status:

Prior to the adoption of the FEIS for the Suppression of the Southern Pine Beetle (SPB) in 1987, there were no restrictions on suppression of SPB infestations within wildernesses. The FEIS dictated that SPB control could only be implemented to protect T&E species and their habitat or to protect susceptible private land or high value federal land when specified criteria were met. These control restrictions coincided with the end of a major SPB epidemic, so the consequences of the FEIS were not evident for several years. In 1990, SPB infestations began to threaten RCW colonies and limited foraging habitat in Little Lake Creek Wilderness in Texas. Ten spots were treated. In 1992, as a new epidemic progressed in Texas, small spots not meeting control criteria continued to grow and merge with other spots, creating large infestations. Little Lake Creek, Indian Mounds, Turkey Hill, and Upland Island Wildernesses all developed large SPB populations. Control activities to protect RCW colonies and habitat in Little Lake Creek continued, and suppression efforts to protect adjacent private land began in Indian Mounds, Turkey Hill, and Upland Island.

## Current Status:

Estimated total acres infested by SPB in each fiscal year.

	General Forest	Wilderness
FY 91	1,095	117
FY 92	2,689	2,130
FY 93	2,134	10,179
FY 94	174	96

Approximate percentage of wildernesses in Texas impacted by SPB through FY 94: Indian Mounds - 73 percent, Little Lake Creek - 26 percent, Upland Island - 14 percent, Turkey Hill - 38 percent. The huge infestations in Indian Mounds and Turkey Hill developed concurrently or after epidemic populations were established in the surrounding National Forest and state and private lands. The large increase in infested acreage in wilderness corresponded with a decrease in infested acreage on general forest in FY 93.

Since September 1992, 13 spots have been treated in Indian Mounds, 3 in Turkey Hill, and 2 in Upland Island to protect adjacent private land. Cut and leave was used on 104 acres, and cut and hand spray was used on 22.4 acres. Thirty-one spots have been treated in Little Lake Creek since April 1990 to

protect RCW clusters and limited foraging habitat. Cut and leave was used on 222 acres, with 54.2 acres of cut and hand spray.

Ten spots have spread directly from wilderness onto adjacent private land in Texas. Estimated impacts to private land directly attributable to SPB from wilderness in Texas are 205 acres infested and salvaged, and 456 acres cut prior to predicted infestation to prevent spread.

No wilderness infestations were treated in 1994, and no direct impacts to private land were observed.

State forestry associations and private landowner groups continue to push for fewer restrictions on wilderness SPB control, citing fire hazard, area wide spread of SPB, and lost revenue as the major reasons for needing increased suppression. Legislation introduced by Congressman Charles Wilson, (D-Texas), which would allow control and salvage of all wilderness infestations is still pending. The tort claim filed against the FS by a landowner with property adjacent to Indian Mounds has yet to be resolved.

Infestations are also being monitored in wildernesses in Alabama, Arkansas, and Louisiana, though none have yet met the criteria for control.

#### **Projected Trend:**

In Texas, SPB activity in wilderness has subsided greatly. Turkey Hill still has several active spots which could continue to build, but no private land is currently threatened. Population increases in the east may lead to increased problems in wilderness in Alabama and Mississippi.

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Topic: SOUTHERN PINE BEETLES IN WILDERNESS

The 1987 Final Environmental Impact Statement for Suppression of the Southern Pine Beetle established stringent criteria for control of southern pine beetles (SPB) in wilderness, allowing suppression measures only to protect endangered species habitat and adjacent private or high value federal lands.

During periods of intense SPB activity, infestations within wilderness often grow unimpeded until control criteria are met. By that time, their momentum and size are so great that successful control is difficult, so impacts to red-cockaded woodpecker (RCW) habitat and to adjacent private land have occurred. Since 1987, approximately 205 acres of forested private land have been impacted by infestations expanding across wilderness boundaries. An estimated 456 acres of private land were cut as a preventative measure. No RCW cavity trees have been lost in wilderness, but foraging habitat has been greatly reduced.

These impacts have resulted in one tort claim and subsequent civil suit being filed against the agency, but two rulings have upheld the Forest Service's actions. A bill sponsored by Congressman Charles Wilson (D - Texas), requiring treatment of all wilderness infestations, is still pending, and further hearings are planned. This proposed legislation is backed by the Texas Forest Service and the Texas Forstry Association.

The RCW FEIS and new NFGT Forest Plan have declared RCW clusters in wilderness as non-essential. The Fish and Wildlife Service has tentatively agreed, though action in wilderness could still be required to protect clusters and foraging habitat outside of wilderness.

Fire danger in wilderness remains high due to the amount of beetle killed timber, and fire plans have been finalized and approved for each wilderness.

Some cumulative statistics on SPB in Texas wilderness, 1987 - 1995:

	Total Spots	Acres Infested	Acres of Susceptible Host Type	Percent Host Type Infested
Upland Island	195	1,768	11,801	15.0
Turkey Hill	105	2,124	4,476	47.5
Big Slough	67	141	939	15.0
Indian Mounds	219	8,301	10,912	76.1
Little Lake Cr.	132	1,536	3,528	43.5
Total	718	13,870		

Infestations treated in Wilderness since 1989

Upland Island	- 1 cut and hand spray	- 329 trees, 4 acres.
	1 cut and leave	- 29 trees, 1 acre.
Total	- 2 spots	358 trees, 5 acres.
Turkey Hill	- 3 cut and leave	- 4,446 trees, 60 acres
Total	3 spots	- 4,446 trees, 60 acres
Big Slough	- 0 spots treated	
Indian Mounds	- 7 cut and leave	- 5,032 trees, 43 acres
	6 cut and hand spray	- 1,470 trees, 18 acres
Total	- 13 spots	6,502 trees, 61 acres
Little Lake Creek	- 26 cut and leave	- 17,331 trees, 222 acres
	5 cut and hand spray	- 2,729 trees, 54 acres
Total	31 spots	20,060 trees, 276 acres
Grand total	- 49 spots,	31,366 trees, 402 acres

SPB activity has been at endemic levels in 1994-1995, and no infestations were treated in either year. The last SPB epidemic year was 1993, when 10,179 acres of wilderness in Texas were infested, as opposed to only 94 acres in 1994.

# **EXHIBIT 3**

RCW Foraging Habitat Analysis

Little Lake Creek Wilderness

Sam Houston National Forest

EXHIBIT 3

Foraging Habitat for RCW clusters  
in/within 1/2 mile  
Little Lake Creek Wilderness  
Sam Houston National Forest, Texas

The calculated foraging habitat that is described below utilized the requirements established by the Regional RCW Strategy, established 6/95 for all Forests in the Southern Region of the U.S. Forest Service. The process record and associated data and tabulation sheets are available for review in the NFGT planning files. All data utilized was collected or verified between 8/95 and 12/95 by specialists on the Sam Houston National Forest (SHNF). Foraging analysis was developed and calculated by Dawn Carrie, Wildlife Biologist, SHNF. Compartments that were surveyed included 7, 9, 10, 11, 12, 13, 14, 15 and 32 that are immediately adjacent to or inside Little Lake Creek Wilderness (LLCW). Clusters outside of LLCW analyzed were only those within 1/2 mile of the wilderness boundary.

Definitions and Assumptions

The "current" figures are total foraging available for the cluster. This current calculation includes acreage inside LLCW; it also includes shared foraging habitat with LLCW clusters where overlap occurs within the 1/2 mile zone surrounding each cluster.

The "excluding LLCW" figures do not include any acreage within LLCW, and also do not share foraging habitat with LLCW clusters where there is overlap in the 1/2 mile zone. To be more specific, the excluding forage calculation for each cluster is strictly that foraging habitat outside LLCW and within 1/2 mile of a cluster that was included in this analysis. In some instances there was shared habitat between clusters that occur outside of LLCW; where this overlap occurs with other non-LLCW clusters, the analysis displayed includes shared habitat.

Cluster	CURRENT		EXCLUDING LLCW	
	Pine BA	#10" Pines	Pine BA	#10" Pines
7-2	5678	4322	5273	3933
7-5	7206	5119	7116	5030
9-4	6579	4350	6441	4204
10-2	11007	9926	This cluster in LLCW	
10-9	6783	5619	4253	3203
10-10	16244	15663	This cluster in LLCW	
10-11	5787	5183	This cluster in LLCW	

<u>Cluster</u>	CURRENT		EXCLUDING LLCW	
	<u>Pine BA</u>	<u>#10" Pines</u>	<u>Pine BA</u>	<u>#10" Pines</u>
11-1	3200	2444	2550	1823
11-4	7283	4864	6702	4274
11-5	5536	4159	4914	3562
11-7	6866	5958	2891	2053
11-8	6051	4576	4900	3425
11-9	9164	6144	8739	5756
11-12	5957	4356	5948	4322
12-1	2056	1847	This cluster in LLCW	
12-2	9000	5736	This cluster in LLCW	
12-3	7987	4923	13459	8303
12-5	7687	5119	9317	5872
13-1	4698	3956	This cluster in LLCW	
13-2	6273	5543	This cluster in LLCW	
14-1	17306	13780	9593	6241
14-2	16356	11590	16083	11332
14-3	10874	7621	10209	6947
15-2	11048	7788	9008	5792
15-3	20863	17470	10810	7707
15-5	9740	6719	9703	6670
15-7	8868	7377	4585	3194
32-2	4432	3420	2255	1418
32-6	7265	4800	7779	4992
32-9	5735	3830	5812	3787
32-10	8549	6288	8669	6318
32-11	10741	8581	6910	4886



**U.S. Fish and Wildlife Service**



**Biological Opinion**

on

**The U.S. Forest Service  
National Forests and Grasslands in Texas  
Revised Land and Resource Management Plan  
Environmental Impact Statement  
and  
Record of Decision of 1996**



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TABLE OF CONTENTS

CONSULTATION HISTORY . . . . . 1

BIOLOGICAL OPINION . . . . . 3

DESCRIPTION OF THE PROPOSED ACTION . . . . . 3

ENVIRONMENTAL BASELINE . . . . . 4

Status of the Species . . . . . 4

    Red-cockaded woodpecker . . . . . 4

National Forests in Texas . . . . . 5

Status of RCW in Wilderness Areas . . . . . 8

Big Slough Wilderness . . . . . 8

RCW Clusters within Big Slough Wilderness . . . . . 9

RCW Clusters adjacent to Big Slough Wilderness . . . . . 9

Indian Mounds Wilderness . . . . . 9

Little Lake Creek Wilderness . . . . . 10

Active clusters within Little Lake Creek Wilderness . . . . . 10

Inactive clusters within Little Lake Creek Wilderness . . . . . 10

Active clusters located both within and outside Little Lake Creek Wilderness . . . . . 12

Inactive clusters located within and outside Little Lake Creek Wilderness . . . . . 12

Little Lake Creek Wilderness Summary . . . . . 12

Turkey Hill Wilderness . . . . . 13

Upland Island Wilderness . . . . . 13

Active RCW Group within Upland Island Wilderness . . . . . 13

Inactive clusters within Upland Island Wilderness . . . . . 14

Inactive clusters adjacent to Upland Island Wilderness . . . . . 14

Summary of the Status of the RCW in Texas . . . . . 14

    American peregrine falcon (Falco peregrinus anatum) . . . . . 14

    bald eagle (Haliaeetus leucocephalus) . . . . . 15

    black-capped vireo (Vireo atricapillus) . . . . . 15

    Louisiana black bear (Ursus americanus luteolus) . . . . . 16

    American alligator (Alligator mississippiensis) . . . . . 17

Houston toad ( <u>Bufo houstonensis</u> ) . . . . .	17
American burying beetle ( <u>Nicrophorus americanus</u> ) . . . . .	17
Navasota ladies'-tresses: ( <u>Spiranthes parksii</u> ) . . . . .	18
white bladderpod ( <u>Lesquerella pallida</u> ) . . . . .	19
American chaffseed ( <u>Schwalbea americana</u> ) . . . . .	19
Texas trailing phlox ( <u>Phlox nivalis texensis</u> ) . . . . .	20
Effects of the Action . . . . .	20
<u>Sam Houston National Forest</u> . . . . .	21
<u>Davy Crockett National Forest</u> . . . . .	22
<u>Sabine National Forest</u> . . . . .	22
<u>Angelina National Forest</u> . . . . .	22
Summary of effects . . . . .	23
Cumulative effects . . . . .	24
Summary . . . . .	25
CONCLUSION . . . . .	26
INCIDENTAL TAKE STATEMENT . . . . .	26
AMOUNT OR EXTENT OF TAKE . . . . .	27
EFFECT OF THE TAKE . . . . .	27
REASONABLE AND PRUDENT MEASURES . . . . .	27
TERMS AND CONDITIONS . . . . .	28
CONSERVATION RECOMMENDATIONS . . . . .	29
REINITIATION - CLOSING STATEMENT . . . . .	30
LITERATURE CITED . . . . .	31



# United States Department of the Interior

FISH AND WILDLIFE SERVICE

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March 25, 1996

Mr Robert C Joslin, Regional Forester  
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Dear Mr Joslin

This biological opinion (BO) responds to the U S Forest Service's (Forest Service) letter dated February 1, 1996, requesting formal consultation with the U S Fish and Wildlife Service (Service) pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U S C 1531-1543). This document represents the Service's BO on the effects of the Forest Service's selection of **Alternative 8** in the **National Forests and Grasslands in Texas (NFGT) Revised Land and Resource Management Plan (Revised Plan), Environmental Impact Statement (EIS) and Record of Decision (ROD)**, on the red-cockaded woodpecker (RCW) in accordance with the Section 7 Interagency Cooperation Regulations 50 CFR Section 402 et seq.

Alternative 8 establishes non-essential designation of RCW groups within wilderness areas on the National Forests in Texas. **The non-essential designation of wilderness RCW groups "is likely to adversely affect" the RCW through the lack of management of clusters and no control of southern pine beetle (SPB) spots in wilderness.** This determination of "may affect" requires formal consultation under section 7 of the ESA, even considering the fact that the overall direction of the Revised Plan is intended to be beneficial to the RCW as a whole. The non-essential designation includes RCW groups within Little Lake Creek Wilderness Area in the Sam Houston National Forest, Upland Island Wilderness Area in the Angelina National Forest, Big Slough Wilderness Area in the Davy Crockett National Forest, and Turkey Hill Wilderness Area in the Angelina National Forest.

The Revised Plan establishes a framework for decisionmaking on the NFGT for the next 10-15 years, using programmatic direction as a gateway for compliance with environmental laws at the project level. It is a general planning document which establishes RCW Habitat Management Areas (HMAs), and identifies standards and guidelines under which project level activities (e.g., prescribed burning, timber harvest, pine restoration, etc.) may be planned and implemented to carry out the management direction of the EIS. This BO does not evaluate the effects of individual actions at the project level. All project level activities will undergo separate National Environmental Policy Act (NEPA) review when proposed, as well as review under section 7 of the ESA. Thus, no irreversible or irretrievable commitment of forest resources is made in the

Revised Plan & EIS, but rather at the point in time when a particular activity/program is proposed and undergoes its own NEPA and section 7 reviews and a decision notice or record of decision is signed. The Revised Plan and EIS will set out management direction that is adjustable through monitoring and evaluation, amendment, and revision.

This BO addresses the potential effects of Alternative 8 on the RCW and is based on information provided in/by the Revised Plan, EIS and the associated biological assessment (BA), telephone conversations, meetings, dialogue, and correspondence between our agencies, scientific literature, personal communication with knowledgeable scientists, researchers, land managers, and biologists, other data sources, and personal knowledge of Service biologists. A complete administrative record of this consultation is on file in our East Texas Area Office in Lufkin, Texas, Arlington Ecological Services Field Office in Arlington, Texas, and the RCW Recovery Coordinator's Office in Clemson, South Carolina.

Based on information available to the Service, including the Revised Plan, EIS, BA, and scientific literature, we concur with the Forest Service's determination that the proposed action, identified as alternative 8 in the Revised Plan and EIS, "is not likely to adversely affect" the following listed species:

Common name ( <u>Genus species</u> )	Federal status
American peregrine falcon ( <u>Falco peregrinus anatum</u> )	Threatened
bald eagle ( <u>Haliaeetus leucocephalus</u> )	Threatened
black-capped vireo ( <u>Vireo atricapillus</u> )	Endangered
Louisiana black bear ( <u>Ursus americanus luteolus</u> )	Threatened
American alligator ( <u>Alligator mississippiensis</u> )	Threatened S/A
Houston toad ( <u>Bufo houstonensis</u> )	Endangered
American burying beetle ( <u>Nicrophorus americanus</u> )	Endangered
Navasota ladies'-tresses ( <u>Spiranthes parksii</u> )	Endangered
white bladderpod ( <u>Lesquerella pallida</u> )	Endangered
American chaffseed ( <u>Schwalbea americana</u> )	Endangered
Texas trailing phlox ( <u>Phlox nivalis texensis</u> )	Threatened

The "is not likely to adversely affect" determination for the above listed species is based on analysis of the effects of the proposed action at the ecosystem level and upon implementation of the Revised Plan.

## **CONSULTATION HISTORY**

Informal consultation with the Service began subsequent to publication of the notice of intent to revise the NFGT plan in the Federal Register on October 23, 1990. Service personnel at the Clear Lake, Arlington, and Austin, Texas Ecological Services Field Offices commented on various aspects of the planning process that involved floral and faunal species of special concern and their habitats. Service personnel also participated on the NFGT Interdisciplinary Planning Team during the preliminary phases of alternative development and discussion of management actions, management area allocations, and development of management standards and guidelines.

The Department of Interior provided written comments on the Draft Revised Plan in correspondence dated December 19, 1994. An October 3, 1995, letter from Regional Forester Robert C. Joslin requested formal consultation on the Revised Plan for the selected Alternative 8. Formal consultation did not begin and informal consultation continued due to the fact that additional data relevant to the assessment of impacts to the RCW resulting from the non-essential designation of wilderness clusters was required prior to initiation of formal consultation. The additional analysis resulted in refinement of management objectives, standards, guidelines, management area allocations, and monitoring actions which were incorporated into the Revised Plan and BA. Formal consultation on the Revised Plan was initiated on February 5, 1996.

## **BIOLOGICAL OPINION**

### **DESCRIPTION OF THE PROPOSED ACTION**

The Revised Plan will implement the directions of the Forest Service's final EIS for management of the RCW on National Forests in the Southern Region (Regional RCW Strategy) on NFGT, and will guide all natural resource management activities. The Revised Plan specifically establishes forest-wide multiple-use goals, objectives, and desired future condition for the NFGT. It also provides quality control checks through monitoring and evaluation. The Revised Plan calls for the enhancement of habitat for threatened and endangered species utilizing an ecological approach towards management.

The Revised Plan incorporates all the standards and guidelines in the ROD for the Regional RCW Strategy. Alternative 8 in the Revised Plan emphasizes longleaf pine restoration and associated ecosystems, sustained timber harvests, and RCW habitat. Upland forest ecosystems {Management Area 1 (MA-1)}, upland forest ecosystems with RCW emphasis {Management Area 2 (MA-2), and Management Area 6 (MA-6)} comprise approximately 218,000, 250,000 and 32,000 acres, respectively, of the 637,000 acres of National Forests in Texas. Management Area 2 is a landscape to be managed primarily for the recovery of the RCW with large, older pine trees within longleaf pine/little bluestem, shortleaf pine/oak, and loblolly pine/oak dominated communities. Management Area 6 of Longleaf Ridge emphasizes restoration of longleaf pine habitats to be utilized by the RCW. Habitat Management Areas larger than described in the Regional RCW Strategy were delineated to allow expansion of the RCW population towards recovery objectives. The long-term population objective for the National Forests in Texas is 1,385 active clusters (541 on the Sam Houston, 330 on the Davy Crockett, and 514 active clusters on the Angelina/Sabine National Forests).

In Texas, habitat suitable for RCW occupation primarily exists in the southeastern portion of the Pineywoods Ecoregion of Texas, it generally consists of a twenty-one county area that includes all or parts of Angelina, Cherokee, Grimes, Hardin, Harris, Houston, Jasper, Jefferson, Liberty, Montgomery, Nacogdoches, Newton, Orange, Polk, Sabine, San Augustine, San Jacinto, Shelby, Trinity, Tyler, and Walker Counties, Texas. Several known populations/subpopulations occur on lands owned or administered by the Texas Parks and Wildlife Department (TPWD) at the Huntsville State Fish Hatchery, Texas Forest Service's (TFS) Fairchild and Jones State Forests, The Woodlands Corporation, Mitchell Ranch, Louisiana Pacific, Temple Inland, Champion International, Alabama-Coushatta Indian Reservation, and the National Park Service's (NPS) Big Thicket National Preserve.

The best available information on active RCW clusters on other federal, private, and state lands is presented in the following table.

<b>Other lands (federal, state, private) with known active RCW Clusters and their respective counties in east Texas</b>	<b>Approximate number of currently active clusters</b>
<b>Big Thicket National Preserve (NPS), Polk County</b>	<b>2</b>
<b>Huntsville State Fish Hatchery (TPWD), Walker County</b>	<b>2</b>
<b>Jones State Forest (TFS), Montgomery County</b>	<b>14</b>
<b>Fairchild State Forest (TFS), Cherokee County</b>	<b>6</b>
<b>Alabama-Coushatta Indian Reservation (Alabama-coushatta Tribe), Polk County</b>	<b>3</b>
<b>Temple Inland (private), Several counties in east Texas</b>	<b>17</b>
<b>Champion International (private), Several counties in east Texas</b>	<b>5</b>
<b>Louisiana Pacific (private), Hardin, Newton, Liberty, San Augustine, and Tyler Counties</b>	<b>12</b>
<b>Mitchell Ranch at Cooks Branch (private), Montgomery County</b>	<b>10</b>
<b>The Woodlands Corporation (private), Montgomery County</b>	<b>21</b>
<b>TOTAL</b>	<b>92</b>

### National Forests in Texas

The numbers of active clusters within each National Forest from 1992 to 1995 as compiled from the Annual RCW Status Meeting Proceedings are presented below. Data for 1988, 1989, 1990, and 1991 were obtained from the March 1992 Five Year Review/AMS compiled by the NFGT.

National Forest in Texas	1995	1994	1993	1992	1991	1990	1989	1988
Angelina National Forest	27	26	27	24	21	24	24	23
Davy Crockett National Forest	38	38	37	36	30	29	27	28
Sabine National Forest	20	16	15	10	10	9	10	11
Sam Houston National Forest	153	149	140	132	132	134	133	122
Total	238	229	219	202	193	196	194	184

Between 1983 and 1988, RCWs on the Angelina and Davy Crockett National Forests declined, however, populations appeared to stabilize between 1988 and 1991 and increased in both 1992 and 1993. Populations on the Sabine National Forest decreased between 1987 and 1990, but increased in both 1992 and 1993. RCW populations on the Sam Houston National Forest decreased between 1988 and 1992, but showed an increase in 1993 (Conner et al 1995). During the period between 1990 and 1993, 50 new RCW clusters were found on the four National Forests in Texas. Eleven of these 50 new active clusters were determined to have been in existence for some time. Results from Conner et al 1995 indicate that an aggressive management program which includes all the new "tools" (artificial cavities, woodpecker translocations, restrictors, etc.) can stabilize and begin to recover a wide range of RCW population and subpopulation sizes.

Use of cavity inserts commenced on the Raven Ranger District in 1992, only then was the decline halted and an increase in RCW population observed on the Sam Houston National Forest. Clearly, stabilization and increases of RCW populations that are currently being observed on the National Forests in Texas are primarily the results of hardwood vegetation control, installation of numerous cavity inserts, and augmentation of single woodpecker "groups" with appropriate mate replacements through translocations. The observed stabilization and population increases are most likely the result of aggressive implementation of midstory control, thinning, cavity restrictors, artificial cavities, and woodpecker translocations.

Long-term management and maintenance of RCWs requires clearly defined populations and associated HMAs. The Regional RCW Strategy defines a population (genetic population) as all RCWs within an area which are separated by 18 miles or less of currently suitable habitat or 5 miles or less of currently unsuitable habitat. The Regional RCW Strategy identified RCW populations on the National Forests in Texas as the Sam Houston, Davy Crockett, and Angelina/Sabine based upon this rationale.

Red-cockaded woodpecker populations and respective HMAs for the four Texas National Forests have been appropriately defined according to the Regional RCW Strategy. Within these three broadly defined NFGT RCW populations, a number of biologically and spatially distinct subpopulations are evident. A subpopulation is considered to be an aggregate of RCW clusters which are separated from other clusters by 5 miles or more of currently suitable habitat, or 3 miles or more of currently or permanently unsuitable habitat. Aggressive management of these subpopulations is imperative if the long range goal of merging these subpopulations into the defined population is to be attained. At present, the spatial separation between subpopulations

across the fragmented landscape of the National Forests in Texas is thought to preempt routine demographic interchange, effectively forming nine separate subpopulations. These subpopulations are described below.

Subpopulations by forest	Active Clusters 1995	Pine/Pine-hardwood acres in HMA (MA-2)	Revised Plan Population Objective based upon 1 cluster/200 acres	Subpopulation potential at approximately 1 cluster/200 acres
North Angelina	13	18,154	252* (514)	90
South Angelina	14	32,457		162
North Davy Crockett	34	56,170	330	280
South Davy Crockett	4	10,075		50
North Sabine	9	18,363	262* (514)	91
South Sabine	11	34,215		171
West Sam Houston	117	60,201	541	301
Central Sam Houston	13	18,233		91
East Sam Houston	23	29,978		149
Total	238	277,846	1,385	1,385

\* The Angelina National Forest subpopulations and the Sabine National Forest subpopulations are considered to be one population in the Regional RCW Strategy (Angelina/Sabine) with a population objective of 514 active clusters.

Conner and Rudolph (1991) studied and documented the impacts of demographic isolation on RCW. They concluded that habitat fragmentation between demographically isolated RCW clusters could inhibit expansion of groups and contribute to their extirpation. Additionally, they concluded that the effect of fragmentation decreases as population densities increase. The Regional RCW Strategy assigns each HMA and RCW subpopulation/population a management intensity level (MIL) based upon risk of extirpation which is determined by the size and trend of the population. Populations in the different MILs (1 = recovered/low risk, 2 = moderate risk, 3 = severe risk, 4 = extreme risk) will receive varying levels of management with smaller populations receiving the most intensive protection/management. In HMAs with more than one subpopulation of RCW, the MIL for the entire HMA must be based on the subpopulation with the highest risk of extirpation. Based upon this rationale, subpopulations on all the National Forests in Texas are considered to be at MIL 4 (extreme risk).

## **Status of RCW in Wilderness Areas**

The Texas Wilderness Act of October 30, 1984, established and the October 29, 1986, Texas Wilderness Act amendment expanded four wilderness areas in National Forests in Texas which include Little Lake Creek (3,810 acres) on the Sam Houston National Forest, Upland Island (13,390 acres) on the Angelina National Forest, Big Slough (3,639 acres) on the Davy Crockett National Forest, Turkey Hill (5,286 acres) on the Angelina National Forest, and Indian Mounds (11,091 acres) on the Sabine National Forest

Lands within Management Area 7 (Wilderness) of the Revised Plan are administered to maintain or achieve a natural state. Wilderness areas are generally maintained in a natural condition by allowing physical and biological processes to operate without human intervention. Southern pine beetle control actions in wilderness to protect RCW habitat and adjacent private land have received considerable objection from environmental groups due to perceptions of conflict with the objectives of wilderness. Alternative 8 in the Revised Plan designates wilderness RCW groups as non-essential thus allowing SPB infestations to continue uncontrolled except for potential impacts to private landowners or adjacent high value resources (e.g. essential RCW groups or limited foraging habitat within MA-2 and MA-6, RCW 1200-meter zones in MA-1, timber, recreation areas, etc.). Foraging habitat within wilderness boundaries will not be protected from SPB infestations. This has the potential to affect RCW groups/clusters within and adjacent to wilderness where available foraging habitat is currently within wilderness boundaries.

Based upon information obtained from the February 1, 1996, BA on the Revised Plan and EIS for the NFGT, Little Lake Creek Wilderness has 3 of 153 RCW groups on the Sam Houston National Forest and Upland Island Wilderness Area has 1 of 27 RCW groups on the Angelina National Forest. Big Slough Wilderness area on the Davy Crockett National Forest and Turkey Hill Wilderness Area on the Angelina National Forest contain no known active RCW groups, however, inactive clusters are known within both areas. Within this document, RCW clusters/groups are numbered by compartment and sequential number assigned when discovered (compartment-number).

### **Big Slough Wilderness**

Big Slough Wilderness area is located in the Davy Crockett National Forest, Trinity County, Texas. Fritz 1993 describes this area which "*is mostly within the one-hundred year floodplain of the usually clear, clean, and serene Neches River, which comprises eleven of the twelve miles along the eastern boundary of the wilderness*". River birch, black willow, sycamore, and elderberry line the Neches River, and land between sloughs and the river is dominated by swamp chestnut oak, bitternut hickory, and cherrybark oak. Loblolly pine dominates the upland sites in Big Slough. Red-cockaded woodpecker clusters were first documented in Big Slough in 1981. In 1983, one active cluster containing 18 acres was known in this area and two adjacent clusters were also known. Active cluster 22-3 is adjacent to Big Slough Wilderness and the cluster boundary actually extends into the wilderness.

### RCW Clusters within Big Slough Wilderness

RCW Cluster 21-1 In 1985 this cluster had one active, one inactive, and one dead cavity tree. This cluster was threatened by a SPB spot and a decision was made to cut and leave the spot and leave the cavity trees. In 1988 there was only one live active cavity tree. In 1989 the cluster was listed as inactive. In 1990 the cavity tree was again threatened by SPB, however, based upon information obtained from the Forest Service dated October 26, 1995, in 1989 the cluster had been determined to be **non-essential** and the spot was monitored. The last cavity tree died from SPB in 1993.

RCW Cluster 24-1 This cluster was recorded as a single tree and inactive from 1981-1983. Annual monitoring documents that the status of this cluster has not changed in recent years. On October 12, 1993, a second inactive cavity tree was found. This cluster is presently inactive.

### RCW Clusters adjacent to Big Slough Wilderness

RCW Cluster 22-3 In 1981, this cluster was originally called 21-1 in stand nine and had seven cavity trees, two of which were active. In 1982-83 only one cavity tree was active. In 1986 a new active cavity tree was located. In 1988-1990 the cluster had four to five RCWs present each year. In 1991, cavity tree five was struck and killed by lightning. The tree had three to four active cavities. Subsequent to the lightning strike, only one bird was documented in the cluster. A new active start within Big Slough Wilderness was located in 1991. On September 16, 1992, a single male was banded in this cluster. On November 12, 1992, a female RCW was translocated to this cluster. This attempt was unsuccessful. On October 20, 1993, a second attempt to augment this cluster also failed. In April 1994, a second bird was observed in the cluster and in May RCW young were heard in cavity tree number 14. However, later that year the cluster was back to a single male. Another attempt to augment the cluster was made on January 26, 1995. This attempt was also unsuccessful. On February 23, 1995, another attempt to augment this cluster was successful. One RCW was fledged, however, when the district wildlife biologist attempted to trap and band the juvenile bird, the cluster was back to one bird. During the summer of 1995, morning roost checks revealed this cluster went inactive.

### Indian Mounds Wilderness

When established as wilderness in 1984, the Indian Mounds area was comprised of contiguous stands of 50 to 60 year-old trees of the upland pine/pine-hardwood habitat types. They were dominated by loblolly and shortleaf pine with approximately 1500 acres dominated by upland hardwoods comprised primarily of red oak, white oak, sweetgum, and hickory. Bottomland hardwood stands containing water oak, cherrybark oak, blackgum, and magnolia occur on about 300 acres. However, subsequent to wilderness designation, massive SPB outbreaks all but decimated the pine component of this wilderness. Currently, the fuel load in the area is so great that a wildfire could destroy the remaining wilderness character. The wilderness is bisected by three major corridors: State Highway FM 3382, gravel Forest Service 115, and a 150-foot wide pipeline right-of-way.

No active RCW clusters are known within or near Indian Mounds Wilderness Area. In 1975, RCW cluster 102-1 was documented in Indian Mounds Wilderness. The cluster has been inactive since 1985 and in July 1993 it was declared dead by the NFGT district wildlife biologist. Actually this cluster should have been declared "destroyed" since it meets the definition in the court-ordered Comprehensive Plan of December 12, 1988.

### Little Lake Creek Wilderness

Little Lake Creek Wilderness is comprised of 3,810 acres within Sam Houston National Forest compartments 10, 12, and part of 13. The ridgetops are dominated by loblolly and shortleaf pine with basal area exceeding 100 square foot per acre in the areas which have escaped SPB infestations. The streamside zones contain a variety of hardwoods interspersed with large pines. Little Lake Creek has been experiencing extensive SPB infestation since 1989. Approximately 26 percent of Little Lake Creek Wilderness has been impacted by SPB. Thirty one SPB spots have been treated in this wilderness since April 1990 to protect RCW clusters and foraging habitat.

#### Active clusters within Little Lake Creek Wilderness

RCW Cluster 10-2 This cluster was first discovered in 1980. The best available information indicates it was active from 1990 through 1995. In 1992, four RCWs were banded within this cluster and during the fall of 1995, two males (age unknown) were banded. A 1995 foraging habitat analysis indicates there are 11,007 square feet of pine basal area and 9,926 pine stems 10-inches or greater in diameter within 0.5-mile of this cluster.

RCW Cluster 12-1 Active from 1990 through 1995. In 1990, two RCWs were occupying this cluster. A single after hatch year male was banded in 1992. On October 27, 1995, a female RCW (age unknown) was banded. A 1995 foraging habitat analysis revealed that **foraging habitat is limited** with only 2,056 square feet of pine basal area and 1,847 pine stems 10-inches or greater in diameter available within 0.5-mile of this cluster.

RCW Cluster 13-2 This cluster was discovered in March 1970 and is documented as active from 1990-1995. In 1992, one hatch year male (juvenile) and one after hatch year male (adult) were captured and banded. A third bird (assumed to be the breeding female) was heard but not captured. In 1995 two males (1 adult, 1 unknown) and 1 adult female were banded in this cluster. A 1995 foraging habitat analysis revealed that **foraging habitat is limited** with only 6,273 square feet of pine basal area and 5,543 pine stems 10-inches or greater in diameter available within 0.5-mile of this cluster.

#### Inactive clusters within Little Lake Creek Wilderness

RCW Cluster 10-6 This cluster contained two inactive starts when discovered in 1980 and was documented as inactive in 1990, 1991, 1992, and 1993. In August 1993 both trees were killed by SPB. On the ground this cluster actually no longer exists, therefore, no foraging analysis was conducted.

RCW Cluster 10-10 This cluster was discovered in July 1988. It was documented as active from 1990-1993 and inactive in 1994 and 1995. In 1992, a single bird was known in this cluster, however, it was not caught and banded. A 1995 foraging habitat analysis indicates 16,244 square feet of pine basal area and 15,663 pine stems 10-inches or greater in diameter available within 0.5-mile of this cluster.

RCW Cluster 10-11 This cluster was discovered in August 1991, at which time it was active. It was documented as active from 1991 to 1994. In 1995 this cluster was inactive. Three RCWs were banded in this cluster in 1992. A 1995 foraging habitat analysis revealed that **foraging habitat is limited** with only 5,787 square feet of pine basal area and 5,183 pine stems 10-inches or greater in diameter available within 0.5-mile of this cluster.

RCW Cluster 12-2 In 1988, four birds were known in this cluster and it was documented as active from 1990 through 1994. In 1995 the cluster went inactive. This cluster contained two birds in 1990 when SPB killed several cavity trees. In 1992, a single after hatch year male was banded. A 1995 foraging habitat analysis indicates 9,000 square feet of pine basal area and 5,736 pine stems 10-inches or greater in diameter available within 0.5-mile of this cluster.

RCW Cluster 13-1 This cluster contains one cavity tree which has been inactive since its discovery in 1970. A 1995 foraging habitat analysis revealed that **foraging habitat is limited** with only 4,698 square feet of pine basal area and 3,956 pine stems 10-inches or greater in diameter available within 0.5-mile of this cluster.

The following is a summary of cluster status (A = active, I = inactive, D =destroyed) in Little Lake Creek Wilderness from 1990 to present. This information is based upon data from the Raven Ranger District of the Sam Houston National Forest files with the exception of 1995, which is based upon surveys conducted in August 1995.

YEAR	Cluster 10-2	Cluster 10-6	Cluster 10-10	Cluster 10-11	Cluster 12-1	Cluster 12-2	Cluster 13-1	Cluster 13-2
1990	A	I	A	Found in 1991	A	A	I	A
1991	A	I	A	A	A	A	I	A
1992	A	I	A	A	A	A	I	A
1993	A	I	A	A	A	A	I	A
1994	A	D	I	A	A	A	I	A
1995	A	D	I	I	A	I	I	A

### Active clusters located both within and outside Little Lake Creek Wilderness

RCW Cluster 10-9 This cluster was discovered in 1988, at which time four birds were heard in the cluster. In 1988, one of the wilderness cavity trees was active, but became inactive prior to 1992. Four of the 13 cavity trees are within the wilderness and all known RCWs in this cluster have been outside of wilderness in compartment 7 since before 1992, where active management (midstory removal, installation of artificial cavities, and burning) has been practiced. The RCWs in this cluster have also expanded to adjacent compartment 11 south of the wilderness boundary, where active management is also practiced. In 1992, three RCWs (no documentation of age or sex was provided) were banded in this cluster. No indication of activities in 1993 were provided. In 1994, this cluster contained three adult birds which produced two fledglings. Both fledglings were translocated to other forests. In 1995 the cluster produced one fledgling (sex unknown). A 1995 foraging habitat analysis revealed that **foraging habitat is limited** with only 6,783 square feet of pine basal area and 5,619 pine stems 10-inches or greater in diameter available within 0.5-mile of this cluster.

RCW Cluster 11-7 No specific information on this group or cluster was provided. A 1995 foraging habitat analysis revealed that **foraging habitat is limited** with only 6,866 square feet of pine basal area and 5,958 pine stems 10-inches or greater in diameter available within 0.5-mile of this cluster.

RCW Cluster 15-3 On June 7, 1989 a total of five birds were documented in this cluster. No other information on this group or cluster was provided. However, a 1995 foraging habitat analysis indicates 20,863 square foot of pine basal area and 17,470 pine stems 10-inches or greater in diameter available within 0.5-mile of this cluster.

### Inactive clusters located within and outside Little Lake Creek Wilderness

RCW Cluster 32-2 No specific biological information on this group or cluster was provided. A 1995 foraging habitat analysis revealed that **foraging is limited** with only 4,432 square feet of pine basal area and 3,420 pine stems 10-inches or greater in diameter available within 0.5-mile of this cluster.

### Little Lake Creek Wilderness Summary

Between 1992 and 1995 the Little Lake Creek RCW population declined from six active groups (13 RCW) to three active groups (six RCW), one of which is a single male. Currently, Little Lake Creek Wilderness has 3 of 153 RCW groups on the Sam Houston National Forest. Available information indicates that eight RCW clusters occur within (10-2, 10-6, 10-10, 10-11, 12-1, 12-2, 13-1, 13-2) and four occur within and outside (10-9, 11-7, 15-3, 32-2) of Little Lake Creek Wilderness Area. Of these, three within the wilderness are currently active (10-2, 12-1, 13-2) and five are inactive (10-6, 10-10, 10-11, 12-2, 13-1). Of the clusters occurring both within and outside of wilderness, three are active (10-9, 11-7, 15-3,) and one is inactive (32-2). Foraging is limited for two of the three active clusters within Little Lake Creek Wilderness. To meet foraging requirements 8,490 square feet of pine basal area and 6,350 pine stems 10 inches

or larger diameter at breast height must be available within 0.5-mile for each cluster. The 0.5-mile radius from cluster sites represents the foraging range of RCW groups.

### **Turkey Hill Wilderness**

Turkey Hill Wilderness Area is located in San Augustine County in the Angelina National Forest. Turkey Creek and Clear Branch of Turkey Creek on the east, and Sandy Creek and Wash Branch of Sandy Creek on the west are separated by an uplift known as pine oak ridge. The lowlands harbor a mature relatively undisturbed mesic beech-mixed hardwood forest along the moderately well drained flat creek bottoms. The uplands are comprised mainly of loblolly/shortleaf pine planted in the early 1900's, with a fairly dense hardwood mid and understory. Thirty-eight percent of Turkey Hill Wilderness has been impacted by SPB through fiscal year 1994, and 47 percent of the upland pine susceptible to SPB attack has been infested. Since September 1992, three SPB spots have been treated in this wilderness area. It is estimated that 2,300 acres of mature upland pine habitat remains in Turkey Hill Wilderness.

**RCW Cluster 9-2** This cluster contains cavity trees both within and outside the wilderness boundary which has been inactive since before 1990.

**RCW Cluster 10-1** Consists of a single relict cavity tree that has been inactive since prior to 1990.

### **Upland Island Wilderness**

Upland Island Wilderness is characterized as a mesic and dry upland habitat dominated by longleaf pine with loblolly pine interspersed in various locations. The hardwood component includes sandjack oak, blackjack oak, post oak, sweetgum, and flowering dogwood. The understory is fairly open and comprised of azalea, American beautyberry, sumac, and wax myrtle. Upland Island Wilderness Area on the Angelina National Forest currently contains 1 of 27 active RCW clusters in the forest. No management activities have been performed in stands surrounding the wilderness to draw RCWs outside wilderness. Considering the fact that much of the southern part of the wilderness is longleaf pine, habitat is more suitable within the wilderness for RCW than in the surrounding loblolly dominated forest.

#### **Active cluster within Upland Island Wilderness**

**RCW Cluster 95-1** In 1987 three trees were active, in 1988 two trees were active, and in 1989 five trees were active. In 1990, four trees were active and three or four birds were present in the cluster. In 1993, two birds were noted in the cluster and young were determined to be in tree 138. In 1994, tree 138 was again the nest tree and two birds were noted in the cluster. In 1995 one active and one marginally active tree was noted in this cluster. A single male was captured and banded on October 23, 1995. A juvenile female RCW was translocated to this single male RCW during December 1995. Monitoring indicates this augmentation was unsuccessful. Midstory encroachment and the number of usable cavities are currently a concern.

The mid and understory comprised of wax myrtle and yaupon juxtaposed to the cavity trees make the cluster susceptible to destruction from wildfire

#### Inactive clusters within Upland Island Wilderness

RCW Cluster 95-2 Three cavity trees were active in 1987. In 1990, 1991, and 1992, no active cavity trees were noted. In 1993 one bird was known in this cluster. In 1994 and 1995 no active cavity trees or birds were documented. This cluster is currently inactive.

RCW Clusters 97-1, 97-2, 97-3, 98-1. These clusters have been inactive for many years. Spring inspections conducted in 1995 revealed no change in status.

#### Inactive clusters adjacent to Upland Island Wilderness

RCW Cluster 49-1 This cluster consists of a single relict cavity tree found in July 1991. Subsequent to discovery, a cluster boundary and replacement stand were laid out. Improvements including artificial inserts, prescribed burning, etc. were authorized in a Decision Memorandum dated February 26, 1992, however, to date no actions have taken place. In two recent surveys of the area no cavity trees could be located.

RCW Cluster 93-1. This cluster was inspected on October 23, 1995 and three inactive cavity trees were noted.

### **Summary of the Status of the RCW in Texas**

Currently, 238 active clusters are known on National Forest lands and 92 active clusters are known on other lands in Texas. Many of the active clusters on other lands are juxtaposed to National Forest boundaries. The best available information suggests that groups on private land are declining, and groups on the National Forests are stable in some populations and may be increasing in others. Population/subpopulation increases on NFGT are a direct result of habitat manipulation involving midstory removal, artificial cavity provisioning, and augmentation.

#### **American Peregrine Falcon (Falco peregrinus anatum)**

Two subspecies of peregrine falcon occur in Texas, Falco peregrinus anatum (American) and Falco peregrinus tundrius (Arctic). The American peregrine falcon nests in west Texas, 600 miles from the forest, but may be found statewide during migration. The Arctic peregrine falcon occurs statewide during the fall and spring migrations, with a few wintering along the gulf coast. No wintering sites have been recorded on any of the National Forests or Grasslands.

The peregrine falcon is a medium-sized raptor with long, pointed wings and a long tail. The adult is slate gray, its wing, tail feathers, and flanks are barred with black. Black moustache

marks exist on the side of the face, and its throat is white. Coloring for the lower part of the body is white and reddish buffy, extensively spotted and barred with black. The legs and feet are yellow. Immature birds are brown above, streaked below. The American peregrine is larger, darker, and has more extensive black markings on the face than the Arctic peregrine. Small to medium sized avian species serve as the falcon's prey. The prey species are usually hunted over open habitat types such as waterways, fields, and swamp or marsh wetland areas. Falcons generally reach sexual maturity at 3 years of age. The American peregrine does not nest in east Texas. Cliffs and high bluffs constitute typical nesting habitat in the Big Bend area of west Texas. However, other forms of nesting habitat have also been utilized such as river cutbanks, trees, and manmade structures including tall towers and the ledges of tall buildings.

### **Bald Eagle (Haliaeetus leucocephalus)**

The bald eagle was recently downlisted from endangered to threatened. It is a large raptor, wingspread about 7 feet, plumage mainly dark brown with pure white head and tail when adult. First year juveniles are often chocolate brown to blackish, sometimes with white mottling on the tail, belly, and underwings. The head and tail become increasingly white with age until full adult plumage is reached in the 5th or 6th year. An opportunistic predator, the bald eagle feeds primarily on fish but also takes a variety of birds, mammals, and turtles (both live and as carrion) when fish are not readily available.

The breeding season of bald eagles varies with latitude and is considered to be October 1 to May 15 in the southeast. In east Texas, nesting activities generally begin in early September, egg laying begins in late October and peaks in late December. Increased use of shelterwood harvests and seedtrees with reserves as proposed in the 250,000 acre MA-2 or HMA will provide substantial bald eagle nesting habitat.

Currently, at least 15 bald eagle nest and roost sites are known on the National Forests along Sam Rayburn Reservoir, Toledo Bend Reservoir and Lake Conroe. Winter sightings are documented annually on the NFGT through Texas Parks and Wildlife Department (TPWD) mid-winter surveys. The Revised Plan incorporates the direction in the "Southern States Bald Eagle Recovery Plan". As directed by the Recovery Plan, all known nest and roost sites are protected by a 1500-foot radius no-action zone, and a one-mile radius restricted action zone. Monitoring of eagle activity will continue, with a formal monitoring plan developed for this species upon implementation of the Revised Plan. Nest monitoring is conducted annually by TPWD's Wildlife Branch.

### **Black-capped Vireo (Vireo atricapillus)**

The black-capped vireo utilizes mid-successional brushy areas (i.e., before the area develops into a mature woodland) for nesting where the dominant woody species are oaks, sumacs, persimmon, and other broad-leaved shrubs. Juniper may be common in vireo habitat, but juniper prominence is not essential or even preferred by the birds. Typical nesting habitat is composed of a shrub layer extending from the ground to about 6 feet covering about 35-55% of the total area, combined with a tree layer that may reach to 30 feet or more. Open,

sometimes grassy spaces separate clumps of trees and shrubs. The black-capped vireo depends on broad-leaved shrubs and trees, especially oaks, which provide insects on which the vireo feeds.

This species breeds from central Oklahoma, through the Edward's Plateau and Big Bend region of Texas, and into central Mexico. In north-central Texas, black-capped vireo habitat is primarily associated with rocky limestone outcrops and escarpment areas. Preferred habitat of the black-capped vireo consists of scattered oaks (*Quercus* spp.), eastern red cedar (*Juniperus virginiana*), and Ashe juniper (*J. ashei*) juxtaposed with dense clumps of bushes growing to ground level, interspersed with open areas of bare ground, rocks, grasses, and forbs. Foliage that extends to ground level is the most important requirement for nesting. The species composition appears to be less important than the presence of adequate broad-leaved shrubs interspersed with open grassy areas, foliage to ground level, and an irregular canopy height. Black-capped vireos may be found in suitable habitat from mid-April to August in central Texas, north central Texas, and central Oklahoma. National Forests in east Texas do not contain habitat suitable for this species. The Caddo and LBJ National Grasslands in Fannin, Montague, and Wise Counties in north central Texas are within the historic range of the black-capped vireo. However, this species has not been documented on the Caddo or LBJ National Grasslands.

#### **Louisiana Black Bear (*Ursus americanus luteolus*)**

The Louisiana black bear is one of sixteen recognized subspecies of the American black bear *U. americanus*, it is distinguished from other black bears by possessing a skull that is longer, more narrow, and flat, and by possessing proportionately large molar teeth. Black bears are huge, bulky mammals with long black hair. Although weight varies considerably, large males may weigh more than 600 pounds. The Louisiana black bear is a habitat generalist and often overwinters in hollow trees either in or along sloughs, lakes, or riverbanks in bottomland habitats. These bears are mobile, opportunistic, largely herbivorous omnivores that exploit a variety of foods and closely track phenological development. The distribution and abundance of foods, particularly mast, largely affects their movements. The size of an individual's range or area it traverses annually to secure food and mates and to care for young is probably directly related to the diversity of vegetative cover, or habitats. Constituent elements of black bear habitat include hard and soft mast, escape cover, denning sites, corridor habitats, and some freedom from disturbance by man. Parturition in black bears has generally been assumed to occur in late January or early February with the actual birthing often occurring while the female is in hibernation. Litter size ranges from one to three.

The historical range of the Louisiana black bear included eastern Texas, Louisiana, and southern Mississippi. The National Forests in east Texas are on the extreme western edge of the Louisiana black bear's range. Sightings of black bear have increased over the last few years with several verified sightings of bears on and near the Angelina (Angelina and Jasper Counties) and Sabine (Newton, Sabine, and Shelby Counties) National Forests.

### **American Alligator (Alligator mississippiensis)**

American alligators have increased in numbers in recent years. Occurrence is documented for the four National Forests. The Revised Plan provides habitat enhancement for alligators (bottomlands and riparian areas identified in Management Area 4) through protection, management standards and conservation measures. TPWD considers alligator populations stable, allowing annual harvest on the species in certain counties within the planning area. Monitoring is performed by TPWD. The Revised Plan doubles the acres in stream management zones and adds three special riparian areas. These land allocations, all of which increase alligator habitat management and protection, provide the potential for increases in the NFGT alligator population.

### **Houston Toad (Bufo houstonensis)**

The Houston Toad is a small (2-3.5 inches long) toad similar in appearance to the American Toad. General coloration varies from light brown to gray or purplish gray, sometimes with green patches. Pale ventral surfaces often have small, dark spots. Males have a dark throat. It occurs in south central Texas on rolling uplands characterized mainly as pine or oak woodlands or savannah with native forbs and grasses. The Houston toad requires the presence of deep loamy sands in which it can easily burrow during hibernation (winter) and aestivation (summer). This toad also requires pools of water that persist for at least 60 days during various stages of breeding activity. Present distribution includes Austin, Bastrop, Burleson, Colorado, Freestone, Lavaca, Lee, Leon, Milam, and Robertson Counties in Texas. Critical habitat is designated in Bastrop and Burleson Counties.

Houston toads breed from January to June (but primarily in February and March), followed by aestivation until the next spring rains. Toads will emerge to breed if conditions are suitable. Some toads, especially first year toadlets and juveniles, may remain active year-round under suitable conditions. Distribution is presently one county west of the Davy Crockett and Sam Houston National Forests. Habitat exists on these forests, but attempts to locate individuals or populations on NFGT have been unsuccessful.

### **American Burying Beetle (Nicrophorus americanus)**

The American burying beetle is a large (1.5 inch, 4 cm) beetle with a shiny black appearance. Wing covers have four relatively large orange spots, and the pronotum is red. The beetle feeds on carrion. It was formerly known as the giant carrion beetle. The American burying beetle is unusual among insects in that both parents provide care to their young. Care involves guarding as well as feeding the young. Adults sometimes have more than one brood in a season. American burying beetles are active on warm (above 60 F or 15 C) nights. Individuals are known to live only about a year.

The American burying beetle historically occurred throughout temperate Eastern North America. Currently this species is only known to exist in Rhode Island, Arkansas, Oklahoma, and Nebraska. Present distribution maps show the beetle with its possible range extending as far

south as the Red River in Oklahoma, just north of the National Grasslands. Ongoing surveys have found no beetles on the Grasslands and this species has not been documented in Texas.

### **Navasota Ladies'-tresses (*Spiranthes parksii*)**

This member of the orchid family (Orchidaceae) is an erect, slender-stemmed perennial herb 8-15 inches tall. The roots are clusters of tubers. The linear leaves are arranged in a rosette, and are absent during flowering. Flowers are in a spiral arrangement on the stalk, giving the plant its generic name. Conspicuously white-tipped bracts occur underneath each 0.25-inch long flower. Flower petals are rounded or ovate, side petals have a green central stripe, and the lip (bottom petal) is distinctly ragged. It occurs primarily in moist sandy soils in small openings amongst Post Oak Savanna vegetation associated with the Navasota and Brazos River drainages. Habitat loss and degradation is attributed to development, road construction, mining, limited range, low numbers, and possible predation. This orchid buds in early to late October, flowers from mid-October to mid-November, and forms fruit from late October to the first frost (late-November). Each fruit normally contains thousands of microscopic seeds. This species is not cultivated very easily.

In 1989, a population of Navasota ladies'-tresses was documented on the Angelina National Forest in Jasper County, Texas (Orzell 1991). This one population is disjunct from the nearest known site by over 170 miles. Navasota ladies'-tresses typically occurs in the post oak belt of central Texas. The Angelina National Forest site, called the Catahoula Barrens, occurs on an unusual soil type for the NFGT. Shallow alfisols with rock outcroppings and shrink-swell subsurfaces create harsh growing conditions. Commercial pine species (site index 50-60) are usually stunted, post oak and black hickory usually dominate, and open herbaceous patches of vegetation are common. The only known NFGT sites with similar soil conditions (and vegetative physiognomy) occur nearby on the Angelina National Forest. There is a remote chance this plant could occur on the Sabine and/or Sam Houston National Forests.

The Revised Plan increases the protection of habitat for Navasota ladies'-tresses through designation of a Special Management Area. The Revised Plan objectives for this special area include management objectives which may contribute to increased populations of Navasota ladies'-tresses. If new populations are found outside the Special Management Areas, they will be provided direct protection and management developed in cooperation with the Service. The Revised Plan objective to increase the longleaf pine ecosystem will have positive effects for the Navasota ladies'-tresses. The open longleaf pine woodlands and frequent burning regimes to maintain that ecosystem will greatly improve conditions on micro-sites that could still have residual populations of Navasota ladies'-tresses.

The selected alternative in the Revised Plan designates the known ladies'-tresses location (Catahoula Barrens micro-site) as a part of the "Longleaf Ridge" Special Management Area 6 (MA-6). A long-term objective is to establish up to five separate populations of this species in Longleaf Ridge. This objective incorporates the possibility of future reintroductions or introductions to suitable habitat on present or newly acquired sites, or it may result from locating currently unknown populations through aggressive inventory and monitoring of these sites. Specific management activities within barrens will be identified and applied to ensure protection.

of this plant and associated species. Due to annual fluctuations in flowering phenology this plant is extremely difficult to monitor. No formal monitoring plan has been adopted, but the Revised Plan directs the establishment of monitoring actions and protection measures for these micro-sites. Monitoring protocol will be proposed, reviewed and directed during implementation of the Revised Plan.

### **White Bladderpod (*Lesquerella pallida*)**

The white bladderpod is a small to medium sized annual plant that ranges in height from 2 to 25 inches. Plants may be erect or spreading. Leaves are linear or oblong, with smooth, toothed, or wavy margins. White flowers are borne singly on the tops of the stems or in groups along an elongated stem. The flowers are on short stalks, and the four petals of each flower are egg-shaped.

This species occurs in grassy openings in association with rocky outcrops of the Weches Geologic formation which consists of a layer of calcareous marine sediments, underlain by a greenish layer of glauconite clay. The glauconite is impermeable to water, making soils of the Weches outcrops seepy and wet much of the year, but hard and dry during the summer. All known locations of this narrow endemic occur within the "redlands" ecological region, and all are in San Augustine County. The Weches formation occurs in limited areas of the central

Sabine National Forest. Recent surveys have located several outcrops with the potential for white bladderpod. However, no populations have been documented on National Forest lands.

### **American Chaffseed (*Schwalbea americana*)**

American chaffseed is an erect perennial herb with unbranched stems (or stems branched only at the base) with large, purplish-yellow, tubular flowers that are borne singly on short stalks in the axils of the uppermost, reduced leaves (bracts). The leaves are alternate, lance-shaped to elliptic, stalkless, 2 to 5 cm (1 to 2 inches) long, and entire. The entire plant is densely, but minutely hairy throughout, including the flowers. Flowering occurs from April to June in the South, and from June to mid-July in the North.

American chaffseed occurs in sandy (sandy peat, sandy loam), acidic, seasonally moist to dry soils. It is generally found in habitats described as open, moist pine flatwoods, fire-maintained savannas, ecotonal areas between peaty wetlands and xeric sandy soils, and other open grass-sedge systems. Chaffseed is dependent on factors such as fire, mowing, or fluctuating water tables to maintain the crucial open to partly-open conditions that it requires. The most serious threats to its continued existence are fire-suppression, conversion of the habitat for commercial and residential purposes, and incompatible agriculture and forestry practices. The loss of periodic fire from the landscape seems to be the most serious factor in its decline. Residential and commercial development adjacent to populations can also pose a threat since urbanization generally results in fire suppression.

Although this plant has been reported to occur in Texas, the county location is unknown, and no herbarium specimens for the species have been located. The plant was also reported from Louisiana but this report is thought to be erroneous.

### **Texas Trailing Phlox (Phlox nivalis texensis)**

The Texas trailing phlox is a short (generally 12 inches high), clump forming perennial herb with evergreen shoots that tend to spread along the ground surface. The persistent leaves are small and needle-like, and pink varying to purplish colored flowers are present March through April. It is presently known from only two sites, one each in Tyler and Hardin Counties in the pineywoods of east Texas. Habitat for the plant is generally open, herbaceous-dominated longleaf pine savannas, fire-maintained pinelands, and the edges of young pine plantations on deep sandy soil. This species is not known on any National Forests in Texas but populations are known on Big Thicket National Preserve and on Texas Nature Conservancy owned lands. Decline of this plant is attributed to habitat loss from land-clearing for pine plantations, pipeline construction, urban development, and suppression of fire.

#### Effects of the Action

The Revised Plan delineates RCW HMAs of 111,418 acres on the Sam Houston National Forest, 67,263 acres on the Davy Crockett National Forest, 51,164 acres on the Angelina National Forest, and 54,721 acres on the Sabine National Forest. The Revised Plan's long-term population objective for the NFGT is 1,385 active clusters (541 on the Sam Houston, 330 on the Davy Crockett, and 514 active clusters on the Angelina and Sabine National Forests). In essence, it provides 277,846 acres in MA-2 of pine/pine hardwood habitat to be managed specifically for RCW habitat management.

There are five timber sales (four ongoing and one proposed) within HMAs which do not meet the standards and guidelines of the Regional RCW Strategy. These timber sales are outside of the tentative HMA for NFGT that were identified in the Regional RCW Strategy, but they are within the HMAs established as MA-2 or MA-6 of the Revised Plan. During informal consultation with the Service, HMA boundaries were changed to include additional compartments, with an understanding that some ongoing actions such as these timber sales were underway. The additional HMA acres are reflected as pine and pine/hardwood habitat that strategically includes corridor areas, potential expansions areas, and areas with high potential for longleaf pine restoration, these additional acres greatly enhance NFGT ability to achieve RCW population objectives. The five timber sales meet most guidelines for HMA management as described in the Regional RCW Strategy, but exceed maximum opening size of 25 acres on most stands regenerated. All of the timber sales are approximately 1.5 miles or more from any active RCW cluster. These timber sales involve compartments 65, 66, and 67 in the Angelina National Forest and compartments 22, 23, and 113 of the Sam Houston National Forest.

## Sam Houston National Forest

The Sam Houston RCW population is the designated recovery population for NFGT and for the coastal plain of east Texas, due to its large population and contiguous RCW habitat. One major effect of the HMA delineation and MA-2 designation for the Sam Houston National Forest is the identification of Little Lake Creek Wilderness RCW clusters as non-essential. Little Lake Creek Wilderness is primarily upland loblolly pine, older aged and with a history of severe SPB outbreaks. In 1992, habitat improvements were initiated along the perimeter of Little Lake Creek Wilderness to provide habitat outside the wilderness for RCW groups within the wilderness that were experiencing deteriorating habitat conditions.

A foraging analysis was conducted in an attempt to quantify the effects of the habitat conditions and to better analyze the non-essential designation. The RCW foraging habitat analyzed included Little Lake Creek Wilderness and the area within 0.5-mile of the wilderness perimeter. This area includes compartments 7, 9, 10, 11, 12, 13, 14, 15, and 32 of the Sam Houston National Forest. Thirty-two RCW clusters (20 active, 12 inactive) are found within this analysis area, three clusters are completely within the wilderness while three clusters straddle the wilderness area boundary. The Little Lake Creek Wilderness area provides foraging for at least 19 groups outside of the wilderness. In the analysis it became evident that 12 RCW groups (compartments 7,9,11,12) on the southwest side of Little Lake Creek have insufficient foraging habitat. Therefore, due to establishing Little Lake Creek as non-essential, this area likely will be unable to support the existing 12 groups.

The NFGT decision not to manage the habitat within Little Lake Creek Wilderness could isolate or fragment a large contiguous area of upland pine, with a dense concentration of RCW groups, from the rest of the Sam Houston HMA. The value of this 3,810-acre wilderness habitat is significant for the demographic configuration of the RCWs on the western Sam Houston National Forest. Between 1992 and 1995 the Little Lake Creek RCW population declined from six active groups (13 RCW) to three active groups (6 RCW), one of which is a single male.

The proposed timber sale in compartment 22 involves 511 acres of thinning for RCW 1200-meter zones, thinning outside 1200 meters for SPB risk reduction, and 174 acres of seedtree harvests. The 1200-meter zone is a 0.75-mile radius habitat management zone around all active and inactive RCW clusters. Management within 1200-meter zones ensures both cluster protection and habitat management to benefit the RCW. These actions will not reduce foraging habitat requirements for RCW within 1.5 miles of active clusters in MA-2. Thinnings will reduce SPB risk and regeneration will promote the dominance of shortleaf pine, resulting in long term improvement of RCW habitat. According to the BA, overall effects for RCW are anticipated to be beneficial.

The ongoing timber sale in compartment 23 includes 174 acres of seedtree harvests on four sites. These sales will not affect foraging habitat requirements for RCW in the HMA and will promote the dominance of shortleaf pine on some sites. According to the BA, the overall effect of this sale for shortleaf pine restoration and RCW is anticipated to be beneficial.

The ongoing timber sale in compartment 113 includes 380 acres of thinning for SPB risk reduction, 185 acres of plantation thinning, and four seedtree harvests totalling 70 acres. These actions will not reduce foraging habitat requirements for RCW within 1.5 miles of active clusters in MA-2. Thinnings will reduce SPB risk and regeneration will promote future habitat availability for RCW. According to the BA, effects for RCW are anticipated to be beneficial.

### **Davy Crockett National Forest**

The Davy Crockett RCW population is primarily found on the northern half of the forest. A small sub-population (four active clusters) exists in the southeastern portion of the forest on the Alabama Creek Wildlife Management Area. The spatial separation of the Alabama Creek sub-population from the remainder of the Davy Crockett RCW population is a concern. Historic clusters and quality habitat in compartments 60, 61, 62, 70, 71, 72, 73, 74, 108, 110 are spatially located between the two Davy Crockett sub-populations. Therefore, upon implementation of the Revised Plan, additional RCW activity outside MA-2 is anticipated in suitable habitat and inactive clusters managed under the court-ordered comprehensive plan but not included in the HMA. RCWs which activate these presently inactive clusters will be afforded 1200-meter zone protection and management.

Presently, no active RCW clusters occur in Big Slough Wilderness on the Davy Crockett. One active cluster was abandoned prior to the 1987 NFGT Plan. It is possible RCW activity could re-occur in Big Slough Wilderness due to its close proximity to other active RCW Clusters. Any future wilderness clusters in Big Slough would be considered non-essential.

### **Sabine National Forest**

The Sabine National Forest RCW population declined rapidly during the 1980's. It is currently stabilized or slightly increasing with 20 active clusters, of which nine occur in the northern subpopulation. No active clusters occur in the Indian Mounds Wilderness, and due to a SPB epidemic in recent years, little habitat remains that could be utilized by RCWs. The southern Sabine RCW subpopulation currently has 11 active clusters. These clusters and the proposed HMA were analyzed for any relationship and potential linkages with RCW clusters on nearby private lands. The southeastern portion of the Sabine National Forest (Stark Tract) is not part of the Revised Plan HMA, though it contains significant longleaf pine habitat and five inactive RCW Clusters.

### **Angelina National Forest**

The Angelina National Forest has the greatest potential for longleaf pine restoration. Longleaf pine has a longer rotation age than other southern yellowpine species and young longleaf pine are fire tolerant. The implementation of an aggressive prescribed fire program in longleaf dominated forests would benefit habitat development suitable for the RCW. The HMA proposed in the Revised Plan is contained both in MA-2 and MA-6 (Longleaf Ridge), and contains large contiguous areas of upland pine that is less than 70 years old and is not occupied by RCW. The

population objective for this HMA is 250 active clusters. The Angelina National Forest will develop significant, high quality longleaf pine habitat for both RCW and many other sensitive plant and animal species associated with this habitat. The development of an Upland Island Wilderness prescribed fire program will substantially improve conditions for RCW.

The Revised Plan identifies the Upland Island Wilderness clusters as non-essential for RCW recovery. Habitat in the wilderness may be improved or maintained indirectly through prescribed fire for fuel reduction and ecosystem management, which will no doubt have secondary benefits for the RCW. Upland Island Wilderness has 1 of 27 active clusters on the Angelina Forest, if fire within the wilderness improves the upland pine system in Upland Island, it is expected that continued use of the wilderness by RCW will continue. The Upland Island cluster will not affect the development of larger HMAs on the other areas of the Angelina National Forest, except to supplement the potential population through natural and artificial dispersal of individual RCW.

The ongoing timber sale in compartments 66 and 67 includes 231 acres of slash pine clearcut for restoration to longleaf pine (all residual longleaf pine was left standing on site). The five restoration sites range from 31 to 65 acres. An additional 209 acres are in four seedtree harvests, ranging in size from 28 to 68 acres. The decision for this sale was signed prior to completion of the Regional RCW Strategy, and before development of the Revised Plan (Alternative 8). However, according to the BA, it is anticipated that overall effects for longleaf pine habitat and RCW would be beneficial.

The ongoing timber sale in compartment 65 in the Revised Plan HMA will be managed as Longleaf Ridge (MA-6) and in concert with the Regional RCW Strategy. Compartment 65 includes four seedtree harvests (216 acres) ranging in size from 39 to 73 acres. These four seedtree cuts are in loblolly pine dominated sites and restoration to longleaf or shortleaf pine was not considered appropriate. An additional 95 acres of thinning will also occur within this sale in compartment 65. The decision for this sale was signed prior to completion of the Regional RCW Strategy, and before development of the Revised Plan (Alternative 8). No adverse effects to RCW are anticipated.

### **Summary of effects**

In summary, the Revised Plan provides RCW habitat for both the recovery population (three subpopulations) on the Sam Houston and the other two support populations on the Davy Crockett (two subpopulations) and Angelina (two subpopulations)/Sabine (two subpopulations) Forests. These subpopulations will be managed through prescribed burning, thinning, regeneration, augmentation, and installation of artificial cavities. The Revised Plan also provides for group expansion outside HMA, through 1200-meter zone protection and management. The Revised Plan's standards and guidelines for clusters directs that monitoring will be according to the Regional RCW Strategy.

The Sam Houston National Forest recovery population has the most active RCW clusters and highest densities, this forest is on the extreme southwestern edge of the RCW's range, and a number of compartments have densities of approximately one active cluster per 190 acres. The

Sam Houston National Forest is in ecological land types that consist of loblolly, shortleaf and pine/hardwood habitat with a broken/fragmented land ownership/use pattern. These facts lead the Service to believe the population objective for the forest may be optimistic, regardless of existing high densities (some exceed one active cluster per 200 acres). With intensive monitoring, continued habitat improvement, augmentation, and artificial cavity installation, the existing population will remain stable or most likely increase. Adjustments to population objectives or HMA boundaries can be accomplished through Plan amendments in 5 years or less.

The non-essential designation of wilderness RCW groups was made due to the limited ability of the Forest Service to maintain or improve the habitat within wilderness areas. The NFGT anticipates that the three active clusters remaining in Little Lake Creek and one active cluster in Upland Island may be lost due to subsequent habitat deterioration resulting from the non-essential designation. In addition, this lack of active management may adversely affect up to six active clusters in the HMA, adjacent to but outside Little Lake Creek, due to reduced foraging habitat. The Forest Service anticipates take of up to 16 birds within and outside wilderness areas over the next 10 years under the proposed plan direction.

The Revised Plan proposes limited actions in wilderness areas, such actions may be needed if RCW habitat in wilderness deteriorates within the next 3-5 years to the degree that the viability of wilderness RCW groups is jeopardized prior to the establishment of replacement breeding groups in "at risk" subpopulations on the forests. These actions would be strictly limited, allowing the clusters to persist, while not altering the natural processes that ensure the wilderness character. They would include limited enhancement of active cavity trees and augmentation of single bird groups.

### **Cumulative effects**

Cumulative effects include the effects of future, State, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed actions are not considered in this section because they would require separate consultation pursuant to section 7 of ESA. The NFGT Revised Plan incorporates an ecological approach to management. The Revised Plan describes ecological units that have been defined from a number of social, physical and biological components, these are defined from both the existing and historical conditions. The Revised Plan directs restoration of habitats and communities that are globally threatened, primarily the longleaf pine-little bluestem plant community or series, and associated inclusional communities (bogs, baygalls and barrens). It also identifies and manages for some ecosystems which are unique and recognized as declining within east and north Texas.

In February 1995, the Resource Protection Division of TPWD and the Texas Forest Service, in coordination with the Service, proposed a conservation strategy under authority of Section 10(a)(1)(B) of the ESA based upon the "safe harbor" concept that encourages voluntary enhancement and restoration of RCW habitat on private and certain other lands. In June 1995, steering and scientific advisory committees were formed to develop a safe harbor habitat conservation plan (HCP) for east Texas. Representatives from the Service's East Texas

Suboffice (Lufkin, Texas) and RCW Field Office (Clemson, South Carolina) , TPWD, TFS, Forest Service, Texas Forestry Association, International Paper, Louisiana Pacific, Temple Inland, Champion International, The Woodlands Corporation, Big Thicket National Preserve, the Houston Audubon Society, and non-industrial private landowners are participating in the development of this plan. The purpose of this HCP is to encourage and facilitate the restoration and enhancement of nesting and foraging habitat for the RCW on privately owned and certain other land in the Pineywoods Region of Eastern Texas.

The HCP would encourage participating east Texas landowners to implement or permit actions that would benefit the RCW on their property such as midstory removal and control through prescribed burning and/or mechanical manipulations, installing new RCW nesting and roosting cavities, or improving abandoned cavities through the placement of restrictors, pine tree planting and thinning, and other activities. Essentially all land other than Federal land and State Lands are potentially eligible for inclusion in the HCP. Priority will be placed on securing cooperative agreements with landowners where the land has the potential to benefit the RCW, particularly land with abandoned or inactive clusters adjacent to Forest Service lands.

In theory, the HCP would provide significant interim benefits for the RCW in the form of population and demographic maintenance during its duration. Such benefits would include temporarily halting or reversing the fragmentation of RCW habitat, creating or strengthening dispersal corridors between subpopulations, contributing some offspring that may either reoccupy previously abandoned clusters or that may be used for relocation to land protected by longer-term conservation arrangements, and providing a form of "insurance" against the possibility of a disastrous event that could significantly reduce the number of RCWs on public land in east Texas. In short, it would provide a hiatus in the long-term decline of the Pineywoods RCW population and thereby will have "bought time" for other conservation strategies to be tested or implemented such as proposed on National Forest Lands.

The acreage needed to support a single RCW group varies by physiographic province. In general, habitat quality in the gulf coastal plain of Texas varies between the loblolly /shortleaf pine, pine/hardwood dominated Sam Houston National Forest on the southwestern fringe of the RCWs range and the loblolly/shortleaf/longleaf pine of the Sabine National Forest on the east. Soil properties, hydrology, and topographic features associated with a particular landscape can influence whether the resulting vegetation will be optimal, suitable, or marginal RCW habitat. The Regional RCW Strategy set a recovery population goal of 542 clusters for the Sam Houston National Forest recovery population on the Texas Gulf Coastal Plain. Based upon the loblolly/shortleaf pine, pine/hardwood dominated landscape juxtaposed with the broken land ownership and use patterns, it is conceivable that the HMA proposed for the land base on the Sam Houston National Forest is not large enough to achieve the population goal.

## **Summary**

In conclusion, the Revised Plan for the NFGT attempts to provide for recovery of the RCW through the implementation of a conservation strategy based, in part, on some principles of ecosystem management. The Revised Plan promotes practices that minimize landscape and habitat fragmentation within HMAs, retains suitable numbers of potential cavity trees well.

distributed throughout the landscape, and restores much of the original forest cover to the degree possible by reestablishing the appropriate pine species, primarily longleaf. The strategy requires the use of prescribed burning, emphasizing growing season fires, to control hardwoods, create open forest conditions, and begin to restore the diverse understory plant communities associated with today's healthy RCW populations. Stabilization and growth of small, high-risk populations will be aided by creating artificial cavities and translocating juvenile birds from larger, stable populations into small ones. However, the Revised Plan designates wilderness RCW groups as non-essential thus allowing progression of habitat degradation in the form of midstory encroachment and uncontrolled SPB outbreaks that would destroy clusters and foraging habitat. This is anticipated to result in the loss of RCWs within wilderness and would reduce available foraging for groups outside wilderness. Basically, the midstory would encroach upon cavity trees and SPB infestations would be allowed to continue uncontrolled except for potential impacts to private landowners or adjacent high value resources.

In conclusion, accomplishment of RCW recovery and support population objectives will be dependent upon successfully implementing and monitoring the proposed NFGT direction. Additionally, the proposed east Texas HCP would also benefit the RCW by minimizing or eliminating landowners fear of the ESA, and encouraging habitat maintenance on private land, thus facilitating the recovery of the RCW in Texas.

## **CONCLUSION**

After reviewing the current status of the RCW, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the RCW, no critical habitat has been designated for this species, therefore, none will be affected.

All project level activities will undergo separate National Environmental Policy Act (NEPA) review when proposed, as well as a review under section 7 of the ESA. NFGT biological evaluations with determinations of effect on the RCW or any other federally listed species of "not likely to adversely affect" will continue to require Service review and concurrence. All projects proposed within the RCW HMAs should have biological evaluations completed, and include management requirements to avoid impacts to habitat where possible, minimize unavoidable impacts to the extent possible, and mitigate unavoidable impacts with actions to facilitate recovery of the RCW. The Service requests all biological evaluations for projects within the RCW HMAs be submitted for review prior to implementation.

## **INCIDENTAL TAKE STATEMENT**

Sections 4(d) and 9 of the ESA, as amended, prohibit taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as

actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency, i.e., the Forest Service. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

## **AMOUNT OR EXTENT OF TAKE**

Incidental take of individual RCWs resulting from the proposed action is difficult to accurately predict, thus this statement will focus on loss of habitat. Without habitat management, habitat degradation in the form of midstory encroachment and SPB infestation would eventually render habitat in wilderness areas unusable for the RCW. It is anticipated that the single active cluster in Upland Island Wilderness ultimately would be lost (become inactive) without midstory removal and maintenance (prescribed fire). In the loblolly and shortleaf pine dominated Little Lake Creek Wilderness, uncontrolled SPB outbreaks and/or midstory encroachment are expected to degrade nesting and foraging habitat resulting in the loss of three active clusters and reduction of available foraging for groups outside wilderness. The Little Lake Creek Wilderness area provides foraging habitat for at least 19 RCW groups outside of wilderness, and the loss of foraging habitat is expected to result in fewer groups adjacent to the wilderness. Currently, foraging habitat associated with 12 clusters on the southwest side of Little Lake Creek is limited, and we anticipate that up to six clusters will become inactive in coming years. In summary, we estimate take of three active clusters in Little Lake Creek, six active clusters outside Little Lake Creek, and one active cluster in Upland Island Wilderness due to lack of management of clusters and no control of SPB spots in wilderness areas.

## **EFFECT OF THE TAKE**

In the accompanying BO, the Service determined that the level of take anticipated is not likely to result in jeopardy to the species. If the HMAs are managed according to the Standards and Guidelines in the ROD implementing the Regional RCW Strategy, as indicated in the Revised Plan for NFGT, the loss of the wilderness groups and the impact on adjacent groups could be considered minor due to the fact that the management direction for the HMAs would lead the population toward recovery.

## **REASONABLE AND PRUDENT MEASURES**

The measures described below are **non-discretionary**, and must be implemented by the Forest Service so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. The Forest Service has a continuing duty to regulate the activity covered by this incidental take statement.

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of RCWs

(1) The Forest Supervisor will consult with recognized RCW authorities and (a) devise an annual translocation, reintroduction and augmentation program that emphasizes actions within subpopulations and groups determined to be most "at risk", (b) determine what intensity of inventory, monitoring and evaluation are needed for each subpopulation/population, (c) prioritize banding and habitat improvement programs, (d) implement all of the above programs, and (e) coordinate monitoring, banding, and translocation activities with ongoing research on the forests conducted by the Southern Research Station;

(2) Attempt to ensure continued viability of wilderness groups until 12 successful reintroductions (pair bonding at a site and remaining through the breeding season) are accomplished in the next 3-5 years outside wilderness areas and within the subpopulations determined to be at highest risk,

(3) Conduct annual monitoring in the form of cluster status checks, group checks and nesting success for all clusters in compartments 7, 9, 11, 12, 14, 15, 31, and 32 surrounding Little Lake Creek Wilderness of the Sam Houston National Forest,

(4) Make annual attempts to band all nestlings and fledglings in compartments 7, 9, 11, 12, 14, 15, 31, and 32 surrounding Little Lake Creek Wilderness in the Sam Houston National Forest for nesting success estimates and translocation purposes Unless determined to be practicable, wilderness nestlings and/or fledglings will not be banded or translocated,

## TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of ESA, the Forest Service must comply with the following terms and conditions, which implement the reasonable and prudent measures described above These terms and conditions are non-discretionary

The following actions are necessary to assess the amount of take, ensure RCW subpopulation viability, and to prioritize management actions

(1) Actions taken to help ensure viability of wilderness groups until successful reintroductions are accomplished outside wilderness areas, **may include but are not limited to** monitoring, selective hand removal of hardwood and midstory encroachment, augmentation, and/or prescribed fire

(2) Prior to the onset of the 1996 translocation season, inventory all inactive clusters and replacement stands in "at risk" subpopulations and identify midstory maintenance needs, usable cavity status, etc ,

(3) Conduct midstory maintenance and cavity installation within inactive clusters and replacement stands targeted by the Forest Supervisor for translocation by September 1996,

(4) In concert with coordination efforts in reasonable and prudent measure 1 (a-e), review the results of (2) and (3) above and formalize by October 1996 an annual strategy for RCW translocation and reintroduction. A long term strategy should draw upon the successes and failures of the annual strategy and be revised as needed. This strategy should be presented to the Service for review, comment, and concurrence prior to implementation,

(5) Translocate available juvenile RCWs during the October 1996 - February 1997 season, as per the Forest Supervisor's strategy. Thereafter, follow the strategy for translocation developed in compliance with reasonable and prudent measure 1 (a - e).

### CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. **Conservation recommendations are discretionary agency activities** to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or develop information. Although discretionary, the Service recommends that the Forest Service implement the following conservation recommendations:

(1) In accordance with the Regional RCW Strategy ROD, the NFGT Supervisors Office must develop a RCW monitoring strategy (Section 5, pages 33-36). It is to include a standardized spring cluster status monitoring program, roost checks in active clusters, nesting success, and database development and management. In addition to the requirements in the Regional RCW Strategy ROD, the following time frames and intensity of activities are recommended by the Service,

(a) Spring cluster status checks be conducted between March 15 and May 7 on the Angelina, Davy Crockett, and Sabine National Forests, and between February 14 and May 7 on the Sam Houston National Forest,

(b) Group checks involve roost checks. These should be **morning** roost checks on the Angelina, Davy Crockett, and Sabine National Forests. Due to the large number of active clusters, roost checks on the Sam Houston National Forest could be conducted in the **morning and/or evening**;

(2) Revise the June 1992 RCW augmentation guidelines incorporating the requirements of the Regional RCW Strategy ROD,

(3) Develop and implement a Fire Management Plan for the wilderness areas,

(4) Conduct surveys in all upland pine/pine hardwood habitat contiguous to the HMA (MA-2/6) during project level planning or site specific analysis to document the expansion of the RCW population in NFGT Upland pine/pine hardwood habitat contiguous to the HMA should be the basis upon which the HMA is delineated and not compartment boundaries Evaluate RCW dispersals and investigate the potential habitat value for RCW on all contiguous pine/pine-hardwood habitat adjacent to HMAs or MA-2/6 Priority for HMA inclusion should be identified recovery populations (Sam Houston), at risk and small HMA populations (Alabama Creek), and habitat linkages between subpopulations and other active clusters on private lands,

(5) Continue annual reviews of the NFGT RCW program (Annual RCW Meeting) through open/peer/scientific disclosure of activities, accomplishments, and strategies for management of habitat, translocation, banding, etc ,

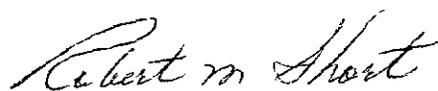
(6) Establish a clear record of actions and decisions for all RCW inactive clusters outside of HMAs, include destroyed (dead) and abandoned clusters Statement of deletion from record should provide all historic and relevant actions with a location map The 1200-meter zone management should continue until documentation is completed and presented to the Service, and,

(7) Prior to the 1996 spring breeding season, a computerized RCW database should be developed for all districts and monitored by the Forest Supervisors Office in Lufkin, Texas The database should track group status, cavity use, habitat improvements, treatment accomplishments and needs, cluster conditions, and population trends and survey status The database should be updated regularly but no less frequently than once a year and be used to set habitat treatment priorities, report accomplishments, identify population trends and reproductive success, and describe response to treatments

This concludes formal consultation on the action(s) outlined in the Forest Service request As provided in 50 CFR Section 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action

Should you have any questions, please contact me at (817) 885-7830 or Fish and Wildlife Biologist Jeffrey A Reid of my staff at (409) 639-8546

Sincerely,

  
Robert M Short  
Field Supervisor

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# Appendix J

## Silvicultural Systems and Associated Regeneration Methods

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### Introduction

Silviculture has been defined as the art of producing and tending a forest; as the application of knowledge of silvics in the treatment of a forest; and as the theory and practice of controlling forest establishment, composition, structure, and growth (Spurr and Barnes 1980). Silvicultural practice consists of the various treatments that may be applied to forest stands to maintain and enhance their utility for any purpose. The duties of the forester are to analyze the natural and social factors bearing on each stand and then devise and apply the treatments that will produce the desired results. A **silvicultural system** is the planned program of silvicultural treatment over the whole life of a stand (Smith 1986). **Regeneration methods** are the treatments applied to the stand and site during the period of regeneration or stand establishment.

This appendix describes three silvicultural systems for managing forest stands—the even-aged, two-aged, and uneven-aged systems—and their associated regeneration methods.

### Even-aged System

Even-aged management consists of regeneration methods that produce stands of trees in which the main canopy level is dominated by trees of essentially the same age or at least in the same 10-year age class. A stand is considered even-aged if the difference between the ages of the oldest and youngest trees in the main canopy level does not exceed 20 percent of the rotation length. Even-aged stands may have a few randomly-distributed older individual trees, clumps of older trees, or small gaps filled with younger trees if these inclusions do not significantly affect the even-aged structure.

An even-aged stand of one species usually has a canopy top of quite uniform height. Stand boundaries are usually distinct. An even-aged stand usually has the same general appearance when viewed from different points. A forest of even-aged stands with a more-or-less balanced distribution of age classes is said to be **all-aged**. Its component stands are of various heights.

A rotation is the number of years between successive regeneration cuts. The rotation includes a period for harvesting the mature stand and for establishing the new stand (usually 5-years in the National Forests in

Texas) During the course of a rotation there may be one or more thinnings prior to the final regeneration harvest to maintain health and vigor in the stand

Forest managers determine rotation lengths by considering management objectives, the growth habits of the species being managed, and the productive capacity of the land.

The principle regeneration methods used in even-aged management are clearcutting, clearcutting with reserves, seed-tree, seed-tree with reserves, and shelterwood.

**Clearcutting** involves removal of all main-canopy trees in one cutting operation. Regeneration can originate naturally or artificially, and sometimes is assisted by site preparation treatments that allow the new trees to become established and survive. Typically, regeneration is obtained by planting seedlings.

Clearcutting creates a temporary opening in the forest. These openings are normally 10 to 80 acres in size. There is usually more site disturbance and more removal of vegetation than with other methods. More sunlight reaches the forest floor than with any of the other regeneration methods. Clearcutting has been used successfully to regenerate loblolly, longleaf, and shortleaf pine on many sites. New stands produced by clearcutting are even-aged.

**Clearcutting with reserves** is a variation in which a few reserve trees are left in the clearcut area. The reserve trees are left for reasons other than to provide seed. Wildlife den trees, nesting trees, and survey monument trees are examples of reserve trees.

The use of clearcutting has been limited by direction in the Chief's 1330-1 letter dated June 4, 1992 and by the National Forest Management Act (NFMA) at 16 United States Code 1604 (g)(3)(F)(1). In keeping with this direction, the amount of clearcutting does not vary significantly among the alternatives in this Environmental Impact Statement (EIS). Clearcutting will be used only where it is the best means of producing a specific desired result.

The **seed-tree** method of regeneration involves removal of most main-canopy trees in one cutting, a small number of seed trees are left singly or in small groups (typically 6 to 12 square feet of basal area per acre). The method is feasible only where well distributed dominant and codominant trees of seed-bearing size are present and where soils do not cause the trees to be shallow-rooted and susceptible to windthrow. The establishment of essentially even-aged regeneration under the seed trees is encouraged, and regeneration is sometimes assisted by the application of site preparation treatments. The seed trees are usually removed after the seedlings are securely established, usually within 2

to 5 years. The quality and spacing of seed trees strongly affect the success of regeneration. The number of seed trees to be left depends on tree height, quantity and frequency of seed production, seed dispersal characteristics, prevailing wind direction, and seedbed characteristics.

The seed-tree method has been successfully used to regenerate loblolly and shortleaf pine in even-aged stands.

The *seed-tree with reserves* regeneration method retains some or all of the seed trees after regeneration has become established. The reserve seed trees may be left indefinitely or removed during a later harvest.

The *shelterwood* method of regeneration involves removal of the main-canopy trees in a series of cuttings (usually two or three) over a relatively short portion of the rotation. The method is practical only where well-distributed dominant and codominant trees of seed-bearing size (usually 20 to 30 square feet of basal area per acre) are present on soils that do not cause the trees to be shallow-rooted, are susceptible to windthrow. The establishment of essentially even-aged regeneration under the seed trees is encouraged and is sometimes assisted by site preparation treatments. Leaving more canopy trees provides more shelter and helps suppress competing vegetation. The sheltering effect gives the method its name and distinguishes it ecologically from the seed-tree method. Once adequate reproduction is well established and the need for shelter is past, a portion or all of the shelterwood is usually removed so that the reproduction can develop as rapidly as possible. The shelterwood can be removed all at once or in a series of harvests.

The shelterwood method has been used successfully to regenerate loblolly, shortleaf, and longleaf pine.

### **Two-aged System**

Two-aged silviculture (also called *shelterwood with reserves*) is a system that produces a stand of trees that contains two age classes for long periods or for most of the rotation. The difference in age between the ages of the oldest and youngest trees is greater than 20 percent of the rotation. Each canopy class is basically even-aged, and the trees in the older class are usually the parents of those in the younger class. Because some trees in younger age class grow in the shade cast by trees in the older age class, the trees in the younger age class can vary considerably in height. The tallest trees are in the most open areas.

Two-aged stands of one species usually have an irregular canopy for a long period. Stand boundaries may or may not be distinct depending on growth and development of the younger age class and the number of parent trees present in each stand.

The shelterwood with reserves method of regeneration is largely untested for loblolly and shortleaf pine. Studies suggest that longleaf pine stands containing two or more age classes will fall far short of fully utilizing the productive capacity of sites (Boyer 1993). In east Texas, Louisiana-Pacific Corporation has used a variation of the two-aged method to regenerate loblolly pine stands with some success.

### **Uneven-aged System**

Uneven-aged management is defined by 36 Code of Federal Regulations (CFR) 219.3 as "the application of a combination of actions needed to simultaneously maintain continuous high-forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes to provide a sustained yield of forest products. Cutting is usually regulated by specifying the number or proportion of trees of particular sizes to retain within each area, thereby maintaining a planned distribution of size classes. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection."

A forest stand is considered to be uneven-aged when three or more distinct tree age or diameter classes are maintained.

Both the single-tree selection and group selection cutting methods involve cutting mature and immature trees singly or in groups. This provides space and light that enables new regeneration to become established and grow. These methods are also used to regulate stand composition and to maintain a desired diameter or age distribution. A perfectly balanced uneven-aged stand would have trees of each age or size class from seedlings to trees of rotation age or maximum tree size, with each age or size class occupying an equal area. Structure in the merchantable component of the stand (usually six-inch and larger diameter classes) is best maintained by the BDQ (basal area, maximum diameter, constant ratio of trees in successive diameter classes) method (Farrar 1984; Farrar and Murphy 1989).

In community types found in Texas, regeneration cutting and stand thinning usually occur in each area every 5 to 10 years. The frequency of the entry is a function of management intensity, species silvics, and each area's productive capacity.

Prescribed burning has limited use in southern pine stands managed under the uneven-aged system.

**Single tree selection** involves the removal of individual trees from all merchantable diameter classes [usually 6-inch diameter breast height (DBH) and larger] at relatively short intervals (3 to 15 years). Regeneration is established in the spaces left by the harvested trees. The

goal is to maintain a specified number of trees per acre in each diameter class. The single-tree selection method is best adapted to tolerant, late-successional species, but has been used successfully to regenerate loblolly and shortleaf pine in uneven-aged stands in which hardwood competition was controlled on a regular basis (Baker 1987). This method is not appropriate for regeneration of longleaf pine because longleaf pine is very intolerant to competition (RCW EIS).

Because most loblolly and shortleaf stands in the National Forests in Texas are even-aged, the initial entry into the stand is heavy thinning to a residual basal area of approximately 45 to 60 square feet per acre. All subsequent entries into the stand are for the purpose of obtaining regeneration. The stand is allowed to grow to approximately 75 square feet of basal area per acre before the next entry occurs. Reproduction is considered inadequate if fewer than 100 seedlings per acre are growing at least 6 inches in height per year.

Loblolly and shortleaf pine are intolerant species (that is, pine seedlings and saplings will not survive or grow well in shade) To ensure that adequate sunlight reaches developing pine reproduction, it is necessary to control competing vegetation by hand, mechanical, or chemical means. Entries into a stand occur about once every 5 to 10 years.

**Group selection** involves removal of trees (usually the oldest or largest ones) in scattered patches at relatively short intervals (about every 10 years) to encourage the continuous establishment of regeneration and maintenance of a balanced uneven-aged stand (Smith 1986; Farrar 1984). A balanced uneven-aged stand managed by group selection is made up of small, essentially even-aged groups of trees Each size class, from seedlings to large trees, occupies approximately the same number of acres in each stand Group size ranges from about 0.25 to about 2 acres.

Group selection should regenerate uneven-aged stands of loblolly, shortleaf, and longleaf pine successfully on some sites (Baker 1987) Use of group selection to regenerate longleaf pine on medium-quality sites has been tested for about 15 years. Farrar and Boyer (1991) state that "A selection system may not work well for longleaf pine on very poor, dry, sandy sites, wet flatwood sites with dense palmetto understories, or very good mesic sites, because prescribed burning for competition control and/or seedbed preparation may be difficult to achieve "

One begins group selection in an even-aged longleaf stand, by thinning the stand heavily enough so that longleaf seedlings can become established in parts of the stand In about 10 years, openings of from 0.5 to 2 acres can be made where adequate numbers of seedlings are present During the next cutting cycle, additional openings are created where adequate regeneration exists (existing openings can be enlarged or new ones be made)

## Management Requirements

To begin group selection in an even-aged loblolly or shortleaf stand, one creates openings from 0.5 to 2 acres in size in parts of the stand. Regeneration is obtained from seed from the surrounding trees. The young pine trees may need to be released from hardwood and shrub competition within 5 years. Height growth of most of the surviving pine seedlings and saplings is 20 to 50 percent less than that of trees grown in large openings.

A silvicultural system is not chosen at random. It is applied as an answer to a specific set of circumstances. Management objectives are primary factors in selecting a silvicultural system.

Many factors affect the reproduction and growth of individual species and individual trees. These factors are related to species silvics, the relationship the tree has with nearby trees and other plants, and the condition of the physical environment in which the trees grow. Some of these factors can be manipulated to provide the best conditions for the individual species or group of species being managed.

Several other factors are important mainly at the time of regeneration. They strongly influence the selection of a silvicultural system and regeneration method. These factors include soil temperature, evaporative stress, amount of exposed soil, and soil moisture availability.

The biological characteristics of all of the trees in the forest determine the range of management treatments that can be prescribed successfully. One of the more important characteristics is tolerance to shade. Species that are more tolerant to shade are better adapted to regenerate under a forest canopy and will eventually dominate the site. Conditions conducive to regeneration of light-demanding species are created by natural disturbances or practices that manipulate the amount of light. Regeneration cutting methods should be selected to provide for the light requirements of the species desired.

## Tolerance to Shade

"Shade tolerance" describes the light conditions required by tree species. Shade-tolerant species can reproduce and grow to normal size under the shade of competing trees or other plants. Species that require full sunlight for successful growth and reproduction are termed "intolerant." Some species can withstand varying degrees of shade and are considered "intermediate." Relative shade tolerance ratings for the major tree species present in the National Forests in Texas are as follows. (Agriculture Handbook 654)

<b>SPECIES</b>	<b>TOLERANCE</b>
<b>Coniferous</b>	
Longleaf pine	Very intolerant
Loblolly pine Shortleaf pine	Intolerant
Cypress	Intermediate
<b>Hardwood</b>	
Sweetgum Black cherry Cherrybark oak Nuttall oak Post oak Water oak Willow oak Sycamore Tupelo Walnut	Intolerant
Blackgum Black oak Overcup oak Swamp chestnut oak Southern red oak	Moderately intolerant

SPECIES	TOLERANCE
<b>Hardwood Continued</b>	
White oak	Intermediate
American elm	Moderately tolerant
Hickory	
Hophornbeam	
Magnolia	
Red maple	
Cedar elm	Tolerant
Winged elm	
American Hophornbeam	
Green ash	
Eastern redbud	
Blackjack oak	
Bluejack oak	
Sugarberry	
American beech	Very tolerant
Flowering dogwood	
American holly	

Single-tree selection cutting allows only a minimal amount of direct sunlight to reach the forest floor. This regeneration method is best suited for management of shade-tolerant trees. When single-tree selection cutting is applied to stands of intolerant species, the intolerants are eventually replaced by more tolerant species (Roach 1972).

Group selection cutting is best suited for management of intermediate and intolerant species. Creation of small openings in the forest produces the light and other conditions these species require. Numbers of intolerant trees that regenerate in groups will, however, decrease in proportion to numbers of more shade-tolerant species as a result of shading by border trees.

Many species, including some that are intolerant to shade, germinate and become established better in partial shade than in full sunlight but survive and grow best in direct light once established. Shelterwood cutting provides both sets of conditions—partial shade after the seed cut and full sunlight after the final overstory removal. Shelterwood cutting can also be used when large numbers of seed trees are needed to regenerate species that do not produce large numbers of seed. It can also be useful where seed are heavy and do not disperse well. Longleaf pine produces small quantities of seed and has inconsistent crops, and oaks have heavy seed (Crocker and Boyer 1975).

Clearcutting is most suitable for regeneration of intolerant species that become established and grow best in full sunlight. Most intermediate and some tolerant species will regenerate in full sunlight that becomes available after clearcutting (Barrett 1980).

Seed-tree cutting is used where natural regeneration of light-seeded species is the objective. The seed-tree method can be appropriate for regeneration of intolerant species if the seed trees are removed after the seedlings become established.

## Species Requirements

### **Loblolly and Shortleaf Pines**

Loblolly and shortleaf pines occur naturally in fairly pure stands and in mixtures over large areas of the National Forests in Texas. The two species have somewhat different site requirements: loblolly prefers soils that are moist, and shortleaf prefers soils that are better-drained to droughty. However, the two species requirements for regeneration and growth are very similar.

Both species are intolerant to shade and are more easily established and grow best in full sunlight. Both even-aged and uneven-aged management systems have been used successfully in natural regeneration and growth of loblolly and shortleaf pines (Brender 1973; Farrar and others 1984; Reynolds 1969, Wahlenberg 1960; Wenger and Trousdell 1958). Clearcut, seed-tree, shelterwood, or selection harvest methods may be used to obtain natural reproduction if competition from understory hardwoods is controlled and the cutting coincides with a good seed crop (Barber and Burns 1977).

Short cutting cycles and vigorous hardwood control are keys to managing uneven-aged pine stands. Cutting cycles range from 3 to 15 years depending on stand basal area growth and residual basal area after each cutting. Uneven-aged management system relies on natural regeneration. Logging disturbance is relied on to prepare seed beds (the ground surface) for seedling establishment. After seedlings are established, they compete for nutrients, moisture, and sunlight. Undesirable competing vegetation must be controlled. If the more shade-tolerant hardwoods that compete with pines are not controlled, they eventually predominate (Barber and Burns 1977).

In the even-aged system, natural regeneration is most easily achieved through seed-tree cutting. When seed trees remain after a harvest, foresters monitor the flower production and cone crop to determine when an adequate seed crop can be expected. Treatments that expose soils for seed reception can be timed to coincide with seed fall.

Clearcutting is usually followed by planting or direct seeding (the spreading of seed by hand or mechanical means) to start a new forest. When seeds fall from mature trees and are stored in the forest floor

until they can sprout, clearcutting can result in natural establishment of regeneration.

### **Longleaf Pine**

Longleaf occurs naturally in fairly pure stands and in mixture with loblolly or shortleaf or both. On drier sites it is associated with post oak, blackjack oak, and southern red oak. It is managed much like loblolly and shortleaf pine. However, longleaf pine is very intolerant to shade. The seedlings are also highly susceptible to root competition (Crocker and Boyer 1975). Per acre seed production peaks at stand densities between 30 and 40 square feet of basal area per acre (Boyer 1979).

Longleaf pine seeds require contact with mineral soil to germinate. The seeds have large wings and cannot penetrate ground cover easily. Seedbed preparation must remove vegetation and litter. Longleaf pine is a poor seed producer in comparison with other southern pines. Seed crops adequate to stock a stand occur about every 4 to 7 years. Approximately 70 percent of the sound seeds fall within 66 feet of the parent tree. The best cone producers are dominant, open-grown trees with large crowns and area at least 15 inches in diameter at breast height.

Only the shelterwood cutting method is suitable for natural regeneration of longleaf pine (Crocker and Boyer 1975). Planting and direct seeding are successful. Throughout its range, longleaf pine in shelterwood stands produces seed crops adequate for natural regeneration. On average, longleaf in shelterwood stands produces about 1,000 seeds per acre once every 4 to 5 years (Crocker and Boyer, 1975).

### **Upland Hardwoods**

The upland hardwoods occur mainly as components of the red oak-white oak-hickory and post oak-black oak cover types. These two groups grow in limited areas, mostly on lower slopes, at branch heads, and along minor streams. The upland hardwoods in these areas include southern red oak, black oak, blackjack oak, white oak, post oak, and various hickories.

These hardwoods are largely intolerant or intermediate in tolerance to shade. Both even-aged and uneven-aged management have been successful in these forest types.

Regeneration of these hardwood forests after a harvesting depends on the presence of advanced regeneration (young trees that came up before the mature trees were cut). Seedlings that sprout from acorns and nuts cannot immediately compete with other plants after a harvest. A seedling's root system grows for years, and a seedling's top dies back

and resprouts a number of times, before the new tree is fully established (Tryon and Powell 1984) If adequate numbers of young trees are present or if enough sprouting stumps are produced, a harvest cut gives rise to a new hardwood forest. The mature forest may be harvested by clearcutting or by an uneven-aged method.

If not enough young trees are present to insure that a new hardwood forest will develop, shelterwood cutting may be appropriate. However, further research is needed before firm recommendations can be made in this situation. New seedling establishment will depend on the occurrence and size of acorn crops. In order to be effective, shelterwood cutting must both reduce the number of tall trees and control the mid-story trees. Once enough young trees are established, the large trees must be removed so that the younger forest can grow satisfactorily.

### **Bottomland Hardwoods**

Almost all of the bottomland hardwoods acreage in Texas is in the sweetgum-Nuttall oak-willow oak or swamp chestnut oak-cherrybark oakforest type. The species that make up the managed component of these stands are cherrybark oak, Nuttall oak, water oak, willow oak, overcup oak, swamp chestnut oak, green ash, blackgum, sweetgum, and American elm. These species are found in most stands, and a wide variety of other species being present.

Most of these species are intolerant to intermediate in shade tolerance. Forests are regenerated by sprouting of stumps and sprouting of young trees when the mature forest is harvested, as with upland hardwoods.

Natural oak regeneration in bottomlands has been inconsistent. Most regeneration failures have been attributed to lack of advance oak reproduction. Generally, advance oak reproduction of sufficient size and in sufficient numbers must be secured before the final harvest cut to successfully regenerate oaks on bottomland sites. The key is to create favorable light conditions on the forest floor prior to final harvest. Bottomland oak reproduction does not survive and grow satisfactorily unless shade-tolerant midstory and understory competitors are controlled. A pretreatment reproduction evaluation is necessary when bottomland oaks are to be regenerated. When sufficient advance oak reproduction and sprout potential are present, a complete harvest or clearcut of all stems usually regenerates the stand to oak.

In theory, shelterwood methods should nurture oak reproduction if oak seed sources are present. In practice however, a heavy shelterwood cutting that creates gaps in the overstory usually favors reproduction of faster-growing intolerant species over oak reproduction, and lighter shelterwood cutting actually encourages the growth of undesirable tolerant species already established in the midstory and understory. Most attempts to regenerate bottomland oaks by shelterwood methods have

failed. Single-tree selection favors the growth and establishment of shade-tolerant species and thus is not recommended for regeneration of bottomland oaks. Group selection can be used to regenerate bottomland oaks if the openings are large enough to admit sufficient light to the forest floor to encourage the establishment and development of oak reproduction.

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