Wildlife Report

Boswell Creek Watershed
Healthy Forest Initiative Project

National Forests and Grasslands in Texas

Sam Houston National Forest

Walker and San Jacinto Counties, Texas

2003

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Appendix A

Table 1. Habitat conditions in RCW clusters/recruitment stands and allocated foraging habitat with *no action.*
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Appendix B Management Indictors Selection.

I. Effects Analysis Considerations

This report includes the *direct*, *indirect*, and *cumulative effects* on each species considered. The *direct* and *indirect effects* analysis is generally limited to areas within the project boundary. The *cumulative effect* analysis area, unless otherwise noted, is national forest land in or near the project area and/or adjacent private land. The effects described in this report incorporate the analyses from other specialist reports included in the Project File.

II. Threatened and Endangered Species

Endangered

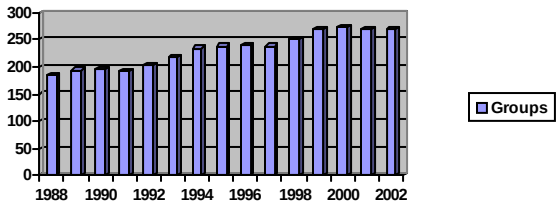
Red-cockaded Woodpecker
(*Picoides borealis*)

Background

The federally endangered red-cockaded woodpecker (RCW) has become imperiled due to the loss of suitable nesting and foraging habitat. Ideal habitat for this species consists of open, fire-maintained mature pine stands with forb or grass dominated ground cover and a midstory relatively devoid of hardwoods (Jackson 1994, Conner et al. 2001). Available habitat for the RCW has been drastically reduced in the project area as a result of a Southern Pine Beetle (SPB) epidemic that occurred in the mid 1980's. The SPB epidemic resulted in the loss of 7 (3 active, 4 inactive) of the 12 RCW clusters that existed in the 4-Notch area (the central core of the Boswell Creek Watershed Project).

The RCW population on the Sam Houston National Forest is composed of three sub-populations, which include; the western (donor), central, and eastern. The project area is located within the central sub-population. RCW population trends are currently stable on National Forests in Texas (Fig.1; NFGT M&E Report 2000-2001). The Sam Houston NF has approximately 152 of the 350 group objective (USFWS 2003). The project area contains 19 inactive clusters and recruitment stands. An additional 12 clusters or recruitment stands possess foraging habitat within, but occur outside, the project area. There has not been an active cluster within the project area since 1996. The last active cluster, in close proximity to the project area, was recorded in the spring of 2000. Systematic ground surveys for this species were conducted in the project area during the spring of 2003. There were no RCW's or active clusters found. The nearest active clusters are located approximately 2 miles from the project area in Compartments 67 and 80.

Fig. 1 Forest Wide RCW Population Trends 1988-2002 (NFGT M&E Report 2000-2001).



The project area encompasses approximately 8,650 acres of the Sam Houston National Forest. Approximately 8,360 acres occur within Management Area 2 (MA-2), Red-Cockaded Woodpecker Emphasis.

Emphasis in MA2 is placed on management actions that would produce future conditions consisting of "*open mature pine forest mixed with some hardwoods species*" (USDA Forest Service 1996). This includes a frequent fire regime that would create an "*open, grass-like understory*." Of the 8,360 acres in MA2, 7,420 acres occur in pine dominated stands. In this habitat type, 2,567 acres are adequate foraging and nesting RCW habitat as determined by age class (i.e. ≥60 yrs. of age). However, these pine stands do not meet the criteria of good quality foraging habitat (USFWS 2003). Good quality foraging habitat is defined in the RCW recovery plan as habitat that has some large old pines, low densities of small and medium pines, sparse or no hardwood midstory, and a groundcover of bunchgrass and forbs (USFWS 2003). Based on the RCW recovery plan, foraging habitat is currently limited for 20 of 31 clusters or recruitment stands that occur in, or that have foraging habitat within, the project area (See Appendix A). In addition, a foraging analysis based on *Plan*[1] standard (MA2-80-4.1), indicates that 22 of 31 of these stands have limited foraging habitat (See Appendix A-1).

Effects of Alternatives

No Action

Direct and Indirect Effects

This alternative would have no *direct effects* on the RCW because this species does not occur in the project area. However, negative *indirect* effects would occur to RCW habitat. This would primarily occur as a result of the degradation or loss of existing nesting or foraging habitat and/or the failure to expand or generate habitat.

This alternative would increase the susceptibility of RCW habitat to stand-replacing wildfire or SPB infestation. In the event of this occurrence, habitat in the project area would be rendered unsuitable for nesting for 60 years or more. Therefore, this alternative may inhibit the possible development of potential nesting habitat.

Under this alternative, habitat suitability in the project area would degrade, or remain unsuitable for occupation by this species (See Table 1 in Appendix A). Dense stands with closed canopies would restrict sunlight to the forest floor, thus inhibiting the establishment of a grassy understory. Similarly, in lower density stands, the exclusion of prescribed fire would permit the development of a woody understory and midstory. This would reduce the desired open conditions and also suppress herbaceous vegetation in the understory. The resulting conditions would render existing clusters or habitat unsuitable for occupation, and ultimately impede potential habitat from developing the appropriate stand structure necessary for RCW habitation.

Cumulative Effects

Pine stands would attain an appropriate diameter, height, and development of heart decay suitable for cavity excavation without management action. However, the time necessary for pine stands to develop these habitat characteristics necessary for RCW use would increase. In addition, with the exclusion of thinning and prescribed fire, suitable stand structure required for occupation by this species is unlikely to develop.

[1] Revised Land and Resource Management Plan for the National Forests and Grasslands in Texas (1996).

The project area is the main link between existing occupied habitat, located SE of the project area, and isolated habitat located NW of the project area. Therefore, habitat suitability in the project area is essential to RCW expansion throughout all available habitat of the central sub-population. The *No Action* alternative would eliminate or delay progress toward future expansion of the central RCW sub-population and ultimately the SHNF population. This would likely impede attainment of population objectives necessary for the recovery of the species (USFWS 2003).

Expansion of the central RCW population in or near the project is likely dependent solely on the maintenance or creation of suitable habitat on federal lands. Adjacent private lands consist primarily of open pasture, and pine forests that occur NW and East of the project area. However, pine on these lands is currently being managed for short rotations (i.e. approximately 30 years), with management practices unlikely to change. Therefore, adjacent private lands are unlikely to produce habitat that would contribute or aid in expansion of the central RCW sub-population in the near future.

Proposed Action

Direct and Indirect Effects

Thinning and prescribed fire would have no *direct effects* on RCW due to the absence of active clusters or known individuals within the project area, and the distance (i.e. approximately 2 miles) from the nearest active cluster.

The *Proposed Action* would reduce fuel loads, thereby lessening the susceptibility of RCW habitat to potentially catastrophic wildfire and SPB infestation. In addition, thinning and prescribed fire would improve stand structure, facilitating the establishment or improvement of RCW habitat.

Thinning of the proposed stands would reduce basal areas and open the forest floor to sunlight. Opening the canopy allows for the establishment of a primarily grass and forb dominated ground cover, the preferred condition for cluster sites (Conner et al. 2001). Decreased canopy competition would result in the acceleration of pine growth, thereby reducing the time for trees to become available for foraging and nesting. Accelerated pine growth would result in increased diameters, larger crowns, increased resin production, and accelerated heartwood decay, enhancing the potential suitability of trees for foraging and cavity excavation.

Prescribed fire would impede the development of a woody understory and midstory, while promoting the establishment or expansion of herbaceous vegetation (See Table 2 in Appendix A).

Negative effects to RCW nesting habitat are possible due to the potential ignition of resin covered cavity trees during burning. However, the threat of cavity trees being harmed is minimized by preventative measures employed during prescribed burning operations (USDA Forest Service 1996, MA-2-80-3.3.3).

Cumulative Effects

The *Proposed Action* would move pine stands toward meeting the desired future condition of Management Area 2 (MA2) and developing the structural elements of good quality foraging habitat as outlined in the RCW recovery plan (USFWS 2003).

Improved habitat conditions within the project area would likely facilitate the future expansion of the central RCW sub-population. Providing suitable habitat creates a link between existing RCW groups and potential habitat NW of the project area, connecting otherwise inaccessible habitat. Given the relative spatial distribution of the national forest land in or near the project area, isolation of any groups in adjacent compartments would be minimized.

Expansion of the sub-population would benefit the SHNF population by reducing threats of extirpation from demographic stochasticity, environmental stochasticity, and inbreeding depression (USFWS 2003). Unfortunately, due to management practices, forests on adjacent private lands are unlikely to provide an additional link to existing habitat, and consequently would not contribute to the expansion of the RCW population (See No Action, *cumulative effects* discussion).

Endangered

Houston Toad (*Bufo houstonensis*)

Background

Houston toad habitat consists of a wide, deep horizon of sandy or loamy sandy soils in which it can easily burrow for hibernation or aestivation, and temporary non-flowing pools of water available for breeding (USFWS 1992). This species has been found in heavily wooded, loblolly pine or mixed deciduous habitats which are interspersed with open grassy areas (Wilson 1995). The Houston toad has primarily experienced declines due to the conversion of wetlands to agricultural and urban development. This species is currently distributed across eight counties in Texas, with the largest population occurring in Bastrop county.

This species has not been documented in or near the Sam Houston National Forest. The distribution of Houston toad populations, and habitat identified as having the potential for the occurrence of this species, are located well outside the project area (USFWS 1992). Based on the lack of suitable habitat and the unlikelihood of this species occurring within the project area, the *No Action* and *Proposed Action* alternatives would have no *direct*, *indirect*, or *cumulative effects* on this species.

Endangered

American Burying Beetle (*Nicrophorus americanus*)

Background

The American burying beetle occurs in a variety of habitats, including sandy grasslands and oak-pine woodlands. This species feeds on carrion, which it buries for reproduction purposes. Although this species historic range includes eastern Texas, no populations are known. The project area has suitable habitat for this species; however, the nearest American burying beetle populations are in Arkansas, Oklahoma, and Nebraska (USFWS 1993). It is unlikely this species occurs within the project area; therefore, the *No Action* and *Proposed Action* alternatives would have no *direct*, *indirect*, or *cumulative effects* on this species.

Endangered

American Chaffseed
(*Schwalbea americana*)

Background

The American chaffseed occurs in sandy, acidic, seasonally moist to dry soils, in sunny or partly sunny areas. This species is dependent on factors such as fire or fluctuating water tables to maintain the crucial open to partly-open conditions that it requires (USFWS 1995). Although parasitic on the roots of a large number of trees, such as sweet-gum, bald cypress, hackberry, and various oaks and pines, American chaffseed is not tolerant of deep shade and is usually found along the margins of forest or woodlands where sufficient light is available.

The American chaffseed has been reported to occur in eastern Texas. However, there are no voucher specimens of this species in any of the major Texas herbaria. Converse Griffith, the Forest Botanist trainee, determined through surveys and an examination of existing habitat, that there is no evidence of this species occurring within the project area (See Project File - Botanical Survey of the Four Notch). Based on these findings, the *No Action* and *Proposed Action* alternatives would have no *direct*, *indirect*, or *cumulative effects* on this species.

Threatened

Bald Eagle
(*Haliaeetus leucocephalus*)

Background

The bald eagle is generally found in coastal areas and around large bodies of water such as reservoirs, lakes, and rivers (USFWS 1995a). In eastern Texas, eagles usually nest in mature pines with an unobstructed line of sight and flight path. Nests are typically located within two miles of open water. Bald eagles primarily forage on fish, but their diet also includes waterfowl, rodents, reptiles, and carrion.

Large bodies of water needed for foraging, and thus nesting, are not located within or adjacent to the project area. The nearest foraging habitat and nest occurs in Huntsville State Park, located approximately 6 ½ miles from the project area. Therefore, the *No Action* and *Proposed Action* alternatives would have no *direct*, *indirect*, or *cumulative effects* on this species.

Threatened

Piping Plover (*Charadrius melodus*)

Background

The piping plover utilizes sandy beaches or lakeshores for nesting. In Texas, this species winters along the gulf coast, but has been observed along shoreline mudflats of inland lakes during migration. Suitable habitat for this species does not exist in or adjacent to the project area. Therefore, the *No Action* and *Proposed Action* alternatives

would have no *direct*, *indirect*, or *cumulative effects* on this species.

Threatened

Louisiana Black Bear
(*Ursus americanus luteolis*)

Background

The historic range of the Louisiana black bear once encompassed all of Louisiana, southern Mississippi, and eastern Texas. Its current range is now limited to two sub-populations in Louisiana's Atchafalaya and Tensas River basins (USFWS 1995b). No populations are known to exist in eastern Texas, but sightings of bears have been reported in some of the more eastern counties (TPWD 1997). However, it is unknown if these are the Louisiana black bear subspecies or bears that have dispersed from Arkansas or Oklahoma. Habitat preferences of this subspecies include bottomland hardwood and floodplain forests, with occasional use of mixed hardwood/pine forest, wetlands, and agricultural fields.

The project area and portions of adjacent private lands have suitable habitat for this species. However, the nearest Louisiana black bear population occurs in central Louisiana, approximately 200 miles from the project area. The Louisiana black bear has not been documented in or near the SHNF. It is unlikely this species occurs within the project area. Therefore, the *No Action* and *Proposed Action* alternatives would have no *direct*, *indirect*, or *cumulative effects* on this species.

Threatened

American Alligator
(*Alligator mississippiensis*)

Background

The American alligator is a species that prefers fresh water habitats such as freshwater marshes, lakes, slow-moving streams and rivers, or virtually any other water-retaining habitat (Bartlett and Bartlett 1999). The American alligator is a fully recovered species that retains a federal listing to protect other endangered species that are similar in appearance (USFWS 1995c). In Texas, this species is a protected game animal that is managed by the Texas Parks and Wildlife Department for annual harvest by special permit. There is no alligator habitat within the project area. Due to these factors, the *No Action* and *Proposed Action* alternatives would have no *direct*, *indirect*, or *cumulative effects* on this species.

III. Sensitive Species

Rafinesque's Big-eared Bat
(*Corynorhinus rafinesquii*) and
Southeastern Myotis
(*Myotis austroriparius*)

Background

Rafinesque's big-eared bat and the southeastern myotis reach the western limit of their range in eastern Texas. These species are experiencing population declines because of the loss of adequate roosting habitat. In eastern Texas, these bats roost in a variety of places that may include; crevices behind loose bark, hollow trees,

under dry leaves, caves, wells, old mine shafts, buildings and cisterns, or other protected cavities or structures (Davis and Schmidly 1994). The southeastern myotis has been recorded in bottomland floodplain forests, lower-slope hardwood-pinelands, flatland hardwoods, and upper-slope pine-oak woodlands (Mirowsky and Horner 1997). Preliminary research on habitat associations for the Rafinesque's big-eared bat in eastern Texas indicates a preference for roosting within bottomland hardwood communities (Mirowsky and Horner 1997).

Effects of Alternatives

No Action

Direct and Indirect Effects

This alternative would have no *direct effects* on these bat species because no actions would be undertaken.

The *No Action* alternative may *indirectly* benefit these bat species. Densely stocked stands are more susceptible to wildfire, SPB infestation, or disease. These disturbance events would create snags, particularly in mature pine stands, that serve as potential roost sites. However, these events would also increase the possibility of pine stands becoming early successional habitats.

Cumulative Effects

The *No Action* alternative would increase the susceptibility of pine stands to disturbance events (See *indirect effects*). Disturbance events that create early successional habitats would provide more snags in the short term. However, these events would also result in the loss of mature stands that provide long-term roosting habitat.

The availability of suitable habitat for these species is limited on adjacent private lands. Private lands are primarily composed of pasture or short rotation forest, with little chance of developing roosting habitat. However, human structures may provide some potential roosting habitat for these species if conditions are favorable.

Proposed Action

Direct and Indirect Effects

The *Proposed Action* may displace or harm individuals. However, these species have a preference for bottomland habitats, in which thinning would not occur and prescribed fires would burn at low intensity. These bats do not hibernate in Texas and would therefore be more mobile and alert during winter, allowing for a higher likelihood of escape from an encroaching fire or other disturbing activity yearlong (Davis and Schmidly 1994).

Direct removal or incidental damage of snags may occur during timber harvest or prescribed burning. Prescribed burning would result in both the loss and production of snags (Van Lear 1993). This action is likely to cause a net reduction in the number of snags in upland sites. However, this habitat component would still exist in uplands and continue to provide bat habitat. In addition, snags are more frequent in lowlands and riparian zones than on upland sites (Van Lear 1993). Roosting habitat for these species is primarily located within low-lying areas of Streamside Management Zones (SMZ's), in which thinning would not occur and tend not to carry fire well. Large hardwoods are unlikely to be harmed by

prescribed fire in these zones. Consequently, most roosting habitat is not likely to be impacted by the *Proposed Action*.

Cumulative Effects

The *Proposed Action* may have long-term benefits to these species by promoting the growth of pine and decreasing the susceptibility of stands to wildfire and SPB infestation. This would increase the chance of pine stands reaching an old age class that provides long-term roosting habitat.

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

Louisiana Pine Snake
(*Pituophis melanoleucus ruthveni*)

Background

The Louisiana pine snake (LPS) inhabits areas with sandy, well-drained soils in open, pine forests with minimal midstory and a well-developed grassy understory (Werler and Dixon 2000). A primary component of the pine snake's habitat is the presence of Baird's pocket gophers (*Geomys breviceps*). Pocket gophers serve an essential role in pine snake ecology by providing the primary source of food and shelter, and burrow systems for escape cover, nest sites, and hibernation sites (Rudolph and Burgdorf 1997).

The Louisiana pine snake is extremely unlikely to occur on National Forest land in Texas other than portions of the Sabine NF and Angelina NF (D. Rudolph, pers. comm.). In these locations, potential LPS habitat occurs where there is a combination of sandy, well-drained soils, moderate to abundant herbaceous vegetation, and the presence of pocket gophers (D. Rudolph, pers. comm.). Based on these requirements, habitat conditions within the project area are inadequate for occupation by the LPS. The project area lacks the deep sandy soils, well-developed grassy understories, and pocket gophers that are closely associated with this species. Based on the absence of suitable habitat and the unlikelihood of the LPS occurring within the project area, the *No Action* and *Proposed Action* alternatives would have no *direct*, *indirect*, or *cumulative effects* on this species.

Texas Emerald Dragonfly
(*Somatochlora margarita*)

Background

The Texas emerald dragonfly has a potential range that may exceed 10, 000 square miles in southeastern Texas, including all National Forests in Texas (Price et al. 1989). Habitat requirements are poorly understood, especially for the larvae which seem to be associated with small, clear, sandy-bottomed spring runs and streams (Linam et al. 1994). Adults forage for insects at canopy level in mature forest and over gravel roads and small openings. The Texas emerald dragonfly has been documented in the

Big Creek Scenic Area of the Sam Houston NF (Price et al. 1989), which is located approximately 10 miles from the project area.

Effects of Alternatives

No Action

Direct and Indirect Effects

Since no actions would be employed under this alternative, no *direct effects* would occur to the Texas emerald dragonfly.

The *No Action* alternative may increase the susceptibility of existing pine stands to wildfire and SPB infestation. While small openings created by these events may benefit foraging adults, deforestation would likely have negative effects on this species.

Cumulative Effects

Existing young pine stands are currently unsuitable habitat for foraging adults. In the absence of management, these stands would experience delayed growth and increased susceptibility to stand-replacing events. Adjacent private lands do not possess any large areas of mature pine, and due to management practices, are unlikely to provide suitable habitat for the Texas emerald dragonfly in the future.

Proposed Action

Direct and Indirect Effects

Given that adults are highly mobile and thinning and prescribed burning would not occur within larval habitat, this alternative would have no *direct effect* on this species.

The *Proposed Action* would have no *indirect effects* on the adult Texas emerald dragonfly. Timber harvest would not result in large clearings of mature pine, and therefore would not negatively affect the suitability of foraging habitat for adults.

Dragonfly larvae are susceptible to the siltation of aquatic habitats that may be caused by ground disturbing activities associated with timber harvest. However, *Plan* measures and design criteria for protecting stream courses would minimize sediment movement into larval habitat.

Cumulative Effects

The *Proposed Action* may increase available foraging habitat for this species. Thinning overcrowded pine stands would promote accelerated growth, reducing the time it takes for these stands to develop the maturity suitable for foraging adults.

Increased road use that is associated with the *Proposed Action* may contribute to the short-term sedimentation of aquatic habitats. The Road Analysis Report indicates that roads are currently a major contributor of silt to creeks within the project area (See Project File). This alternative would incorporate the maintenance/repair of roads utilized during implementation. This would result in reduced sediment delivery to streams, and subsequently improve larval habitat in the long term.

Migrant Loggerhead Shrike
(*Lanius ludovicianus migrans*)

Background

The breeding range of the migrant loggerhead shrike includes northeastern Texas, with the winter range extending south to the gulf coast. Breeding habitat is

varied, but must include open grassland areas with scattered trees or shrubs. Shrikes are generally absent from closed canopy forests, and grasslands without trees or shrubs. Historic habitat included open pine-grasslands; however, pastures and hayfields are considered suitable (USFWS 2000). Shrike populations have experienced declines due to loss and degradation of habitat.

The migrant loggerhead shrike has not been detected at four survey points located within the project area that have been monitored since 1998. Wintering loggerhead shrikes have been observed utilizing the pastures of private lands located adjacent to the project area (D. Carrie, pers. comm.). However, given that this species prefers open grasslands with scattered trees, the project area does not support suitable habitat. Loggerhead shrikes would not benefit from the habitat conditions that would result from either alternative, particularly because the area would not be converted to grassland. Since the *No Action* and *Proposed Action* alternatives would not affect habitat suitability for this species, no *direct*, *indirect*, or *cumulative effects* are anticipated.

Bachman's Sparrow
(*Aimophila aestivalis*)

Background

Bachman's sparrow inhabits open, fire-maintained pine forests with grassy understories, or other open areas with thick grassy cover (Hamel 1992). Nesting occurs from mid-April to late July in areas with a high density of herbaceous cover and a low density of woody shrubs (Hardin and Probasco 1983). The Bachman's sparrow has not been detected during annual bird point counts located within the project area. The species has experienced a reduced range due to declines in suitable habitat, and has become localized in many places.

Effects of Alternatives

No Action

Direct and Indirect Effects

Since no actions would be employed under this alternative, no *direct effects* would occur to the Bachman's sparrow.

The *No Action* alternative would decrease the probability of generating habitat required by this species. This alternative would lead to the continued degradation of existing habitat conditions within the project area as pine stands increase in density, and/or woody understory and midstory vegetation thicken.

Cumulative Effects

In the absence of thinning and prescribed fire, suitable stand structure required by this species is unlikely to develop. The *No Action* alternative would result in habitat within the project area becoming or remaining unusable by this species, and therefore would not contribute to the growth or expansion of Bachman's sparrow populations.

Proposed Action

Direct and Indirect Effects

The Bachman's sparrow is unlikely to occur within the project area due to the lack of suitable habitat. Therefore, the *Proposed*

Action would have no *direct effects* on this species.

Bachman's sparrow would benefit from thinning and prescribed fire. These practices offer the greatest opportunity for improving or creating suitable habitat for this species. Thinning would reduce overstory density and open the understory to sunlight, while prescribed fire would promote and maintain herbaceous vegetation.

Cumulative Effects

Suitable habitat for this species is limited in or near the project area. Adjacent private pine forests primarily lack the grassy understory and general open conditions that are required by this species. In addition, existing pastureland is subjected to heavy grazing pressure that restricts the density and height of grasses required for cover.

The *Proposed Action* would lead to the creation of habitat that would sustain this species in the future. In addition, establishing desirable conditions may aid in the expansion of localized populations, and help restore the Bachman's sparrow to its historic range.

Plants

Texas Bartonia (*Bartonia texana*), **Warner's Hawthorn** (*Crataegus warneri*), **Branched Gayfeather** (*Liatris cymosa*), and **Texas Sunnybell** (*Schoenolirion wrightii*).

Background

Texas Bartonia occurs in baygalls and loamy wet forested seeps (MacRoberts et al. 2002), Warner's Hawthorn occurs on dry banks and sandy woods (Correll and Johnston 1979), Texas Sunnybell is found in barrens, glades, and weches barrens, and Branched Gayfeather is found in grassy openings in post oak woodlands or in a post oak savanna-blackland prairie ecotone (NatureServe Explorer 2003).

Effects of Alternatives

Texas bartonia, Warner's hawthorn, Texas sunnybell, and branched gayfeather have been documented in the counties containing the Sam Houston NF (Nesom and Brown 1998). However, suitable habitat for these sensitive plant species does not exist in the project area and would not become available as a result of either alternative (See Project File - Botanical Survey of the Four Notch Area). Therefore, the *No Action* and *Proposed Action* alternatives would have no *direct*, *indirect*, or *cumulative effects* on these plant species.

Aquatic Species

The following sensitive fish, fresh water bivalves, and crayfish are addressed: **Western Sand Darter** (*Ammocrypta clara*) and **Sabine Shiner** (*Notropis sabinae*), **Texas Pigtoe** (*Fusconaia askewi*), **Triangle Pigtoe** (*Fusconaia lananensis*), **Sandbank Pocketbook** (*Lampsilis satura*), **Louisiana Pigtoe** (*Pleurobema riddellii*), and **Texas Heelsplitter** (*Potamilus amphiachaenus*), and **Neches Crayfish** (*Procambarus nechesae*), ***Procambarus nigrocinctus*** (no common name), and ***Procambarus kensleyi*** (no common name). While specific habitat requirements for these species differ, these species are primarily impacted by sedimentation. Therefore, aquatic species

are considered concurrently in the effects analysis.

Fish

Western Sand Darter (*Ammocrypta clara*) and **Sabine Shiner** (*Notropis sabinae*)

Background

The western sand darter usually inhabits large streams in slight to moderate current, primarily over a sandy substrate (Kuehne and Barbour 1983). The western sand darter has not been documented on the Sam Houston NF and is only known from the Sabine and lower Red rivers. The Sabine shiner is closely restricted to substrate of fine, silt-free sand in small streams and rivers having slight to moderate current (Lee et al. 1980). Surveys conducted at a variety of aquatic sites across the SHNF failed to detect this species over four sampling periods in 1997 and two sampling periods in 1999-2000 (Herbert 1999, Healy 2002). Of the sites surveyed, Boswell, Pea, and Briar creeks occur within the project area and Roark creek and Winters bayou occur adjacent to the project area. However, these surveys did include detections of the goldstripe darter (*Etheostoma parvipinne*), a species closely associated with the Sabine shiner. This species was found in Briar and Pea creek, located within the eastern and southeastern portion of the project area, respectively. The goldstripe darter is found in clear, sandy bottom streams that are spring fed (D. Peterson, pers. comm.). This species requires unimpeded waterways that allow passage to headwaters needed for fulfilling life cycle requirements and for survival during summer droughts. Spring run streams of this type may indicate the presence of suitable habitat conditions necessary to support the bottom dwelling Sabine shiner.

Freshwater Bivalves

Texas Pigtoe (*Fusconaia askewi*), **Triangle Pigtoe** (*Fusconaia lananensis*), **Sandbank Pocketbook** (*Lampsilis satura*), **Louisiana Pigtoe** (*Pleurobema riddellii*), and **Texas Heelsplitter** (*Potamilus amphiachaenus*)

Background

Freshwater mussels may inhabit a variety of water-body types, including large and small rivers and streams, lakes, ponds, canals, and reservoirs (Howells et al. 1996). These sensitive mussel species are generally found in large river systems in mixed mud, sand, and fine gravel (Howells et al. 1996). Mussels filter feed on algae, detritus, small particles in the water, and may be able to absorb some organic material in solution (Howells 1996). Pollution, over harvest, reduced spring and river flows, and sedimentation are probable causes of decline (Howells et al. 1996). In addition, any impacts to fish may negatively affect mussels, which use fish as hosts for larval development (Howells 1996).

Surveys conducted in 1994 and a study conducted from 1999-2000 on the Sam Houston NF, including streams in close proximity to the project area, did not detect any of these sensitive mussel species (Howells 1994, Healy and Gelwick undated). In addition, live mussels were

rarely collected in streams on the SHNF during this study. Evidence of mussels was found at 8 of 18 sites (17 streams), in which three of these sites only dead individuals or valve fragments were collected (Healy and Gelwick undated).

Crayfish

Neches Crayfish (*Procambarus nechesae*), ***Procambarus nigrocinctus*** (no common name), and ***Procambarus kensleyi*** (no common name).

Background

The Neches crayfish and *P. kensleyi* have been found in simple burrows in temporary or semi-permanent pools in roadside ditches. *P. kensleyi* habitat requirements include sandy clay soils with grasses and sedges. *P. nigrocinctus* primary occurs amongst debris in streams with sandy or rocky bottoms (Hobbs 1990).

The Neches crayfish and *P. nigrocinctus* were not detected in 1999-2000 surveys conducted in variety of aquatic habitats throughout the SHNF (Healy 2002). These species are associated with the Neches River Basin that occurs northeast of the SHNF (D. Peterson, pers. comm.). However, *P. kensleyi* was detected within the southeastern portion of the project area in Pea creek and adjacent to the project area in Winters bayou (Healy 2002).

Effects of Alternatives

No Action

Direct and Indirect Effects

Since no actions would be employed under this alternative, no *direct effects* would occur to these aquatic species.

The *No Action* alternative would increase the susceptibility of pine stands to catastrophic wildfire. High intensity wildfire may remove riparian vegetation that functions to impede soil movement. The absence of vegetation may result in increased sediment runoff into streams, thus degrading water quality.

Cumulative Effects

Several roads and stream channels within the project area are eroding due to improper drainage. Erosion of these features is contributing sediment to streams (See Project File - Aquatics Report). In addition, improper culvert placement is impeding fish movement (See Project File - Road Analysis Report). The *No Action* alternative would not include the repair of roads, stream channels, or culverts. Therefore, these features would continue to cause sedimentation of aquatic habitats and impede fish movement in the long term.

Proposed Action

Direct and Indirect Effects

Streamside protection measures are incorporated that exclude harvest activities within SMZ's. Stream crossings would be avoided and alternative routes used to access harvest units when possible. While prescribed fire would occur within these

zones, ignition would be excluded. Prescribed fire within SMZ's would consist of generally low intensity backing fires that are unlikely to directly impact aquatic habitats. Therefore, the *Proposed Action* is unlikely to have *direct effects* on aquatic species.

The *Proposed Action* would not include the construction of any new roads; however, thinning activities and road, stream channel, or culvert restoration would likely cause increased sedimentation that may negatively impact aquatic species. Sediment may smother benthic organisms, cause clogging of gills, change water temperature, and hinder foraging (Ellis 1936, Cordone and Kelly 1961, McDaniel 1993). However, since restoration or these structures or drainage systems would reduce erosion, negative impacts are expected to be temporary. Adherence to *Plan* measures and project design criteria for protecting stream courses would impede movement of sediment (USDA Forest Service 1996). These measures are designed to limit sediment delivery to streams and are consistent with, and exceed, state Best Management Practices for protecting aquatic habitats from sedimentation.

This alternative would decrease the susceptibility of pine stands to high intensity wildfire. High intensity wildfire may temporarily remove vegetation that functions to impede the movement of sediment into aquatic habitats. Thinning and prescribed burning would reduce fuel loads, thereby minimizing the likelihood of this event.

The *Proposed Action* would incorporate prescribed burning and the construction of fire lines within SMZ's. Although prescribed fire would occur within SMZ's, low intensity backing fires are unlikely to remove soil stabilizing riparian vegetation. In addition, fire lines near streamsides are hand prepared with minimal disturbance to soils, and therefore are unlikely to negatively impact aquatic habitats.

Cumulative Effects

Implementation of the *Proposed Action* may result in short-term sediment increases to aquatic habitats. However, adherence to *Plan* measures and design criteria for protecting stream courses would minimize the magnitude of this occurrence (USDA Forest Service 1996). In addition, aquatic species would likely experience long-term benefits from the reduced sedimentation and improved water quality that would result from improved road, stream channel, and culvert drainage.

Timber harvest and cattle grazing on private lands may reduce, degrade, or cause fragmentation of suitable aquatic habitat. However, streams occurring within the project area primarily originate in or near national forest land. Therefore, private land management is unlikely to affect these aquatic habitats.

Downstream effects to aquatic habitats are also of concern. Management practices on national forest require measures that protect aquatic habitats from sedimentation. Therefore, the *Proposed Action* is unlikely to alter water quality downstream of the project area.

IV. Management Indicator Species (MIS)

Management indicator species are identified in the Revised Land and Resource Management Plan for the National Forests and Grasslands in Texas (USDA Forest Service 1996). Management indicator species are selected because their population changes are believed to indicate the effects of management activities. They include: species with special habitat needs that may be influenced significantly by planned management programs; species commonly hunted, fished or trapped; non-game species of special interest; and plant and animal species whose population changes are believed to indicate the effects of management activities on other species of selected communities [36 CFR 219.19(a)(1)].

The MIS approach is designed to function as a means to provide insight into the effects of forest management on plant and animal communities. Management indicator species may be used as a tool for assessing changes in specialized habitats, formulating habitat objectives, and establishing standards and guidelines to provide for a diversity of wildlife, fish, and plant habitats (USDA Forest Service 2002).

For this project, a subset of the forest-wide management indicators was selected. Four species (white-tailed deer, Eastern wild turkey, yellow-breasted chat, and pileated woodpecker) and one macroinvertebrate group (stonefly guild) were selected based on their associations with the habitat present in the project area, and their suitability as indicators of habitat changes brought about by the proposed alternatives (See Appendix B for attached list of those species considered and those that were eliminated from further consideration and the rationale therein).

White-tailed Deer
(*Odocoileus virginianus*)

Background

The white-tailed deer is a wide-ranging species that occurs in a variety of habitats. In southeastern Texas this species occurs where the principal vegetation is a mixture of pine and hardwood, or nearly pure stands of pine (Davis and Schmidly 1994). White-tailed deer are dependent on the availability of browse, hard mast in the fall and winter, and escape cover throughout the majority of the year. Herbaceous plants are frequently used as forage in summer months and trees and shrubs in the winter (Martin et al. 1951). The white-tailed deer was selected as an MIS because this species is in demand.

White-tailed deer population trends in the pineywoods region of Texas are stable to increasing (Fig.2; NFGT M&E Report 2000-2001). Estimates of deer populations on the National Forests and Grasslands in Texas and the 4-Notch area follow a similar trend (Fig.3; NFGT M&E Report 2000-2001 and Fig 4; Texas Parks and Wildlife Department 2003).

Fig. 2 Trends in estimated White-tailed Deer Populations for the Pineywoods Ecological Region.

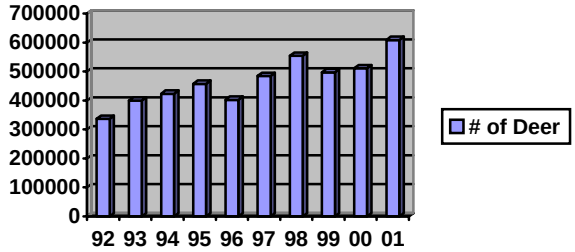


Fig. 3 Estimated White-tailed Deer Population on NFGT. (NFGT M&E Report 2000-2001).

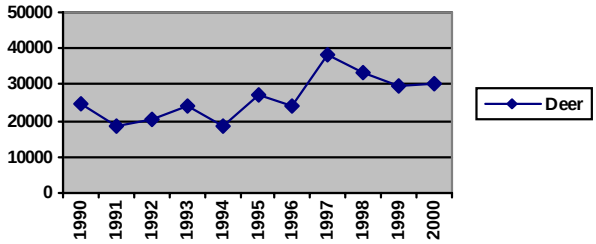
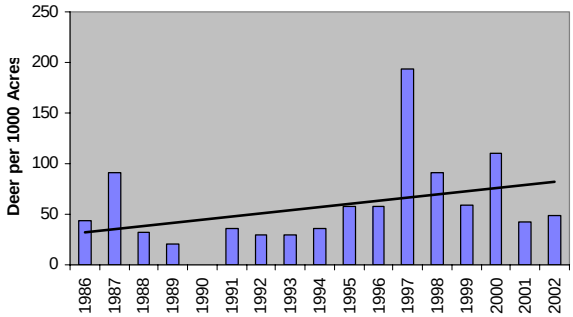


Fig. 4 Deer Population Trends in the 4-Notch Area, 1986-2002, Texas Parks and Wildlife Department.



Effects of Alternatives

No Action

Direct and Indirect Effects

No *direct effects* would occur to whitetail deer under this alternative because no actions would be undertaken.

The pine stands in the project vicinity are at increased risk of SPB infestation and/or wildfire. In the event that pine stands are killed by wildfire or SPB infestation, cover for this species would be reduced, while available forage would increase. Reduced overstory would result in an increase in the efficiency of photosynthesis in plants, increasing both quantity and quality of available forage that would benefit this species (Harlow 1984).

In the absence of pine thinning, stands will likely develop closed canopy conditions that will reduce the amount of sunlight reaching the forest floor. This would result in decreased growth of forage in the understory. With the exclusion of fire in lower density stands, the availability of browse will likely decrease as the height of understory vegetation increases above the height that deer are able to forage.

Cumulative Effects

Habitat for the white-tailed deer is available on adjacent private lands, in which management for timber production creates patches of early succession habitat. Frequent timber harvest creates areas of increased forage, but increases in availability are transient, as pine stands are regenerated. In addition, deer benefit from the edge effect resulting from the variety of land management practices (e.g. pastureland,

and early and mid-succession forest) on private lands (G. Creacy, pers. comm.).

Proposed Action

Direct and Indirect Effects

Individual animals may be killed or injured by prescribed fire. However, this is uncommon due to the fact that prescribed burning is conducted under favorable weather conditions, and generally results in low intensity fires. The white-tailed deer is highly mobile and individuals would avoid areas of activity. Prescribed burning and tree harvest activities would temporarily displace individuals during implementation.

Hardwoods are susceptible to mortality from prescribed fire. However, prescribed burning is unlikely harm mature, mast producing hardwoods or young hardwoods in or near streamsides or bottomlands, primarily due to relatively low fire intensity in these areas. For this reason, possible losses of mature hardwoods would likely be negligible.

Prescribed fire and thinning of pine stands would not change the distribution of seral stage habitat. However, these actions would influence understory vegetation composition and structure within those stands. White-tailed deer would likely benefit from thinning and prescribed burning. Thinning would permit increased light filtration to the understory and stimulate growth while prescribed fire would improve quality of forage available to this species (Crawford 1984). Thinning and prescribed fire may promote increases in woody species in the short-term and possibly herbaceous vegetation in the long-term. Due to the adaptability of this species, the resulting habitat would remain suitable. Deer would use the resulting forage based on quality, availability, and season.

Cumulative Effects

Suitable habitat is dispersed across the forest and adjacent private lands. Due to the unlikelihood of changes in land uses on surrounding private lands, the adaptability of this species, overall range, and locally stable or increasing population trends, substantial positive or negative *cumulative effects* on deer populations are not expected.

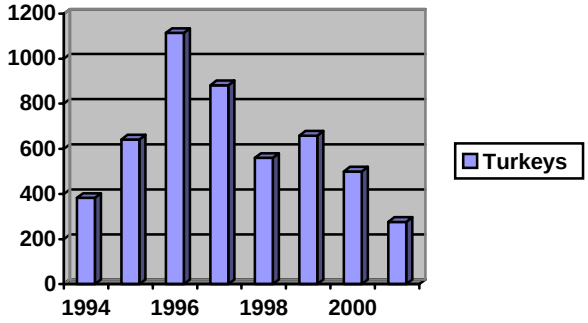
Eastern Wild Turkey
(*Meleagris gallopavo*)

Background

Eastern wild turkeys require trees for roosting, and suitable nesting and brood habitat. In the eastern Texas pineywoods, turkey hens select nest sites in pine stands with low timber stocking, low tree mid-story density, scattered shrub cover, and abundant herbaceous ground cover (Campo et al. 1989). Brood-rearing habitat consists of vegetation that produces insects and in which poults can efficiently forage, and cover that allows the adult female unobstructed vision for protection from predation (Porter 1992). Turkeys forage on a wide variety of plant and animal items, with much variation resulting from seasonal abundance of particular food items. Studies of eastern wild turkey diets in the South have found that major food items include: hard and soft mast, grasses and grass seeds, insects, and where available agricultural grains and crops (Hurst 1992). The eastern wild turkey was selected as an MIS because this species is in demand.

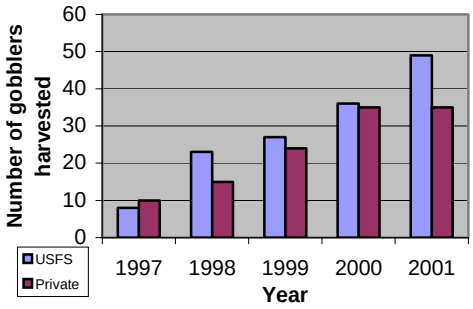
Reintroduction of the eastern wild turkey into its former range involved transplanted turkeys to the NFGT. These efforts continued until 1997. Surveys indicate that once stocking ceased, the population decreased (Fig. 5; NFGT M&E Report 2000-2001). This is not surprising, as one would expect the population to begin to reflect a population level based on survival of existing adults and reproductive success, in the absence of additional transplanted birds. However, populations of this species are expected to persist throughout the National Forests in Texas (USDA Forest Service 2000-2001).

Fig. 5 Number of Eastern Wild Turkeys counted during Annual Brood Surveys by Texas Parks and Wildlife Department in Counties where National Forest and Grasslands are located. (NFGT M&E Report 2000-2001).



Hunter harvest data indicates that the NFGT supports a sufficient population of turkeys to provide recreational hunting opportunities. Data also suggest that habitat found on the NFGT is important for maintaining wild turkey populations in eastern Texas (Fig. 6; NFGT M&E Report 2000-2001).

Fig. 6 Comparison of turkey harvest on USFS vs. Private lands in Angelina, Jasper, Sabine, San Augustine, Shelby, San Jacinto, and Walker Counties from 1997-2001. (NFGT M&E Report 2000-2001).



Effects of Alternatives

No Action

Direct and Indirect Effects

Since no actions would be employed under this alternative, no *direct effects* would occur to the eastern wild turkey.

The *No Action* alternative would *indirectly* affect habitat suitability and foraging quality and/or quantity for the eastern wild turkey. Foraging would be limited by the existence of dense pine stands, in which closed canopy conditions would shade the forest floor, inhibiting the establishment of vegetation that produces greater insect abundance. In addition, the exclusion of fire in low density stands would facilitate the growth of tall, dense woody vegetation. These conditions would limit turkey movement and visibility, and possibly result in increased susceptibility of this species to predation.

Dense stand conditions would increase the susceptibility of stands within the project

area to disturbance events such as SPB infestation and wildfire. These disturbance events may result in early successional habitats, in which use by turkey is limited to nesting cover and edge for brood-rearing. Use of these areas would decrease, and this species would become less abundant in this habitat type, as growth of pine saplings shade understory plants.

Cumulative Effects

While surrounding private lands do support some turkeys, they are not managed to provide high quality habitat. Management practices on these lands are unlikely to enhance future habitat for this species.

Proposed Action

Direct and Indirect Effects

Possible effects of the *Proposed Action* include the displacement of individuals, death or injury of poults, and the loss of nests. Hens with nests damaged or destroyed as a result of management actions may not re-nest. The proposed actions would displace or harm individuals, but the use of thinning and prescribed fire offers the greatest potential for improving or maintaining suitable nesting and brood habitat for this species.

Hardwoods are susceptible to mortality from prescribed fire. However, prescribed burning is unlikely to harm mature, mast producing hardwoods or young hardwoods in or near streamsides or bottomlands, primarily due to relatively low fire intensity in these areas. For this reason, possible losses of mature hardwoods are negligible.

Poults would benefit from habitat improvements resulting from thinning and prescribed fire. Thinning of densely stocked pine stands would allow the penetration of sunlight to the understory. This, combined with prescribed fire, would facilitate the establishment of herbaceous vegetation that promotes increased insect production.

Thinning operations would require the continued use of presently closed roads. The increased use of roads would likely contribute to the disturbance of this species during brood-rearing. However, roads provide openings that may be particularly used by hens and poults due to the abundance of insects for foraging.

Cumulative Effects

Thinning and prescribed burning on federal land will improve nesting and brood habitat conditions that would benefit the eastern wild turkey. Management practices on most adjacent private lands currently do little to enhance habitat for wild turkey (G. Creacy, pers. comm.). Future sustainability or growth of the eastern wild turkey populations in the vicinity will depend largely on habitat developed or maintained on national forest land.

Yellow-breasted Chat
(*Icteria virens*)

Background

The yellow-breasted chat is an indicator species of early succession habitat. This species prefers blackberry tangles, dense shrub thickets, and scattered saplings interspersed among dense herbaceous cover. The yellow-breasted chat has experienced significant population declines in eastern

North America due to loss of habitat from the re-growth of cleared forests, and the clearing of early succession landscapes for agriculture and urban development (Cornell Lab. of Ornithology 2000).

State rankings in Texas and Louisiana indicate the populations are secure and stable (NatureServe Explorer 2002). Available data gathered from point count surveys indicates a stable to increasing trend on the NFGT (Fig. 7 and 8; NFGT M&E Report 2000-2001).

Fig. 7 Number of Yellow-breasted Chats in 0-20 year old forest stands. (NFGT M&E Report 2000-2001).

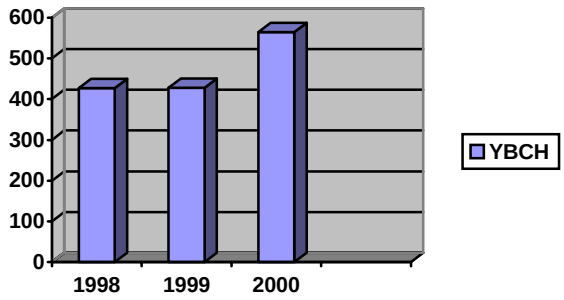
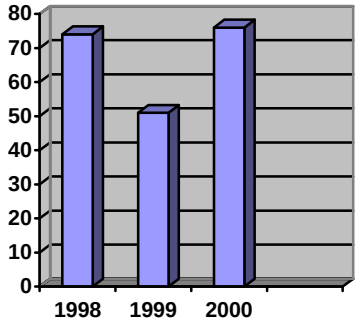


Fig. 8 Number of Yellow-breasted Chats in 20-50 year old forest stands. (NFGT M&E Report 2000-2001).



Effects of Alternatives

No Action

Direct and Indirect Effects

Since no actions would be employed under this alternative, no *direct effects* would occur to the yellow-breasted chat.

Habitat for the yellow-breasted chat may decline as pine stands increase in density and reduce sunlight to shrubs. However, dense stand conditions increase the severity of disturbance events such as wildfire or SPB infestation. The early successional habitats that may result would temporarily benefit this species, particularly as a shrub layer developed. However, in the absence of stand-replacing events, continued growth of existing pine stands would likely reduce habitat quality for this species.

Cumulative Effects

Management practices on adjacent private lands, in which timber production creates patches of early succession habitat, may benefit the yellow-breasted chat. Short rotations and infrequent use of prescribed fire promote the development of habitat conditions (i.e. shrub layer) suitable for use by this species. The frequency of timber harvest and prescribed fire are unlikely to change, and therefore will continue to provide habitat for this species in the long term.

Proposed Action

Direct and Indirect Effects

The *Proposed Action* may displace individuals or disrupt nesting. Losses of

nests to prescribed fire would be minimal, since prescribed burning is generally less frequent during mid-May and June, when this species is nesting.

Thinning may temporarily improve habitat for this species as the canopy of pine stands are opened, promoting the growth of dense understory shrubs. However, in the long-term, prescribed fire would reduce the occurrence of a woody understory.

Cumulative Effects

Thinning and prescribed burning would promote the growth of pine stands, and decrease their susceptibility to stand replacing events. As acres of early succession habitat decline on the forest, populations of yellow-breasted chats are expected to also decline (USDA Forest Service 2000-2001). However, as a result of intensive timber management, surrounding private lands will continue to provide early succession habitat.

Pileated Woodpecker
(*Dryocopus pileatus*)

Background

The pileated woodpecker is an indicator of mid and late succession, and old growth habitats. Preferred habitat includes mature coniferous-deciduous forests or bottomland hardwood forests. Pileated woodpeckers are dependent on the availability of large snags for foraging, roosting, and nesting. Habitat for this species, in the form of older age class stands, is increasing across the NFGT. In 1996, suitable habitat was estimated at 280,000 acres. Current habitat trends indicate a net increase of 22,400 acres of suitable habitat and the availability of a variety of habitats across the National Forests in Texas (USDA Forest Service 2000-2001). Point count surveys have been used on the NFGT to monitor pileated woodpecker numbers since 1996. Available data on the NFGT indicates trends in pileated woodpecker numbers are decreasing in young stands and are stable to increasing in older stands (Fig. 9 and 10; NFGT M&E Report 2000-2001).

Fig. 9 Number of Pileated Woodpeckers in 0-20 year old stands. (NFGT M&E Report 2000-2001).

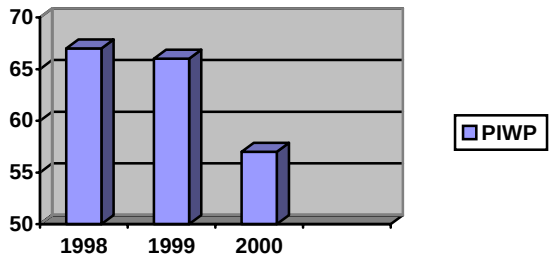
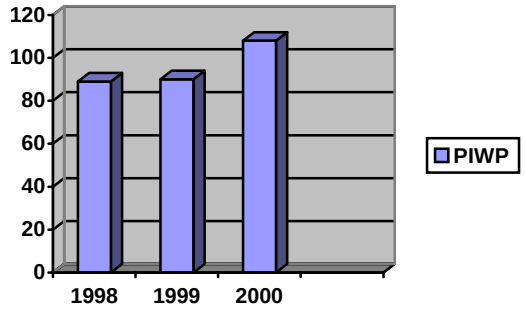


Fig. 10 Number of Pileated Woodpeckers in 20-50 year old stands. (NFGT M&E Report 2000-2001).



Effects of Alternatives

No Action

Direct and Indirect Effects

Since no actions would be employed under this alternative, no *direct effects* would occur to the pileated woodpecker.

Pileated woodpeckers would benefit as stands continue to mature. Densely stocked pine stands are more susceptible to wildfire and SPB infestation, both of which would create snags. However, the same disturbance events would also increase the probability of pine stands becoming early successional habitats. Effects on this species would vary depending on the severity and scale of the disturbance.

Cumulative Effects

On adjacent private lands, management practices do not favor the creation of snags or large areas of mature forest, and are unlikely to change. Substantial areas of pileated woodpecker habitat have been removed through conversion to pastures, residential development, and very young pine plantations. National forest land would continue to provide the majority of the habitat for this species in the project vicinity.

Proposed Action

Direct and Indirect Effects

Prescribed burning would result in both the loss and production of snags and downed logs (Van Lear 1993). This action is likely to cause a net reduction in the number of snags and downed logs in upland sites. However, these habitat components would still exist in uplands and continue to provide pileated woodpecker habitat. In addition, snags are more frequent in lowlands and riparian zones than on upland sites (Van Lear 1993). Suitable habitat for this species would continue to exist in SMZ's, where thinning would not occur, and in which low intensity prescribed fire would have only minimal effects on snags and downed logs.

Cumulative Effects

The *Proposed Action* would decrease the likelihood of stand replacing wildfire or SPB infestation. Increasing the probability that pine stands will attain an older age class, preferred by pileated woodpeckers, would have beneficial effects to this species in the long term.

On adjacent private lands, management practices do not favor the creation of snags or large areas of mature forest, and are unlikely to change. Substantial areas of pileated woodpecker habitat have been removed through conversion to pastures, residential development, and very young pine plantations. National forest land would continue to provide the majority of the habitat for this species in the project vicinity.

Stonefly Guild

Background

The stonefly guild consists of macroinvertebrates as a group. By determining the type and quantity of various classes of macroinvertebrates, water quality can be assessed. Indices derived from macroinvertebrate sampling are an estimate

of water quality based on the tolerance of species to pollution. Those organisms with a low tolerance value are more susceptible to pollution, while organisms with a high tolerance value are more tolerant to pollutants (USDA Forest Service 2001-2002). Boswell and Briar creeks were sampled in 2001 for macroinvertebrates. An assessment of the indices from these surveys was used to derive an excellent water quality determination for these creeks.

Effects of Alternatives

No Action

Direct and Indirect Effects

Since no actions would be employed under this alternative, no *direct effects* would occur to water quality.

This alternative would increase the susceptibility of stands to catastrophic wildfire. High intensity wildfire may remove riparian vegetation that functions to impede soil movement. The absence of riparian vegetation may result in increased sediment runoff into streams, thus degrading water quality.

Cumulative Effects

Several roads and stream channels within the project area are eroding due to improper drainage. Erosion of these features is contributing sediment to streams (See Project File - Aquatics Report). Under this alternative, these features would continue to cause sediment movement into streams, resulting in long-term impacts to water quality.

Proposed Action

Direct and Indirect Effects

Streamside protection measures are incorporated that exclude harvest activities within SMZ's. While prescribed fire would occur within these zones, ignition will be excluded. Prescribed fire within SMZ's would generally consist of low intensity backing fires that are unlikely to directly impact aquatic habitats. Therefore, the *Proposed Action* is unlikely to have *direct effects* on water quality.

High intensity wildfire may remove soil stabilizing riparian vegetation that impedes sedimentation of aquatic habitats. This alternative would reduce fuel loads, thereby decreasing the susceptibility of pine stands to high intensity wildfire.

Cumulative Effects

Proceeding the SPB outbreak, intensive site-preparation in the project area was conducted from 1986-1987. This included mechanical treatment and prescribed burning. In addition, 927 acres of timber in compartments 70, 72, and 75 were harvested from 1995-1999.

These past management activities incorporated measures for protecting SMZ's. Macroinvertebrate sampling in 2001 was conducted in the portions of Boswell and Briar creeks that occur at the southern boundary of the project area. Probable effects of management activities on water quality within the project area would likely be detectable at these downstream locations. The excellent water quality estimates derived from macroinvertebrate indices demonstrate that

past management activities did not have long-term effects on water quality. Because the proposed thinning and prescribed burning are less intensive than the site-preparation done in the past, and would employ *Plan* standards and guidelines for protecting streams, these actions are unlikely to impact water quality in the long term.

V. References

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Table 1. Habitat conditions in RCW clusters/recruitment stands and allocated foraging habitat with *no action*.

Compartment/ Stand		RCW Cluster/RC ID	Pine Basal Area ft^2/ac within Cluster/RC	Acres of Adequate Foraging[1]	Foraging Requirement (120 acres)	Predicted Condition	
						Hardwood Midstory	Herbaceous Understory
66	27	66RC27*	n/a	165#	met	increasing	declining
69	7	69-1*	n/a	146	met	increasing	declining
	19	69-2*	n/a	9	limited	increasing	declining
	20	69RC20*	n/a	65	limited	increasing	declining
70	17	70-1	73	91	limited	increasing	declining
	26	70-2	83	93	limited	increasing	declining
	27	70-3	99	239	met	increasing	declining
70/72	25/19	72-5	67	129	met	increasing	declining
71	27	71-10*	n/a	181	met	increasing	declining
72	17	72-4	33	83	limited	increasing	declining
	18	72-3	105	39	limited	increasing	declining
	23	72-11	55	77	limited	increasing	declining
73	6	73RC06	78	24	limited	increasing	declining
	15	73RC15	53	81	limited	increasing	declining
	24	73RC24	97	94	limited	increasing	declining
73/77	13/20	77-3	114	20	limited	increasing	declining
75	30	75-3	137	68	limited	increasing	declining
	27	75-2	60	75	limited	increasing	declining
	42	75-1	90	136	met	increasing	declining
	45	75RC45	75	117	limited	increasing	declining
76	12	76-2	70	55	limited	increasing	declining
	27	76-1	80	140	met	increasing	declining
77	19	77-2*	n/a	80	limited	increasing	declining
	32	77RC32*	n/a	133	met	increasing	declining
	33	77RC33	80	76	limited	increasing	declining
	37	77-6*	n/a	147	met	increasing	declining
78	19	78-1*	n/a	91	limited	increasing	declining
	32	78RC32*	n/a	93	limited	increasing	declining
83	32	83RC32*	n/a	261#	met	increasing	declining
	33	83RC33	97	158#	met	increasing	declining
	34	83-1*	n/a	90	limited	increasing	declining

[1] = Acres of foraging habitat within 0.5 mi of RCW clusters/recruitment stands. Criteria for adequate foraging determined as pine stands that are ≥ 60 years in age, > 40 basal area ft^2/ac, and are not separated by > 200' of non-foraging areas.

= require inclusion of pine stands 30-59 years in age in order to meet minimum foraging requirement.

*= RCW clusters/recruitment stands that occur outside, but have affected habitat within, the project area. Predicted conditions address habitat that occurs within the project area.

Table 2. Habitat conditions in RCW clusters/recruitment stands and allocated foraging habitat with the *proposed action.*

Compartment/ Stand		RCW Cluster/RC ID	Pine Basal Area ft^2/ac within Cluster/RC	Acres of Adequate Foraging[1]	Foraging Requirement (120 acres)	Predicted Condition	
						Hardwood Midstory	Herbaceous Understory
66	27	66RC27*	n/a	165#	met	reduced	increasing
69	7	69-1*	n/a	146	met	reduced	increasing
	19	69-2*	n/a	9	limited	reduced	increasing
	20	69RC20*	n/a	65	limited	reduced	increasing
70	17	70-1	60-80	91	limited	reduced	increasing
	26	70-2	60-80	93	limited	reduced	increasing
	27	70-3	60-80	239	met	reduced	increasing
70/72	25/19	72-5	60-80	129	met	reduced	increasing
71	27	71-10*	n/a	181	met	reduced	increasing
72	17	72-4	60-80	83	limited	reduced	increasing
	18	72-3	60-80	39	limited	reduced	increasing
	23	72-11	60-80	77	limited	reduced	increasing
73	6	73RC06	60-80	24	limited	reduced	increasing
	15	73RC15	60-80	81	limited	reduced	increasing
	24	73RC24	60-80	94	limited	reduced	increasing
73/77	13/20	77-3	60-80	20	limited	reduced	increasing
75	30	75-3	60-80	68	limited	reduced	increasing
	27	75-2	60-80	75	limited	reduced	increasing
	42	75-1	60-80	136	met	reduced	increasing
	45	75RC45	60-80	117	limited	reduced	increasing
76	12	76-2	60-80	55	limited	reduced	increasing
	27	76-1	60-80	140	met	reduced	increasing
77	19	77-2*	n/a	80	limited	reduced	increasing
	32	77RC32*	n/a	133	met	reduced	increasing
	33	77RC33	60-80	76	limited	reduced	increasing
	37	77-6*	n/a	147	met	reduced	increasing
78	19	78-1*	n/a	91	limited	reduced	increasing
	32	78RC32*	n/a	93	limited	reduced	increasing
83	32	83RC32*	n/a	261#	met	reduced	increasing
	33	83RC33	60-80	158#	met	reduced	increasing
	34	83-1*	n/a	90	limited	reduced	increasing

[1] = Acres of foraging habitat within 0.5 mi of RCW clusters/recruitment stands. Criteria for adequate foraging determined as pine stands that are ≥ 60 years in age, > 40 basal area ft^2/ac, and are not separated by > 200' of non-foraging areas.

#= Require inclusion of pine stands 30-59 years in age in order to meet minimum foraging requirement.

*= RCW clusters/recruitment stands that occur outside, but have affected habitat within, the project area. Predicted conditions address habitat that occurs within the project area.

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Foraging habitat analysis based on *Plan* standard[1] MA-2-80-4.1. Values in parentheses indicate the percentage of required foraging habitat.

Compartment/ Stand		RCW Cluster/RC	Pre-thinning		Post-thinning	
			Pine Stems [6,350]	BA ft²/ac [8,490]	Pine Stems [6,350]	BA ft²/ac [8,490]
66	27	66RC27*	9,771 (154)	11,520 (136)	no change	
69	7	69-1*	5,880 (93)	12,451 (147)	limited[3]	
	19	69-2*	0 (0)	450 (5)	limited[3]	
	20	69RC20*	2,057 (32)	4,865 (57)	limited[3]	
70	17	70-1	3,644 (57)	7,519 (89)	limited[3]	
	26	70-2	5,216 (82)	8,525 (100)	limited[3]	
	27	70-3	11,276 (178)	23,316 (275)	9,428 (148)	16,730 (197)
70/72	25/19	72-5	9,301 (146)	13,844 (163)	8,986 (142)	12,562 (148)
71	27	71-10*	10,582 (167)	16,707 (197)	no change	
72	17	72-4	3,890 (61)	7,266 (86)	limited[3]	
	18	72-3	5,297 (83)	8,624 (102)	limited[3]	
	23	72-11	3,701 (58)	6,859 (81)	limited[3]	
73	6	73RC06	958 (15)	2,270 (27)	limited[3]	
	15	73RC15	5,217 (82)	8,558 (101)	limited[3]	
	24	73RC24	5,075 (80)	7,754 (91)	limited[3]	
73/77	13/20	77-3	1,663 (26)	2,389 (28)	limited[3]	
75	30	75-3	3,574 (56)	8,322 (98)	limited[3]	
	27	75-2	3,275 (52)	5,941 (70)	limited[3]	
	42	75-1	11,602 (183)	16,013 (189)	10,548 (166)	13,447 (158)
	45	75RC45	5,120 (81)	8,437 (99)	limited[3]	
76	12	76-2	2,030 (32)	3,633 (43)	limited[3]	
	27	76-1	5,122 (81)	15,163 (179)	limited[3]	
77	19	77-2*	3,790 (60)	5,597 (66)	limited[3]	
	32	77RC32*	6,531 (103)	9,179 (108)	no change	
	33	77RC33	6,969 (110)	8,640 (102)	no change	
	37	77-6*	7,256 (114)	10,210 (120)	no change	
78	19	78-1*	5,299 (83)	7,976 (94)	limited[3]	
	32	78RC32*	5,412 (85)	7,371 (87)	limited[3]	
83	32	83RC32*	18,123 (285)	21,142 (249)	17,925 (282)	20,127 (237)
	33	83RC33	8,547 (135)	18,095 (213)	limited[3]	
	34	83-1*	4,673 (74)	7,337 (86)	limited[3]	

* = RCW clusters/recruitment stands that occur outside, but have affected habitat within, the project area.

[1] = Foraging habitat standards include: habitat within 0.5 mi of RCW clusters/recruitment stands, at least 8,490 square feet of BA in pine stems larger than 5 inches DBH, and at least 6,350 pine stems 10 inches DBH or larger and ≥ 30 years old.

[3]= Foraging habitat for these clusters/recruitment stands is limited prior to thinning. Deficiencies in foraging habitat would increase following thinning as permitted by the *Plan* (MA2-80-4.2).

Management Indicators (MI) Selection

Management Indicator	Management Indicator For:	Selected for Project		Rationale
		YES	NO	
Red-cockaded Woodpecker	Longleaf Pine Woodland/Savanna Dry-Xeric Oak-Pine Forest Mesic Oak-Pine Forest		X	Project area is in the HMA and is being managed to improve habitat for this species. This species is addressed in the Threatened and Endangered section of the Wildlife Report.
Slender Gayfeather	Longleaf Pine Woodland/Savanna		X	Eliminated from consideration on Sam Houston NF by the Plan (Appendix D); the species and its habitat do not occur on the SHNF.
Incised Groovebur	Longleaf Pine Woodland/Savanna		X	Eliminated from consideration on Sam Houston NF by the Plan (Appendix D); the species and its habitat do not occur on the SHNF.
Scarlet Catchfly	Longleaf Pine Woodland/Savanna		X	Eliminated from consideration on Sam Houston NF by the Plan (Appendix D); the species and its habitat do not occur on the SHNF.
Longleaf - Bluestem Series	Longleaf Pine Woodland/Savanna		X	This series does not occur in the project area.
Navasota Ladies Tresses	Longleaf Pine Barrens		X	Eliminated from consideration on Sam Houston NF by the Plan (Appendix D); the species and its habitat do not occur on the SHNF.
Little Bluestem - Rayless Goldenrod Series	Longleaf Pine Barrens		X	Eliminated from consideration on Sam Houston NF by the Plan (Appendix D); the species and its habitat do not occur on the SHNF.
Yellow Fringeless Orchid	Herbaceous Wetlands		X	Eliminated from consideration on Sam Houston NF by the Plan (Appendix D); the species and its habitat do not occur on the SHNF.
Sphagnum - Beakrush Series	Herbaceous Wetlands		X	This series does not occur in the project area.
Nodding Nixie	Bay – Shrub Wetlands		X	This species and its habitat do not occur in the project area.
Texas Bartonia	Bay – Shrub Wetlands		X	This species is addressed in the Project File - Botanical Survey of the Four Notch Area.
Sweetbay - Magnolia Series	Bay – Shrub Wetlands		X	This series does not occur in the project area.
Louisiana Squarehead	Dry-Xeric Oak-Pine Forest		X	Eliminated from consideration on Sam Houston NF by the Plan (Appendix D); the species and its habitat do not occur on the SHNF.
Shortleaf - Oak Forest	Dry-Xeric Oak-Pine Forest		X	Acreage of this community type would not be altered by this project.

Management Indicator	Management Indicator For:	Selected for Project		Rationale
		YES	NO	
Loblolly-Oak Forest	Mesic Oak-Pine Forest		X	Acreage of this community type would not be altered by this project.
Southern Ladyslipper	Mesic Hardwood Forest		X	This species and its habitat do not occur in the project area.
Beech-White Oak Series	Mesic Hardwood Forest		X	This series does not occur in the project area.
Bobwhite Quail	Tallgrass Prairie		X	Similar habitat requirements as Eastern Wild Turkey.
Little Bluestem-Indiangrass	Tallgrass Prairie		X	This plant community does not occur in the project area.
Neotropical Migrants	Bottomlands, Streamsides		X	Bottomlands or streamsides minimally impacted by the alternatives.
Neches River Rose Mallow	Bottomlands, Streamsides		X	Eliminated by the Plan (Appendix D) from consideration on Sam Houston NF; the species and its habitat do not occur on the SHNF.
Bottomland Hardwood	Bottomlands, Streamsides		X	Bottomlands or streamsides minimally impacted by the alternatives.
Eastern Wild Turkey	Forest/Grassland: Early Succession (0-20 yrs) Mid-Succession (20-50 yrs) Late Succession (50-90 yrs) Old Growth (90+ yrs)	X		Selected because this species is in demand; responds to forest management actions.
Whitetail Deer	Forest/Grassland: Early Succession (0-20 yrs) Mid-Succession (20-50 yrs) Late Succession (50-90 yrs) Old Growth (90+ yrs)	X		Selected because this species is in demand.
Yellow-breasted Chat	Forest/Grassland: Early Succession (0-20 yrs) Mid-Succession (20-50 yrs) Late Succession (50-90 yrs)	X		Selected as MIS for early successional habitat only (Forest MIS Document, March 01,2002)
Pileated Woodpecker	Forest/Grassland: Mid-Succession (20-50 yrs) Late Succession (50-90 yrs) Old Growth (90+ yrs)	X		Selected because this species is dependent on snags for foraging and nesting.

Management Indicator	Management Indicator For:	Selected for Project		Rationale
		YES	NO	
Gray/Fox Squirrel	Forest/Grassland: Mid-Succession (20-50 yrs) Late Succession (50-90 yrs) Old Growth (90+ yrs)		X	Squirrel populations fluctuate more in response to annual variations in mast crops rather than forest management; thus they are poor indicators of changing forest conditions that result from management.
Snags	Forest/Grassland: Early Succession (0-20 yrs) Mid-Succession (20-50 yrs) Late Succession (50-90 yrs) Old Growth (90+ yrs)		X	Addressed in discussion of bats in the Sensitive Species section of the Wildlife Report; key habitat component of the pileated woodpecker.
Largemouth Bass	Aquatic – Ponds and Reservoirs		X	No ponds/reservoirs in project area.
Sunfish – Redear and Bluegill	Aquatic – Ponds and Reservoirs		X	No ponds/reservoirs in project area.
Channel Catfish	Aquatic – Ponds and Reservoirs		X	No ponds/reservoirs in project area.
Paddlefish	Aquatic – Rivers and Streams		X	Inhabits large rivers; no large rivers in/near project area.
Sabine Shiner	Aquatic – Rivers and Streams		X	Addressed in Wildlife Report - Sensitive Aquatic Species section. Also see Project File - Aquatics Report.
Dusky Darter	Aquatic – Rivers and Streams		X	The sources of siltation that impact mussels are the same that impact this species. See Wildlife Report - Sensitive Aquatic Species section.
Scaly Sand Darter	Aquatic – Rivers and Streams		X	The sources or siltation that impact mussels are the same that impact this species. See Wildlife Report - Sensitive Aquatic Species section.
Stonefly Guild	Aquatic – Rivers and Streams	X		Selected as an indicator of water quality.