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

MAMMALS (continued)

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

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

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 Phobe	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	Polioptila caerulea
Golden-crowned Kinglet	Regulus satrapa
Ruby-crowned Kinglet	Regulus calendula
Cedar Waxwing	Bombycilla cedrorum
Loggerhead Shrike	Lanius ludovicianus

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

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.

Research Natural Areas - Exhibit 3

Trout Creek RNA Candidate Information

Candidate Name: Trout Creek

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, Lone Star Chapter of the Sierra Club

Acres: 6,400 (approx.)

Hectares: 2,560 (approx.)

Land Class: 500, 800, 801, 820

Major Cover Types: Longleaf Pine (SAF 70), Loblolly Pine, Slash Pine

Unique Feature: Large tract of longleaf pine; intact restoreable longleaf ecosystem. Hillside seepage bogs; hardwood stringers along stream courses.

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 tract of intensively managed National Forest lands on the Angelina Ranger District in an area known locally as Longleaf Ridge. Historical records show that this area was dominated by longleaf pine in the past. Now many stands contain a mixture of pine species and some stands were planted to slash, which is not native. The District is working to restore longleaf on all appropriate sites. The area has 12 RCW clusters; 3 of which are active. The area is criss-crossed by recreational trails. ATV use is extensive and horseback trails are popular. The entire area is well-roaded. A private inholding that was acquired was to have been developed for housing. Road rights-of-ways were cleared prior to acquisition by the Forest Service. See TNHP report for details.

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: Special use permittees, ATV Riders Association, Horseback Riders Club, grazing permittee, and Lone Star Chapter of Sierra Club.

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.

Research Natural Areas - Exhibit 5

McGee Bend RNA Candidate Information

Candidate Name: McGee Bend

Date of Report: 6/8/92

Forest: Angelina National Forest

District: Angelina

Forest Coordinator: Ron Haugen

Assigned Scientist: Margaret Devall

Candidate Proposed by: Texas Committee on Natural Resources

Acres: 400

Hectares: 160

Land Class: 500, 820

Major Cover Types: Bottomland hardwood, Loblolly pine hardwood (SAF 82)

Unique Feature: Old-growth bottomland hardwoods, with areas of pine and hardwood mixtures; 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 candidate area consists of a band of bottomland hardwoods and pine-hardwood forest cover along what was formerly the Angelina River channel. The construction of the dam for Sam Rayburn Reservoir diverted the river to the west of McGee Bend. There are pine plantations outside the candidate area. Some of these plantations are of slash pine, which is not native to East Texas.

List of Review Team Membership:

Margaret Devall
Ron Haugen
Sue Grace
Jerry Larson
Alfredo Sanchez
Tom Zimmerman
Dave Drummond
Steve Clarke
Ned Fritz
Larry Shelton
Jim Garrison
Merlinda Schory

Meeting Dates:
4/16/92

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: The candidate area shows no signs of management within the last 50 years. Because access is relatively poor, recreational use is limited. Hunting pressure is moderate. The pine stands adjacent to the candidate area were

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.

List of Review Team Membership:
Margaret Devall
Ron Haugen
Karl Stoneking
Ron Bertsch
Ben Harbour
John Beck
Joel Shepard
Ike McWhorter

Meeting Dates:
7/29/92

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

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; Heyword 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 (Croker 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 successionally 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 (Bruseth 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 tuples (*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*), buttonbush (*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 (*Forestirea 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. nuttallii) waterlocust (*Gleditsia aquatica*), baldcypress (Taxudium distichum), roughleaf dogwood (*Cornus drummondii*), swamp-privet (Forestieraacuminata), 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 (Buchemia 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. ruba*), white ash (*Fraxinus americana*), Carolina ash (*Fraxinus caroliniana*), pignut hickory (*Carya glabra*), bitternut hickory (*C. cordiformis*), shagbark hickory (*Carolina ovata*), basswood (*Tilia caroliniana*), yellow popla *(Liririodendron tulipifera*), red mulberry (*Morus rubra*), and others. The forest usually contains loblolly pine *(Pinus tacda)* and may support shortleaf pine *(P. echinata)*.

Midstory: Includes regenerating overstory species and may support a variety of small trees and shrubs including American hornbean *(Carpinus caroliniana)*, eastern hophornbean *(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. grandifolins)*, 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 saandens)* wild grape *(Vitis* spp.), common trumpetcreeper *(Campsis radicans)*, poison-oak *(Toxicodendron radicans)*, croosvine *(Bignonia capreolata)*, American star jasmine *(Trachelospermum difforme)*, 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 variants 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*), dwarft 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. aguatica)*, 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 *(Styraz americames)*, 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 borbonia*), 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 – lanrel greenbrier

Herbaceous Wetland

Sphagnum - Beakrush Series (Hillside Bog)

(Spagnum - Rhynchospora)

These communities consist of predominantly graminoid cover, butwetland 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. Subsurface water percolation and frequent fires from surrounding uplands are important factors maintaining these habitats.

VEGETATION:

DOMINANTS: Beakrushes esp. *R. oligantha, R. gra- cilenta, R. tii, 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 h (*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 (*Eeryngo 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 ophioglossoides

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 of development of a seep depends will be 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 to 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 linifolia – coreopsis

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. michau- xii*), 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. corynmbosum), 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 (*Amelanchier 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 (*Pre- nanthes 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 (*Aristilochia* spp.), sweet-william phlox (*Phlox divaricata*), cranefly orchid (*Tipularia discolor*), Carolina lily (*Lilium michanxii*), giant cane (*Arundinaria gigantea*), and twoflower melic (*Melica mutica*).

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
Dentoria laciniatea
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 carolinina*), eastern hophornbeam (*Ostrya virginiana*), flowering dogwood (*Cornus florida*), bigleaf snowbell (*Styrax grandifolius*), witch-hazel (*Hamamelis virginiana*), brook euonymus (*Euonomys americanus*), southern arrow-wood (*Viburnum dentatum*), arrowwood *(V. acerifolium)*, rusty blackhaw *(V. rufidulum)*, blueberries

(*Vaccinium* spp., including *V.amoenum*, and *V. corymbosum)*, sweetleaf (*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 (*Galium 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 mutica*).

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
Maianthemum 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 becasue 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 marshallii*), 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 gronovii*), 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 longeaf 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. *falcax*), hairy sunflower (*Helianthus hirsutus*), goldenrod (*Solidgo* 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 grayioides
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

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

Species/Habitat/Area	(Status)	Objective
RCW Sam Houston Population	(153)	525 active clusters
Davy Crockett Population	(39)	330 active clusters
Angelina/Sabine Population	(49)	510 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:

Common Name	Scientific Name	Federal Status
Species that may occur on NFGT		
Louisiana black bear	Ursus americanus luteolus	T
peregrine falcon	Falco peregrinus anatum	E
black-capped vireo	Vireo atricapillus	E
Houston toad	Bufo houstonensis	E
American burying beetle	Nicrophorus americanus	E
white bladderpod	Lesquerella pallida	E
American chaffseed	Schwalbea americana	E
Texas trailing phlox	Phlox nivalis texensis	T
Species with confirmed occurence on NFGT		
red-cockaded woodpecker	Picoides borealis	E
bald eagle	Haliaeetus leucocephalus	T
American alligator	Alligator mississippiensis	T-similarity appearance
Navasota ladies'-tresses	Spiranthes parksii	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	111,418 ac
Total Pine/Pine Hardwood Acres in MA-2	108,412 ac
Regional RCW Strategy Pine/Pine Hardwood Acres	105,194 ac
Net Difference Pine/Pine Hardwood acres (Tentative RCW HMA EIS and MA-2)	3,218 ac
Current RCW Population (active clusters)	153
Expected RCW Density (acres/cluster)	200
RCW HMA RCW Population Objective (new)	525

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:

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

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

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

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 deterioriates 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 regenrated. 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 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

Conner, R. N., D.C. Rudolph and L. Bonner. 1995. Red-Cockaded Woodpecker Population Trends and Management on Texas National Forests. J.Field Ornithol. 66(1) 140-151.

Orzell, S.L. 1991. Texas Natural Heritage Program Inventory of National Forests & Grasslands in Texas. Texas Parks and Wildlife Department. Texas Natural Heritage Program. 526 pp.

USDA Forest Service. National Forests and Grasslands in Texas. 1992. Five Year Review and Analysis of the Management Situation. USDA Forest Service, Lufkin, Tx. 817 pp.

USDA Forest Service Southern Region. 1995. Final Environmental Impact Statement and Record of Decision for Management of the Red-cockaded Woodpecker on Southern National Forests. 758 pp.

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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
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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.*"

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[1]
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

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	1991
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[illegible]	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[1], 55[2]	3,639
Indian Mounds	10,695	227[1], 120[3]	11,037
Little Lake Creek	3,671	139[1]	3,810
Turkey Hill	5,251	35[1]	5,286
Upland Island	12,423	227[1], 740[4]	13,390
Total	35,176	1,986	37,162

1 Added through boundary adjustment in FY87 (Public Law 99-584).
2 Land purchase completed in FY87.
3 Land exchange completed in FY87.
4 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[1]

	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

1 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

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.

REFERENCES

Cordell, H. K., J. C. Bergstrom, L. A Hartmann, and D. B. K. English. 1990. *An Analysis of the Outdoor Recreation and Wilderness Situation in the United States: 1989-2040: A Technical Document supporting the 1989 RPA Assessment*. USDA Forest Service. Gen. Tech. Report RM-189.

National Forests and Grasslands in Texas. 1987. *Final Land and Resource Management Plan - National Forests and Grasslands in Texas*. NFGT. 319 pp.

_____. 1990. *Monitoring and evaluation of the land and resource management plan FY 1987 through July, 1990*. NFGT. 41 pp.

Roggenbuck, J. W., A. E. Watson. 1989. Wilderness recreation use: the current situation. In Watson, A. E. comp. *Outdoor Recreation Benchmark 1988: Proceedings of the National Outdoor Recreation Forum*; 1988 January 13-14; Tampa, FL. Gen. Tech. Rep. SE-52. Asheville, NC: USDA Forest Service, Southeastern Forest Experiment Station. pg. 346-356.

USDA Forest Service. 1987. *Final Environmental Impact Statement for the Suppression of the Southern Pine Beetle*. USDA Forest Service. Management Bulletin R8-MB-2.

_____. 1990. *The Forest Service Program for Forest and Rangeland Resources: A Long-Term Strategic Plan*. USDA Forest Service: Washington D.C.

Walsh, R.G.; Loomis, J.B. 1989. The nontraditional public valuations (options bequest, existence) of wilderness. In: Freilich, H.R., comp. 1989. *Wilderness Benchmark 1988: Proceedings of the National Wilderness Colloquium; 1988*. January 13-14;Tampa FL. Gen. Tech. Rep. SE-51. Asheville, NC: USDA Forest Service. Southeastern Forest Experiment Station. pg. 181-192.

Watson, A. E. , J.J. Daigle, M. J. Niccolucci. 1990. *Upland Island Wilderness Recreation Visitor Survey*. Intermountain Research Station; Missoula, MT.

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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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November 15, 1995

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.

	CURRENT		EXCLUDING LLCW	
Cluster	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	

Cluster	CURRENT Pine BA	CURRENT #10" Pines	EXCLUDING LLCW Pine BA	EXCLUDING LLCW #10" Pines
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