THREATENED AND ENDANGERED PLANT SPECIES

Green Pitcher Plant (*Sarracenia oreophila*)

Affected Environment

The U.S. Fish and Wildlife Service (USFWS) listed the green pitcher plant (*Sarracenia oreophila*) as an endangered species on September 21, 1979. Much of the following is taken from the 1994 revision of the Recovery Plan (U.S. Fish and Wildlife Service 1994) written for the species.

The green pitcher plant is restricted to sites in the Cumberland Plateau and Ridge and Valley Provinces in northeast Alabama, and to the Blue Ridge Province in Georgia and North Carolina. Only 35 natural populations of this species are known to be extant in Alabama (32), Georgia (1), and southwest North Carolina (2). Habitat for the plant is variable, and consists of both moist upland areas, many of which are described as seepage bogs, as well as boggy, sandy stream edges (U.S. Fish and Wildlife Service 1994).

Historical *Sarracenia oreophila* populations have been destroyed by residential development and clearing and disruption of the hydrological regimes for agriculture, silviculture and industrial use. Flooding of sites through construction of reservoirs, collection of plants and cattle grazing are also cited as reasons sites have been destroyed. All of these activities continue to be threats to extant populations of the green pitcher plant. Plant succession and woody encroachment in green pitcher plant bogs also threaten the bog habitat where this species occurs (U.S. Fish and Wildlife Service 1994).

This pitcher plant is not known to naturally occur on National Forest lands in the analysis area. However, the Chattahoochee National Forest has one population which was established, with the help of the Georgia Natural Heritage Program and the Atlanta Botanical Gardens, using propagated material from plants occurring only a few miles away on Nature Conservancy property. The *Sarracenia oreophila* population established on the Chattahoochee is currently protected from any direct or indirect adverse effects of forest management activities. Private landowners are not required to protect federally-listed plants, and thus public land is critical in protecting and aiding in recovery of *Sarracenia oreophila* where possible.

Direct, Indirect, and Cumulative Effects

Recovery opportunities on National Forest lands consist of continuing to survey for additional populations, protecting and managing populations if they are found, and protecting and managing the transplanted population on the Chattahoochee National Forest. Management actions are primarily those of controlling vegetative competition through pruning and prescribed burning, increasing light levels in the sites, and restoring the natural hydrological regime where necessary (U.S. Fish and Wildlife Service 1994). Effects to the green pitcher plant could occur through habitat

manipulation, but should be beneficial to the plants. Because the pitcher plant is protected under the Endangered Species Act, no activities with potential to affect the plants either adversely or beneficially can take place in the sites without concurrence from, or consultation with, USFWS.

It is likely that fire is needed to maintain suitable pitcher plant habitat (NatureServe 2001, U.S. Fish and Wildlife Service 1994). Myers (1997) noted in his paper on management of a green pitcher plant bog in North Carolina, that without fire the site will eventually become a shrub-dominated bog. Sutter et al. (1994) reported positive effects to green pitcher plants following prescribed burning in the spring. This would correspond to the period of greatest likelihood (April and May) of lightning fires in the Southern Appalachians (Bratton and Meier 1996). Sutter recommends, however, that fire be used as a management tool only when *Sarracenia oreophila* is beginning to decline and the site is dense with woody vegetation. Therefore, the revised Forest Plan contains a standard that states the 2-acre site on the Chattahoochee is burned only in the early spring and only as needed to control woody vegetation.

The transplanted site probably does not provide ideal soil conditions for the pitcher plants. There is an ongoing problem with lush growth of herbaceous competition. Current information indicates that naturally occurring green pitcher plant sites may contain an impermeable clay layer, or fragipan, limiting growth of competing herbaceous vegetation (R. Determann, pers. comm). However, the established plants are robust and many bloom annually, despite the limitations of the site. The Forest has been looking for additional introduction sites for establishment of green pitcher plants, but to date, no sites have been found with the appropriate habitat conditions. The Chattahoochee will continue to search for appropriate sites for establishment and maintenance of this species, and will notify USFWS is a site is found.

The green pitcher plant often occurs in riparian corridors, and the Riparian Prescription (MRx 11) will provide protection for any pitcher plants located in the corridors. In addition to the forestwide and green pitcher plant standards already discussed, standards in the Chattahoochee National Forest Plan that will provide additional protection to the green pitcher plant are those in the 9.F prescription that protect wetland rare communities. The pertinent standards are:

- Management actions that may negatively alter the hydrologic conditions of wetland rare communities are prohibited. Such actions may include livestock grazing and construction of roads, plowed or bladed fire lines, and impoundments in or near these communities. Exceptions may be made for actions designed to control impacts caused by beavers, or where needed to provide for public and employee safety and to protect private land resources.

- Beaver ponds and associated wetlands are normally protected as rare communities; however, beaver populations and dams may be managed to prevent negative effects to public safety, facilities, private land resources, and other rare communities. Where beaver wetlands and other rare communities are in conflict, decisions are based on the relative rarity of the communities and associated species involved, with the rarest elements receiving priority.

Of the 35 natural green pitcher plant populations in Alabama, Georgia and North Carolina, the Recovery Plan revision (U.S. Fish and Wildlife Service 1994) states that 6 sites are protected and considered secure in the long-term. In addition, The Nature Conservancy recently acquired the only naturally occurring population in Georgia, previously located on private land, thereby assuring its protection. There are 12 green pitcher plant populations protected on private land through Conservation Agreements with US Fish and Wildlife Service. Thus a total of 19 natural populations are currently protected (6+1+12). However, the 12 populations under Conservation Agreements are on privately owned land and are protected only as long as the landowner agrees to do so (U.S. Fish and Wildlife Service 1994). Continued protection and management of the transplanted population on the Chattahoochee NF as described above, and protection and management of the natural population on the newly acquired Nature Conservancy site, will prevent any cumulative effects to the species in Georgia.

The established site of *Sarracenia oreophila* on the Chattahoochee NF is protected under all alternatives for the reasons discussed above. To ensure no adverse effects to green pitcher plant occur on the Forest, botanical inventories would be conducted in potential habitat in accordance with procedures outlined in the Region 8 supplement of Forest service Manual 2672, before any ground disturbing activities take place. Site manipulation for improvement of green pitcher plant populations and habitat would be conducted only in consultation with USFWS. Because of the forestwide protective measures for wetland rare communities, for individuals and sites of federally-listed species, control of exotic species threatening federally-listed species and the additional standards discussed above, implementation of any alternative in the revised Forest Plan is not likely to adversely affect the green pitcher plant.

Large-flowered Skullcap (*Scutellaria montana*)

Affected Environment

The large-flowered skullcap was federally-listed as endangered in 1986, when only 10 populations were known. It was reclassified as federally-listed threatened effective February 13, 2002 based on an additional 74 occurrences (Federal Register 2002). This member of the mint family is only known to occur in the Ridge and Valley and Cumberland Plateau physiographic provinces in Tennessee, and the Ridge and Valley in Georgia (U.S. Fish and Wildlife Service 1996, Federal Register 2002). Habitat tends to be rocky, submesic to xeric, dominated by oak and hickory with some pine present, in mid to late successional forests (NatureServe 2001).

A population of large-flowered skullcap is considered to be self-sustaining (viable) if it has a minimum of 100 individuals (Federal Register 2002). According to the Federal Register (2002), Tennessee has 19 total populations, 9 of which are viable and 10 nonviable. Georgia has a total of 29 populations. Eight of the 29 populations are self-sustaining, and 21 are nonviable.

Two of the 29 populations are located on Forest Service land. Both are considered nonviable and consist of only 3 individuals in one of the populations, and 10 in the other. There are 2 additional, introduced populations located on the Chattahoochee National Forest. The plants were rescued from areas slated for development, propagated in the Atlanta Botanical Gardens, and then planted in appropriate habitat on the National Forest.

The skullcap is threatened primarily by habitat destruction from activities such as residential development, grazing, logging, and trampling along hiking trails. The presence of invasive species such as Japanese honeysuckle (*Lonicera japonica*) is a problem where disturbance allows the exotic species to become established (U.S. Fish and Wildlife Service 1996, Federal Register 2002). Currently, none of these threats appear to be a problem with any of the Chattahoochee populations.

Direct, Indirect, and Cumulative Effects

At this time there are no habitat management activities recommended for large - flowered skullcap. Several recovery tasks are discussed in the Recovery Plan for the skullcap (U.S. Fish and Wildlife Service 1996). They include the need to search for additional populations and the protection of existing sites through existing laws and regulations. The Chattahoochee is implementing both tasks.

Forestwide standards in the Chattahoochee National Forest Plan that would provide protection to the skullcap are those standards that would protect individuals and sites of federally-listed species and those that would control exotic species where they are adversely affecting listed species. To ensure that no adverse effects to the skullcap occur on the Forest, project-level inventories would be conducted in accordance with procedures outlined in the Region 8 supplement of Forest Service

Manual 2672, for all activities occurring within the known range and in potential habitat for *Scutellaria montana*.

In summary, two natural and two introduced populations of skullcap are present on the Chattahoochee National Forest where they are protected. These populations are currently considered nonviable. Management conditions necessary for long-term maintenance and vigor are not currently known. However, if information for management of the species does become available, it will be implemented where appropriate with the concurrence of USFWS.

The four populations (naturally-occurring and introduced) of *Scutellaria montana* on the Chattahoochee National Forest would be protected under all Plan alternatives. Because of the protective measures discussed above, implementation of any Plan alternative is not likely to adversely affect the large flowered skullcap.

Persistent Trillium (*Trillium persistens*)

Affected Environment

The persistent trillium (*Trillium persistens)* was federally-listed as endangered in 1978. Known populations are restricted to the Tallulah-Tugaloo River system in Rabun, Habersham, and Stephens Counties, Georgia, and Oconee County, South Carolina. The trillium appears to be restricted to gorges and steep ravines (U.S. Fish and Wildlife Service 1984). Habitat is variable, with plants occurring primarily in mixed pine-hemlock forests where they are often associated with *Rhododendron maximum*, or in mixed oak-beech forests (Patrick et al 1995). The persistent trillium population in South Carolina is located on private land (U.S. Fish and Wildlife Service 1984). One of the Georgia populations is located on the Chattahoochee National Forest. The Chattahoochee site is mesic with the presence of rhododendron (*Rhododendron maximum*) and dog-hobble (*Leucothoe axillaris*). Prior to the construction of dams and reservoirs that would have flooded former habitat, the population may have been more extensive along the riverbanks (NatureServe 2001).

Threats to the species include recreation use in the form of trails and camping (T. Patrick, pers. comm., U.S. Fish and Wildlife Service 1984), collection pressure, wildfire, and residential development (U.S. Fish and Wildlife Service 1984). The species cannot withstand disturbance, and populations on state land near abandoned or closed trails appear to be flourishing now that the trails are no longer used. (T. Patrick, pers. comm.). These threats do not appear to be pertinent to the Chattahoochee population, which is not located in an area of heavy recreation use.

Direct, Indirect, and Cumulative Effects

At this time there are no habitat management activities recommended for persistent trillium. The Recovery Plan (U.S. Fish and Wildlife Service 1984) mentions the need for research into light regime and soil moisture requirements to determine appropriate habitat management techniques. (Kral 1983) believes prescribed fire would damage *T. persistens*, and the Chattahoochee site of the trillium does not appear to be a fire maintained community. (Kral 1983) estimates that thinning and/or removing the overstory would damage or destroy the trillium plants. Should habitat manipulation appear to be necessary for the well being of the population on the Chattahoochee NF, management would be conducted only with informal or formal consultation with USFWS.

Several recovery tasks are discussed in the Recovery Plan for persistent trillium (U.S. Fish and Wildlife Service 1984). Among these are the need to search for additional populations and protection of existing sites through existing laws and regulations. The Chattahoochee is implementing both tasks. To date, no new populations have been found on Forest Service land.

Where needed to protect this species from potential adverse effects of management activities, project-level inventories would be conducted in accordance with procedures outlined in the Region 8 supplement of Forest service Manual 2672. This

would occur under all alternatives. Forestwide standards in the Chattahoochee National Forest Plan that provide additional protection to the persistent trillium are those standards that protect individuals and sites of federally-listed species and those that control exotic species where they are adversely affecting federally-listed species, as well as the additional standards already discussed.

As mentioned previously, one site of persistent trillium in Georgia occurs on the Chattahoochee National Forest. The majority of persistent trillium sites in Georgia are located on Georgia Power Company land within Federal Energy Regulatory Commission project boundaries and are, therefore, subject to ESA consultation requirements (U.S. Fish and Wildlife Service 1984). A few sites in Georgia are located on State land and two are reported to occur on private land (T. Patrick pers. comm.). Therefore, most of the sites are protected through Federal and State laws. This protection will prevent any cumulative effects to the species in Georgia.

The known site of *Trillium persistens* on the Chattahoochee National Forest is protected under all Plan alternatives. Where needed to protect this species from potential adverse effects of management activities, project-level inventories would be conducted in potential habitat within the known range of the trillium, in accordance with procedures outlined in the Region 8 supplement of Forest service Manual 2672. Because of the protective measures for individuals and sites of federally-listed species, control of exotic species threatening federally-listed species as well as the additional standards discussed, implementation of the revised Plan is not likely to adversely affect the persistent trillium.

Relict Trillium (*Trillium reliquum*)

Affected Environment

Relict trillium is a federally-listed species of basic mesic hardwood forests occurring on soils that contain a high level of organic matter and medium-to-high levels of calcium. The largest and most vigorous populations are located in the lower Piedmont/fall line sandhills province, in drainages of both the Savannah and Chattahoochee Rivers of Georgia and South Carolina. Relict trillium is known to occur from 21 populations (U.S. Fish and Wildlife Service, 1990) in Alabama, Georgia, and South Carolina, but none of the populations occur on National Forest land. Primary threats to the species are loss of habitat resulting from urban development, and in some cases, competition with invasive exotic species, logging, species conversion, or fire (TNC, 1990).

Direct, Indirect, and Cumulative Effects

All high quality basic mesic forest communities, habitat for relict trillium, would be managed under the 9.F Rare Community prescription under all alternatives. Several standards for rare communities ensure their maintenance and restoration across the landscape. Rare communities would be protected from detrimental effects caused by management actions across all alternatives. There is a forestwide standard that generally will exclude prescribed burning in basic mesic forests. Any prescribed fires occurring in that habitat will be low intensity. Where needed to protect the relict trillium from potential adverse effects of management activities, project-level inventories would be conducted in potential habitat within the known range of the trillium, in accordance with procedures outlined in the Region 8 supplement of Forest service Manual 2672.

Due to the fact relict trillium populations have not been found on National Forest land, project-level inventories would be conducted in potential habitat within the known range of the trillium, project-level inventories will be conducted in potential habitat within the known range of the trillium, because habitat for the species will be protected through the Rare Community Prescription (9.F), and because standards would be in place to protect the trillium should it be found in the future, there will be no effect to the species across all alternatives.

Rock Gnome Lichen (*Gymnoderma lineare*)

Affected Environment

Rock gnome lichen (*Gymnoderma lineare*) is a rare squamulose lichen that is endemic to the Southern Appalachian mountains of North Carolina, Tennessee, South Carolina, and Georgia. This species is the only member of its genus that occurs in North America and is similar in appearance to the more common genus *Cladonia*. The U.S. Fish and Wildlife Service listed rock gnome lichen as endangered on January 18, 1995 (Federal Register 1995) and a Recovery Plan (U.S. Fish and Wildlife Service 1997) was developed for this species that includes a range-wide summary of existing

population information and a comprehensive literature review. Much of the information provided below is taken from that document.

Gymnoderma lineare (Evans) Yoshimura and Sharp, is currently known from a total of 35 extant locations within four states (North Carolina, Tennessee, South Carolina, and Georgia) and has been extirpated from at least five sites where it was historically known to occur. Thirty of the remaining thirty-five sites are located on public lands where long-term protection may be afforded, yet many of these sites have experienced recent declines (U.S. Fish and Wildlife Service 1997).

Gymnoderma lineare populations are restricted to high elevation sites that are often bathed in fog, or steep humid gorges at lower elevations. High humidity seems to be an important habitat factor and the dense colonies are usually limited to near vertical, moist rock faces. Very little information exists regarding the life history or population biology of the species including dispersal mechanisms, and consequently populations are rather arbitrarily defined based on spatial separation (U.S. Fish and Wildlife Service 1997).

Gymnoderma lineare populations are threatened by recreational impacts associated with hikers, climbers, and sightseers, collectors, and the indirect effects of habitat modifications associated with logging and other disturbances. Air pollution and exotic pests also may be contributing to habitat declines through their effect to high elevation spruce/fir forests. No cause has been documented for the extirpation of the five historic sites, though one is suspected to have been impacted by highway construction, and the other four sites currently are subject to heavy recreational use. Most populations occupy an area less than one square meter and only eight of the remaining thirty-five populations cover greater than two square meters (U.S. Fish and Wildlife Service 1997) leaving all sites vulnerable to impact despite their occurrence on public (protected) lands. The combined factors of small populations and habitat declines related to factors that cannot be controlled by Forest Service management (air pollution and exotic pests) heighten the importance of maintaining existing populations and quality habitat.

Gymnoderma lineare is known from one location on the Chattahoochee National Forest on the Tallulah Ranger District. The lichen has not been found elsewhere on the Forest, despite searches for the species on other rock outcrops.

Direct, Indirect, and Cumulative Effects

The Recovery Plan for the lichen emphasizes the protection and monitoring of existing populations and inventory of suitable habitats to locate new populations. Major threats to populations include the singular or cumulative effects of habitat loss caused by recreational trampling (scraping), collection, air pollution, and declining forest canopies in adjacent high elevation forests. Due to its location on an exposed, steep, rock outcrop, recreational trampling and declining forest canopies are not threats to the Chattahoochee population.

The Rare Community (9.F) prescription and associated objectives and standards would provide adequate protection for *Gymnoderma lineare* from potential negative

effects of management activities. The standard written specifically for rock outcrops and cliffs states:

- Mature forest cover is maintained within 100 feet slope distance from the top of cliffs and 200 feet slope distance from the base of cliffs to provide habitat for cliff-associated species. Within this zone, activities are limited to those needed to ensure public safety or to maintain or improve habitat for federally-listed species or other species whose viability is at risk.

The Chattahoochee National Forest Plan includes forestwide standards that would protect individuals and locations of federally-listed threatened or endangered species, and where possible, control exotic species when they are causing adverse effects to federally-listed species. In appropriate habitat, project-level surveys would be conducted for the lichen in accordance with procedures outlined in the Region 8 supplement of Forest Service Manual 2672.

The combination of prescription allocations, forestwide standards, and project-level surveys discussed above would provide protection to *Gymnoderma lineare* populations and habitats from potential negative effects due to forest management activities. On the Chattahoochee National Forest, the known site for *Gymnoderma lineare* would be protected under all Plan alternatives. Because of the protective measures for individuals and sites of federally-listed species, control of exotic species threatening federally-listed species, and standards to protect the rock outcrop and cliff habitats, implementation of any Plan alternative is not likely to adversely affect the rock gnome lichen.

Small Whorled Pogonia (*Isotria medeoloides*)

Affected Environment

The small whorled pogonia (*Isotria medeoloide*s) was listed by the U.S. Fish and Wildlife Service as endangered in 1982 and revised to threatened status in 1992 based on discovery of new sites, achievement of protection for many of the sites, and additional life history and population information. This information and much of the following is taken from the Revised Recovery Plan (U.S. Fish and Wildlife Service 1992) written for the species.

*Isotria medeoloide*s (Pursh.) Raf. is a federally-listed orchid known from 16 states, including Virginia, West Virginia, North and South Carolina, Georgia and Tennessee (NatureServe 2001). This species occurs in three primary population centers, consisting of New England, the southern extreme of the Appalachian Blue Ridge at the juncture of North and South Carolina, Georgia, and Tennessee, and the coastal plain and piedmont region of Virginia, with outliers in Delaware and New Jersey. Disjunct populations occur in six sites in Pennsylvania, Ohio, Michigan, Illinois, and Ontario (U.S. Fish and Wildlife Service 1992). In the Southern Appalachian planning region, the only small whorled pogonia sites occurring on National Forest lands are located on the Chattahoochee and Sumter National Forests in Georgia and South Carolina, respectively. The locations on these National Forests are especially important because they are the only sites of the orchid known in the two states.

The Chattahoochee National Forest has 16 known sites with 33 colonies of the small whorled pogonia (using the definition of sites and colonies in the 1992 USFWS Recovery Plan). Numbers of individuals in each colony range from 1 to 50 according to Forest monitoring data from 2003. Colony sizes and stem counts of the species fluctuate widely year to-year on the Chattahoochee, a fact that makes viability assessment difficult and which is also noted in the 1992 Recovery Plan.

This species is found primarily in second and third-growth deciduous and mixed-deciduous/coniferous forests. Ages of the older trees on the sites vary from as young as 30 years old in South Carolina to 80 years old in Virginia. The forest habitat in which this orchid is found is not rare, yet only a small percentage of the habitat has colonies of small whorled pogonia. Site characteristics are highly variable, but are usually mesic, with sparse to moderate ground cover and a relatively open understory canopy. Old logging roads or streams are often nearby. Many sites show signs of past agricultural use (U.S. Fish and Wildlife Service 1992, Personal observation).

Most small whorled pogonia sites on the Chattahoochee National Forest in Georgia are near a stream and have sparse ground cover. Two sites have a dense coverage of New York fern (*Thelypteris noveboracensis*). Habitat varies from mixed hardwoods to hardwoods mixed with white Pine and hemlock. Several colonies of the orchid are growing in former pasture land with the presence of old house sites nearby, and one site appears to be in an old wagon road.

The primary threat to the small whorled pogonia throughout its range is habitat destruction by residential and commercial development. Collection of plants, recreational use, herbivory, and inadvertent damage from research activities are also cited as harming populations. Whereas heavy timbering and clear-cutting are considered threats, selective timbering may not be harmful to a population (U.S. Fish and Wildlife Service 1992).

Direct, Indirect, and Cumulative Effects

The Recovery Plan for small whorled pogonia (U.S. Fish and Wildlife Service 1992) lists several implementation tasks for recovery of the species. Those listed for federal agencies consist primarily of protection through existing laws and coordination with other governmental agencies and conservation organizations. The Forests in Georgia, South Carolina and Virginia have been implementing these tasks as well as conducting inventories for new locations of the orchid.

In South Carolina and Georgia, there is a concern that under-and midstory vegetation may be shading plants and possibly causing a decline in individual colonies. Vegetative removal studies have been conducted in Maine in 1993 and 1996, with possible positive response of the *Isotria* to the increased light at the forest floor (Dibble et al 1997). Vegetative removal studies began in New Hampshire in 1998, but will take at least 5 years to determine any effects of the removal (Sperduto, pers. comm). The Recovery Plan identifies the need for further research into effects of vegetation removal in small whorled pogonia sites, and thus there is an opportunity for the National Forests to experiment with such removal. Any risks of habitat manipulation through vegetation manipulation would likely be outweighed by potential benefits to the species (D. Harris, pers. comm.) Because the orchid is protected under the Endangered Species Act, no activities with potential to affect the plants either adversely or beneficially can take place in the sites without concurrence from, or consultation with, USFWS. Where needed to protect this species from potential adverse effects of management activities, project-level inventories would be conducted in accordance with procedures outlined in the Region 8 supplement of Forest Service Manual 2672. This will occur under all alternatives. Forestwide standards in the Forest Plan that provide additional protection to the small whorled pogonia are those standards that protect individuals and sites of federally-listed species and those that control exotic species where they are adversely affecting listed species.

A number of the small whorled pogonia sites occur on state and Federal lands, affording the species protection from development. According to the Recovery Plan (U.S. Fish and Wildlife Service 1992), 47 percent of known sites have some level of habitat protection. Known populations of the small whorled pogonia in Georgia occur only on the Chattahoochee National Forest where they are protected from potential adverse effects of forest management activities as discussed above. Private land sites in other states are being protected through agreements and conservation easements between the landowner and the state (U.S. Fish and Wildlife Service 1992). However, private landowners are not required to protect federally-listed plants, and thus public land is critical in protecting and aiding in recovery of the species.

According to the Recovery Plan, monitoring results of protected populations followed for years have shown declines, and many extant populations may not be self-sustaining. Causes for the declines are not known, but the loss of habitat functionality may be a factor. Until causes of declines are known, the small whorled pogonia could be at risk throughout its range. Meanwhile, populations of *Isotria medeoloides* will be protected through enforcement of the Endangered Species Act and efforts made to strengthen protective regulations at the state and local levels (U.S. Fish and Wildlife Service 1992).

Sites of *Isotria medeoloides* would be protected on the Chattahoochee NF under all revised Plan alternatives. To ensure no adverse effects to small whorled pogonia occur on the Forest, botanical inventories would be conducted in potential habitat in accordance with procedures outlined in the Region 8 supplement of Forest Service Manual 2672. Any site manipulation for improvement of *Isotria* populations and habitat would be conducted only in consultation with USFWS. Because of the protective measures for individuals and sites of federally-listed species and control of exotic species threatening federally-listed species, implementation of any alternative in the revised Plan is not likely to adversely affect the small whorled pogonia.

Smooth Coneflower (*Echinacea laevigata)*

Affected Environment

Smooth coneflower, a federally-listed species, is a plant of roadsides, open woods, barrens and glades, utility rights-of-way, or other sunny situations, usually in association with calcium- or magnesium-rich soils underlain by mafic rock (Gaddy 1991). Smooth coneflower is known to occur in Georgia, South Carolina, North Carolina, and Virginia, but has been reported historically from Pennsylvania, Maryland, Alabama, and Arkansas as well. Based on information of 24 surviving populations, summarized in the Recovery Plan, 7 populations occur on National Forest land (South Carolina, Georgia, Virginia), 9 occur on private land, and the remaining 8 occur under various federal or state ownerships (US Fish and Wildlife Service 1995). The recovery objective for classification from endangered to threatened is 12 geographically distinct, self-sustaining (stable or increasing for 10 years or more) populations.

On the Chattahoochee National Forest, smooth coneflower is known to occur only on the Chattooga Ranger District in Habersham and Stephens Counties. There are 25 known sites on national forest land in Georgia, ranging in size from 1 individual to approximately 1,000 plants. These sites for smooth coneflower occur predominantly along roadsides and in power line rights-of-way.

Historically, much of the species' habitat was xeric woodlands, savannas, or grasslands that were maintained in an open condition by fires caused by lightning or Native American burning (Davis et al. 2002). Optimal sites for smooth coneflower have little herbaceous competition and an abundance of sunlight (Gaddy 1991). With the concurrence of USFWS, habitat management, including removal of encroaching woody vegetation and prescribed burning, has been ongoing on the Chattahoochee sites for several years to provide these open conditions for the plants.

Direct, Indirect, and Cumulative Effects

All alternatives include the general goal of contributing towards the recovery of federally-listed threatened and endangered species. A population size of at least 250 plants may be required to ensure maintenance of genetic diversity, protect against random events that may lead to local extinctions, and facilitate attraction of pollinators (Kindscher pers. comm. with R. Roecker). In order to meet this objective, active management would be required. Management tools needed to achieve this condition would primarily be prescribed fire, mid-story or overstory removal, and mowing between November and early March (U.S. Fish and Wildlife Service 1995). Site-specific planning of these activities would be used to ensure there would be no adverse effects to individuals. Concurrence from U.S. Fish and Wildlife Service will occur prior to implementation of any management in the coneflower locations. All alternatives in the revised Forest Plan include a forestwide objective for the development of a management plan for the coneflower over the next 3 years. The smooth coneflower management plan will address the number of acres to be managed for the coneflower; boundaries of a Habitat Management Unit (HMU) for the

coneflower and the associated Georgia aster; number of populations to be managed within the HMU; methods of habitat management for the species, including appropriate burn interval; road maintenance adjacent to roadside populations; establishment of coneflowers (local genetic stock) into appropriate, protected (i.e. not along road banks) habitat; and any additional information appropriate for the management plan.

Forestwide standards in the Chattahoochee National Forest Plan that would provide protection to the smooth coneflower are those standards that would protect individuals and sites of federally-listed species and those that would control exotic species where they are adversely affecting listed species. Additional objectives included in the Forest Plan would increase abundance of optimal habitat for this species and create opportunity for establishment of new populations. Objectives call for restoration and maintenance of woodland, savanna, and grassland habitats. Alternatives would vary only slightly in the size of habitat restoration efforts and therefore extent to which coneflower would be encouraged to spread in these habitats. In all alternatives, glades and barrens rare communities, with which this species is sometimes associated, will be restored or maintained where they occur on the Forest, and will be managed under the Rare Community Prescription (9.F) and associated objectives and standards. Project-level surveys will be conducted in accordance with procedures outlined in the Region 8 supplement of Forest Service Manual 2672 to document new occurrences in these habitats, providing them with the site-specific protections afforded to existing sites. Project-level surveys would be conducted in accordance with procedures outlined in the Region 8 supplement of Forest Service Manual 2672 to document new occurrences in these habitats, providing them with the site-specific protections afforded to existing sites.

Many T&E plants require only protection of known locations. Because their populations do not primarily reflect effects of management activities, they are often ineffective as Management Indicator Species (MIS). However, T&E plant species that are known to be highly associated with, or responsive to, forest management activities are appropriate. Fire-dependent species meet these criteria. As discussed above, the smooth coneflower (*Echinacea laevigata*) is dependent on prescribed fire and other methods of habitat restoration. Therefore, this species is selected as an MIS to indicate the effects of management on its recovery. Other T&E plant species will continue to be monitored. Population trend estimates based on expected trends in coneflower habitat quantity and quality by alternative are shown in Table 3- 120:

Table 3- 120. Expected Population Trend[1] Of Smooth Coneflower (*Echinacea Laevigata*) On The Chattahoochee NF by Alternative, 10 And 50 Years Following Plan Adoption

	Alternative						
Time Period	A	B	D	E	F	G	I
10 years	+	+	+	+	+	+	+
50 years	++	++	++	++	+	++	++

[1] *Population trend expressed as expected change from current levels: "++" = relatively large increase, "+" = increase, "=" = little to no change, "-" = decrease, "- -" = relatively large decrease.*

Federally-listed plants receive little or no protection on private land. Therefore, public land plays a critical role in their conservation. The occurrence of the smooth coneflower primarily along roadsides and utility rights-of-way, along with the necessity of active management such as prescribed fire, suggest that in the future this species will continue to be extremely vulnerable to extirpation on private land. Cumulatively, therefore, persistence of the species in the area of the national forest, as well as across its range, will be greatly enhanced from efforts on the Chattahoochee to maintain and expand populations.

Because of provisions for protecting and maintaining existing sites of populations, and activities that would maintain and restore quality habitats, all Plan alternatives are not likely to adversely affect *Echinacea laevigata*, and are expected to have beneficial effects on the species.

Swamp pink (*Helonias bullata*)

Affected Environment

The swamp pink (*Helonias bullata*) was designated as federally-threatened in 1988. It is currently known from 7 states; New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, and Georgia (U.S. Fish and Wildlife Service 1991). A population reported from an eighth state, New York, is believed extirpated. The majority of the populations are found on private lands. Populations on national forest lands in the Southern Appalachians occur only in North Carolina and Virginia. Coastal Plain populations are known only from New Jersey to Virginia, and none of these occur on national forest lands.

Habitat for the swamp pink consists of a variety of wetland types, including bogs, spring seeps, wet meadows, and swampy forests that border small streams (U.S. Fish and Wildlife Service 1991). Habitat loss through draining and filling of wetlands, development, and timbering, as well as collection, trampling, and biological factors are all cited as threats to the swamp pink. The species is also highly vulnerable to habitat siltation resulting from run-off from adjacent development (NatureServe 2001).

Helonias is not known to naturally occur on the Chattahoochee National Forest. However, the Forest has one population, which was established by the Georgia Plant Conservation Alliance, using propagated material from plants occurring several miles away on private land.

Direct, Indirect, and Cumulative Effects

Recovery opportunities for swamp pink on the Chattahoochee consist primarily of continuing to survey for populations, protecting and managing populations and habitat if they are found, and protecting and managing the transplanted population (U.S. Fish and Wildlife Service 1991). Private landowners are not required to protect federally-listed plants, and thus public land is critical in protecting and aiding in the recovery of *Helonias bullata*. The established site of *Helonias bullata* would be protected on the Chattahoochee under all alternatives in the revised Forest Plan. On the Chattahoochee National Forest, the wetland habitats necessary for the swamp pink would be protected through the Rare Community (9.F) and Riparian (11) prescriptions. Additionally, the revised Plan includes forestwide standards present in all alternatives that would protect individuals and sites of federally-listed species, and standards that would control exotic species where they are adversely affecting federally-listed species. Project-level surveys would be conducted in accordance with procedures outlined in the Region 8 supplement of Forest service Manual 2672, to ensure that management activities do not adversely affect the swamp pink. Because of the protective measures for wetland rare communities through the riparian and rare community prescriptions, protection for individuals and sites of federally-listed species, and control of exotic species threatening federally-listed species, implementation of any Plan alternative is not likely to adversely affect the swamp pink.

Georgia Aster – *Symphyotrichum georgianus*

Affected Environment

Georgia aster, a candidate for federal listing, is a plant of roadsides, open woods, barrens and glades, utility rights-of-way, or other sunny situations, and appears to be adaptable to dry, open habitats independent of soil type (Mathews, 1993). Historically, much of the species' habitat was xeric woodlands, savannas, or grasslands that were maintained in an open condition by fires caused by lightning or Native American burning (Mathews 1993, Davis et al. 2002).

Georgia aster is known to occur in North Carolina, Georgia, South Carolina, and Virginia. Based on information summarized in a status survey completed in December 1993, there are 56 surviving populations, though many appear to be declining (Matthews 1993). On the Chattahoochee National Forest, Georgia aster is documented from four locations on the Chattooga Ranger District. All known sites occur along roadsides.

Direct, Indirect, and Cumulative Effects

To ensure maintenance of genetic diversity, protect against random events that may lead to local extinctions, and facilitate attraction of pollinators, a population size of at least 250 plants may be required (Kindscher pers. comm. with R. Roecker). In order to meet this objective, active management would be necessary. Maintenance of existing sites would likely involve prescribed burning, but could also include other vegetation management treatments, such as removal of competing vegetation. Seed collection, propagation, or out- planting, may also be used to supplement populations or ensure their spread from road banks and rights-of-way into adjacent stands. Site-specific planning of these activities would be used to ensure that adverse impacts to populations would not occur.

Forestwide standards in the Chattahoochee National Forest Plan that provide protection to the Georgia aster are those standards that protect individuals and sites of species with viability concerns, and those that control exotic species where they are adversely affecting such species. These standards apply across all alternatives. Additional objectives included in the Forest Plan would increase abundance of optimal habitat for Georgia aster and create opportunity for establishment of new populations. Objectives call for restoration and maintenance of woodland, savanna, and grassland habitats. Expected levels of such restoration and maintenance vary by alternative (see Section on Woodlands, Savannas, and Grasslands), but all would provide some potential benefit. In addition, glades and barrens, with which this species is sometimes associated, are identified as rare communities and would be restored or maintained across all alternatives and would be managed under the Rare Community Prescription (9.F) where they occur. Project-level surveys would be conducted in accordance with procedures outlined in the Region 8 supplement of Forest Service Manual 2672 to document new occurrences in these habitats, providing them with the site-specific protections afforded to existing sites.

Because rare plants often receive little or no protection on private land, and are often not well inventoried, public land plays a critical role in their conservation. The occurrence of this species primarily along roadsides and utility rights-of-way, along with the necessity of active management such as prescribed fire, suggest that this species will continue to be extremely vulnerable in the future to extirpation on private land. Cumulatively, therefore, persistence of the species in the area of the national forest, as well as across its range, will be greatly enhanced from efforts on the national forest to maintain and expand populations.

Based on provisions for protection and maintenance of existing populations and sites, and objectives for restoring and improving suitable habitat, all alternatives are expected to result in beneficial impacts to this species.

White Fringeless Orchid (*Platanthera integrilabia*)

Affected Environment

White fringeless orchid or monkeyface orchid (*Platanthera integrilabia*) is listed as a Candidate for federal listing by the U.S. Fish and Wildlife Service, and is on the Regional Forester's Sensitive Species List for the Southern Region. A Conservation Strategy (Bailey, 2001) was developed for this species in 2001 on the Cherokee National Forest that includes a range-wide summary of existing population information and a comprehensive literature review. Much of the information provided below is taken from that document.

Platanthera integrilabia (Corell) Luer is currently known from a total of sixty-one extant locations within five states (Alabama, Georgia, Kentucky, Mississippi, and Tennessee) and is considered extirpated from three states (North Carolina, South Carolina, and Virginia). *Platanthera integrilabia* populations occur across a wide geographic area and consequently are found under a diverse array of environmental conditions. Because of this, it is difficult to characterize the specific habitat requirements for any given locale. However, in general plants are found in wet, flat, boggy areas, stream heads, or seepage slopes in acidic muck or sand in association with species of *Sphagnum* moss and one or more of the following fern species: Cinnamon fern (*Osmunda cinnamomea*), chain fern (*Woodwardia areolata*), and New York fern (*Thelyptris noveboracensis*).

The rarity of *Platanthera integrilabia* throughout it's range may be dependent on a combination of several factors including natural rarity of habitat, habitat loss, low seed germination rates, low flowering and fruit-set rates, and lack of effective pollinators. Habitat loss is recognized as the primary threat to the species range-wide and can be manifested directly through habitat conversion, or indirectly through alterations to the hydrology at a given site, occurring as secondary effects from activities such as road building, timber harvest, etc. Siltation of habitat, herbivory, and competition from exotic species are other threats that may impact populations.

Like many orchid species, *Platanthera integrilabia* is dependent upon a symbiotic relationship with a fungus for seed germination (Zettler et al. 1990, Zettler and McInnis 1992, Zettler 1994, Currah et al. 1997). While an individual orchid capsule may produce thousands of dust-like seeds, only a tiny fraction of those seeds will be dispersed to a site that supports adequate habitat conditions and the required fungal species for seed germination. While many orchid species have a symbiotic relationship with several different fungal species, it has been suggested (Crock 1996, Zettler 1996) that the distribution of *Platanthera integrilabia* is further limited by the fact that there may be only a single fungal symbiont capable of initiating seed germination. Zettler (1996) showed that both in the lab and under natural conditions only 3 percent of *Platanthera integrilabia* seeds germinate to produce a seedling plant. Similarly, only a very small percentage of individuals ever flower and set viable seeds. With so many biological constraints affecting the viability of populations, the importance of maintaining existing populations and quality habitat through land management is heightened.

Platanthera integrilabia is known from one location on the Chattahoochee National Forest, on the Chattooga Ranger District. The plants occur in a small, swampy streamside area dominated by red maple (*Acer rubrum*) and poplar (*Liriodendron tulipifera*). The plants were first noted in 1957, and revisited in 1991 by Margaret Shea while conducting a status survey for the species for U.S. Fish and Wildlife Service (Shea 1992). At that time 11 flowering plants and 34 vegetative plants were noted. The orchid has been documented from 6 other sites in Georgia, all on private land (Patrick et al. 1995).

Direct, Indirect, and Cumulative Effects

Threats to the orchid include illegal collection, herbivory, disease, and competition from exotic species (Zettler and Fairey 1990). Zettler and Fairey (1990) noted both herbivory and disease in a large population on private land in Rabun County, Georgia. Alterations to existing hydrology could threaten the species, as discussed above. In Georgia, draining and clearing land for conversion to agricultural use is cited as a reason for significant habitat loss for the orchid (Patrick et al. 1995).

On the Chattahoochee National Forest, all wetland habitats and known sites for *Platanthera integrilabia* would be protected under all Plan alternatives through the Rare Community and Riparian prescriptions. Additionally, the Chattahoochee National Forest Plan includes forestwide standards that would 1) protect individuals and locations of species needed to maintain their viability within the planning area, and, 2) control exotic species where they are causing adverse effects to rare species within the planning area. Where needed to protect this species from potential adverse effects of management activities, project-level inventories would be conducted in accordance with procedures outlined in the Region 8 supplement of Forest service Manual 2672. This will occur under all alternatives. Because the plants and their habitat will be protected under the implementation of any Plan alternative, there will be no impact to *Platanthera integrilabia*.

As already discussed, this species has some inherent biological limitations that could continue to pose risks to its long-term survival, especially at sites where population numbers are low. Out of 61 extant sites for the species across their range, only a few occur on Forest Service lands. In Georgia, only 1 site out of 7 occurs on national forest. Based upon this, it is apparent that while Forest Service conservation actions may contribute to sustainability of the species range-wide, cumulatively, the long-term survival of the species across its range is at risk due to the fact most locations occur on private land.

THREATENED AND ENDANGERED TERRESTRIAL ANIMAL SPECIES

Bald Eagle (*Haliaeetus leucocephalus*)

Affected Environment

The bald eagle ranges over most of the North American continent, from as far north as Alaska and Canada, down to Mexico. Experts believe that in 1782 when the bald eagle was adopted as our national bird, their numbers may have ranged from 25,000 to 75,000 nesting pairs in the lower 48 states. Since that time the species has suffered from habitat destruction and degradation, illegal shooting, and most notably from contamination of its food source by the pesticide DDT. In the early 1960's, only 417 nesting pairs were found in the contiguous 48 states. In 1999, more than 5,748 nesting pairs of bald eagles were recorded for the same area, resulting primarily from the banning of DDT in the United States in 1972 aided by additional protection afforded under the Endangered Species Act (U.S. Fish & Wildlife Service 1999). Bald eagles have few natural enemies, but usually prefer an environment of quiet isolation from areas of human activity (i.e. boat traffic, pedestrians, or buildings), especially for nesting. Their breeding areas are generally close to (within 4 km) coastal areas, bays, rivers, lakes, or other bodies of water that reflect general availability of primary food sources including fish, waterfowl, rodents, reptiles, amphibians, seabirds, and carrion (Andrew and Mosher 1982, Green 1985, Campbell et al. 1990). Although nesting territory size is variable, it typically may encompass about 2.59 square kilometers (Abbott, 1978). Most nest sites are found in the midst of large wooded areas adjacent to marshes, on farmland, or in logged-over areas where scattered seed trees remain (Andrew and Mosher, 1982). The same nest may be used year after year, or the birds may alternate between two nest sites in successive years. Bald eagles mate for life and are believed to live 30 years or more in the wild. Although bald eagles may range over great distances, they usually return to nest within 100 miles of where they were raised (U.S. Fish & Wildlife Service 1995).

Winter home ranges for eagles can be very large, especially for non-breeding birds. They generally winter throughout the breeding range but are more frequent along the coast. These birds commonly roost communally.

The primary threats to the bald eagle include loss of nesting, foraging, and roosting habitat especially along shorelines, disturbance by humans, biocide contamination, decreasing food supply, and illegal shooting (Byrd and Johnstone 1991, Buehler et al 1991). Bald eagles also have died from lead poisoning as a result of feeding on waterfowl that had inadvertently ingested lead shot. In 1991, the U.S. Fish and Wildlife Service completed a program to phase out lead shot for waterfowl hunting.

Bald eagles have been seen foraging on Lakes Notley, Chatuge and Blue Ridge on the Chattahoochee. They are seen more frequently foraging on the Oconee National Forest on Lake Oconee, Lake Sinclair, and the Oconee River. There have also been reports of eagles foraging on the Ocmulgee River. Eagle nests are present below Wallace Dam on Lake Sinclair, on Lake Jackson north of the Oconee National Forest, and on Lake Juliette approximately 10 miles from the Oconee National Forest.

Nesting and winter roosting habitat does occur on the Chattahoochee-Oconee National Forest, but no active nests have been found on the Forest during recent aerial surveys for the species (Ozier, pers. comm.), and no winter roosts have been found. Known nesting activity is concentrated along the coast and in the central and southern portions of Georgia (Ozier 1999).

Direct, Indirect, and Cumulative Effects

Timber harvesting or road building activities have the potential to impact the bald eagle or its habitat should it occur near streams, lakes, or other wetlands. Human disturbance from roads, trails, and campgrounds can also adversely affect the use of an area for nesting or roosting by eagles.

The Forest Plan includes a standard establishing 1,500-foot protection zones around bald eagle nests and communal roost sites. Vegetation management that would affect forest canopy within these zones is prohibited, and other activities that may disturb eagles are prohibited within these zones during periods of use by eagles. The Riparian Prescription (prescription 11), with its emphasis on low levels of disturbance and maintenance of mature forest, provides direction for management of shorelines where bald eagles may forage.

Currently no nests have been found on National Forest (Ozier pers. comm.). However, if nests are found, protective measures will be implemented immediately. Standards for bald eagle and riparian habitat will protect nesting, roosting and foraging habitat for the species. These protective measures will also prevent adverse cumulative effects to bald eagle nesting, roosting or foraging habitat.

Through management direction and standards that address protection of habitat, roosts and nests from human disturbance, the Forest Plan and alternatives are not likely to adversely affect the bald eagle, and should provide conditions beneficial to this species.

Red-cockaded Woodpecker (*Picoides borealis*)

Affected Environment

The red-cockaded woodpecker (RCW), *Picoides borealis,* is a federally-listed endangered species endemic to open, mature and old–growth pine ecosystems in the southeastern United States. Currently, there are an estimated 14,000 RCWs living in roughly 5,600 active clusters across eleven states. This is less than three percent of estimated abundance at the time of European settlement (U.S. Fish and Wildlife Service 2003). The RCW was listed as endangered in 1970 and received federal protection under the Endangered Species Act of 1973. The precipitous decline in population size that led to the species' listing was caused by an almost complete loss of habitat. Fire-maintained old-growth pine savannas and woodlands that once dominated the southeast, no longer exist except in a few, isolated, small patches. Longleaf pine (*Pinus palustris*) ecosystems, of primary importance to RCWs, are now among the most endangered ecosystems on earth. Shortleaf (*P. echinata*), loblolly (*P. taeda*), and slash pine (*P. elliottii*) ecosystems, important to RCWs outside the range of longleaf, also have suffered severe declines (U.S. Fish and Wildlife Service 2003).

The red-cockaded woodpecker occurs on the Oconee and Hitchiti portions of the Oconee National Forest (ONF) south of Interstate 20 in Jasper, Jones, Putnam and Baldwin counties. The area is located in the Piedmont physiographic province in central Georgia. It consists of 51,746 acres of predominantly loblolly and shortleaf pines in the overstory, with a dense mid-story of regenerating sweetgum, pine and oak species. A majority of the area consists of old pine plantations located on lands that were previously used as agricultural fields. In the revised LRMP, this portion of the ONF is allocated to Management Prescriptions 3.B (Hitchiti Experimental Forest), 8.D (RCW HMA) and 8.D.1 (RCW sub-HMA).

The Oconee, along with the Piedmont National Wildlife Refuge (PNWR), is designated in the Recovery Plan for the Red-cockaded Woodpecker Second Revision, as the Oconee/Piedmont secondary core population and together they comprise the Piedmont Recovery Unit. According to the RCW Recovery Plan, the ONF and PNWR together are responsible for providing 250 potential breeding groups of the bird. Currently, there are 15 active clusters on the Hitchiti Experimental Forest and two active clusters on the sub-HMA, for a total of 17 active clusters on the ONF. The number of active clusters generally is equal to 1.1 to 1.4 times the number of potential breeding groups (USFWS 2003).

Current threats to RCW recovery on National Forest lands are: the loss of roosting and nesting substrate through past over-harvest or die-off of mature pines; the loss of foraging habitat and proper stand structure through encroachment of woody vegetation into preferred herbaceous ground-covers due to the absence of dormant- and, especially, growing-season fires; and the loss of suitable habitat through unimpeded succession of pine and pine-hardwood stands toward hardwood-dominated conditions. Red-cockaded woodpeckers' naturally low fecundity and the

potential effects of isolation, habitat fragmentation, and cavity competition exacerbate these habitat limitations (U.S. Fish and Wildlife Service).

Direct, Indirect, and Cumulative Effects

The Forest will utilize several management actions to alleviate these threats and to restore habitat for the species. These actions will follow the direction in the RCW Recovery Plan, and will include:

- production and retention of pine trees 100+ to 120+ years old, depending on tree species (not less than 120 years for shortleaf, and 100 years for loblolly pines)
- retention of potential roost trees; the installation of artificial roosting and nesting cavities
- protection of artificial and natural cavities from competitors through the installation of excluder devices
- restoration and maintenance of low (50-80 sq. ft per acre) basal areas of trees in upland pine and pine hardwood forest stands
- restoration of native pine species on altered, off-site plantations and other appropriate upland sites
- thinning of mid-successional and mature pine and pine-hardwood stands
- control of hardwood midstory encroachment through the use of mechanical, chemical, and prescribed burning methods.

Chemical and mechanical treatment of midstory hardwoods will be used where fire is not a viable management tool.

Both dormant season and growing season prescribed burns will be utilized to maintain RCW habitats. Growing season burns are more efficacious in killing encroaching hardwoods, restoring habitat structure, and favoring the development of native, pyrophytic grasses and forbs. There will be approximately 16,000 total acres per year burned in the RCW HMA, and the sub-HMA, and Hitchiti Experimental Forest. During the prescribed burning, active and inactive cavity trees within burn units will be protected using the guidelines in the second revision of the RCW Recovery Plan.

Additional methods used to aid in the recovery of the RCW are capture, banding and monitoring of individual birds, the translocation of birds from donor populations to recipient populations, and inter-population (as well as intra-population if approved by USFWS) translocations as necessary to optimize annual reproduction. These techniques will follow RCW Recovery Plan (Second Revision) requirements for permits, training of personnel, and other guidelines for translocation. Translocation to the HMA will occur when habitat has been established and within 5 to 7 years of Plan implementation. Because there are risks in translocating RCWs, including mortality of individual birds related to capture and handling, translocation will be implemented only through consultation with USFWS.

Table 3- 121 identifies red-cockaded woodpecker population objectives on the HMA Oconee portion of the Oconee/Piedmont secondary core population. Long-term population goals were determined in cooperation with the U.S. Fish and Wildlife

Service as part of the Revised Recovery Plan. Short- term population goals are defined as population increase objectives over the next ten years. These objectives are for minimum population growth as directed in the Revised Recovery Plan. Greater population growth during the planning period is desirable and encouraged.

Table 3- 121. Red-cockaded Woodpecker Habitat Management Area Population Objectives for the Oconee NF portion of the Oconee/Piedmont Secondary Core Population

RCW HMA	2002 Active Clusters	Long-Term Population Goal	Short Term Population Goal	Recovery Designation
Oconee	17	176	25	Secondary Core

Management direction has been incorporated into the Forest Plan through the allocation of acres to the RCW HMA Area Prescription (MRx-8.D.) and the RCW sub-HMA Prescription (MRx 8.D.1). These prescriptions and their associated standards will aid in the protection and recovery of the species. Management direction to benefit the RCW also has been incorporated into the Hitchiti Experimental Forest Management Prescription (MRx 3.B). Additional benefits to the RCW will be derived from objectives and standards in the Rare Communities Prescriptions for woodlands, savannas and grasslands, and the prescription for Restoration of Shortleaf Ecosystems.

The actions discussed above will reduce habitat isolation and fragmentation, thus encouraging RCW population expansion as suitable habitat is increased across the Habitat Management Areas. Adherence to the RCW Recovery Plan, the Chattahoochee-Oconee Land and Resource Management Plan (LRMP), and the "FEIS for the Management of the Red-cockaded woodpecker and its Habitat on National Forests in the Southern Region" (U.S. Forest Service 1995) will avoid any adverse cumulative effects to the RCW.

Compliance with the Recovery Plan for the Red-cockaded Woodpecker, Second Revision, along with management actions discussed in the above sections, will ensure that implementation of the Land and Resource Management Plan for the Chattahoochee-Oconee National Forest is not likely to adversely affect the red-cockaded woodpecker.

Wood Stork (Mycteria americana)

Affected Environment

The United States breeding population of wood storks is listed as an endangered species. This species may have formerly bred throughout all of the coastal southeastern United States from Texas to South Carolina. Currently, they breed throughout Florida, Georgia, and coastal South Carolina. Post-breeding storks from Florida, Georgia, and South Carolina occasionally disperse as far north as North Carolina and as far west as Mississippi and Alabama. Storks sighted in Arkansas, Louisiana, Texas, and points farther west may have dispersed from colonies in Mexico. The amount of overlap and/or population interchange is unknown (U. S. Fish and Wildlife Service 1996).

The estimated total population of nesting storks throughout the southeastern United States declined from 15,000 to 20,000 pairs during the 1930's to a low of between 4,500 and 5,700 pairs for most years between 1977 and 1980. Since 1983, the U.S. population has ranged between 5,500 and 6,500 pairs. Factors contributing to the decline include loss of feeding habitat, water level manipulations affecting drainage, predation and/or lack of nest tree regeneration, and human disturbance (U. S. Fish and Wildlife Service 1996).

Wood storks use a variety of freshwater and estuarine wetlands for nesting, feeding, and roosting. Freshwater colony sites must remain inundated throughout the nesting cycle to protect against predation and abandonment. Foraging sites occur in shallow, open water where prey concentrations are high enough to ensure successful feeding. Good feeding conditions usually occur where the water column is uncluttered by dense patches of aquatic vegetation. Typical foraging sites throughout the species range include freshwater marshes and stock ponds, shallow, seasonally flooded roadside or agricultural ditches, narrow tidal creeks or shallow tidal pools, managed impoundments and depressions in cypress heads and swamp sloughs. Almost any shallow wetland depression where fish become concentrated, either through local reproduction or the consequences of area drying may be used as feeding habitat (U.S. Fish and Wildlife Service 1996).

Portions of the Oconee National Forest are used as late summer foraging areas by post-breeding storks that disperse from the nesting areas (E. Caldwell, USFS; N. Nicholson, Georgia DNR, pers. comm.). There are no known nesting or roost sites on the Oconee National Forest. The closest nesting colony is in Burke County, Georgia, approximately 100 miles to the southeast. On the Oconee, wood storks forage in wetlands, beaver swamps and the Dyar Pasture waterfowl impoundment. Use of most feeding areas is short-term and the use of any individual area varies from year-to-year depending on water levels and the availability of forage fish. During the recent drought years, wood storks have consistently used Dyar Pasture between late June and August. As many as 40-50 birds have been present at once for short periods of time (3-4 weeks). In addition to Dyar Pasture, occasional foraging use by wood storks has been observed at two wetland/beaver swamp sites near Falling Creek in the Scull Shoals Experimental Forest. The use of these sites as foraging areas is

dependent on having appropriate water levels during late summer, which to a great degree is dictated by weather conditions. Even at Dyar Pasture where there is some ability to control water levels, the timing and duration of use by wood storks is influenced by rainfall patterns. Alterations to the water control structure at Dyar Pasture to permit further drawdown are needed to optimize use by foraging wood storks (N. Nicholson, pers. comm.). Georgia DNR and the U. S. Forest Service have periodically stocked Dyar Pasture with prey fish to enhance foraging conditions for wood storks (E. Caldwell, pers. comm.).

Wood storks are not known to use the Chattahoochee NF.

Direct, Indirect, and Cumulative Effects

Factors contributing to the decline of wood storks include loss of feeding habitat, water level manipulations affecting drainage, predation and/or lack of nest tree regeneration, and human disturbance (U.S. Fish and Wildlife Service 1996).

Under the revised Forest Plan, the wood stork foraging areas at Dyar Pasture and the Falling Creek sites would be managed in all alternatives under the Riparian Corridor prescription. The riparian corridor standards ensure that these sites would be managed to retain, restore, and/or enhance the inherent ecological processes and function of the associated aquatic, riparian, and upland components within the corridor. The appropriate Wetland Rare Community (9.F) standards also would be applied to natural wetland sites currently used for foraging (such as the Falling Creek sites) as well as other wetland sites that may be used in the future. The wetland rare communities would be managed under all alternatives for protection, maintenance, and where possible, restoration. The Dyar Pasture and Falling Creek sites also fall within the Oconee River corridor, which would be managed under the Outstandingly Remarkable Rivers prescription (4.H). The primary emphasis for management of this river corridor is to protect and enhance its unique values.

The Forest Plan also contains several specific standards designed to enhance foraging conditions for wood stork on the Oconee National Forest. This includes a standard that will ensure that water levels in artificial impoundments (such as Dyar Pasture) used by foraging wood storks would be managed to provide favorable water levels for this species, and a standard that encourages the stocking of artificial impoundments used by wood storks with preferred prey fish such as sunfish, bullhead and catfish. These standards, along with the riparian corridor and rare community standards discussed above would ensure that vegetative and hydrologic conditions of existing and potential wood stork foraging areas would be protected and foraging conditions enhanced under all alternatives.

Human disturbance also can negatively impact wood stork populations. This is primarily an issue with nesting areas, but to a lesser degree, also is a concern for foraging areas. At Dyar Pasture there is a public boat ramp approximately 200 yards away from the area used by storks. The sites are separated by a row of willows that provides a vegetative screen (E. Caldwell, pers. comm.). The peak time of boater use of the ramp is in the early spring. During late summer when the storks are present, the lake is drawn down so there is limited use of the ramp, and therefore human

disturbance does not appear to be a problem at this site (N. Nicholson, pers. comm.). For other existing and potential foraging areas, the riparian corridor and wetland rare community standards will protect the vegetation around these sites and provide a vegetative screen from human activity.

No wood stork nesting colonies are present on the Oconee National Forest. However, several sites on the forest are used as late summer foraging areas. Since loss of foraging habitat is considered one of the causes for the decline of this species, protection of foraging habitat can contribute to the recovery of this species. The riparian corridor and wetland rare community standards and foraging area standards described above are the same under all alternatives. Therefore, there will be no adverse cumulative effects to these wetland communities or to the wood stork and other associated species.

Through the implementation of riparian corridor and wetland rare community standards, and foraging areas standards discussed above, the vegetative and hydrologic conditions of existing and potential wood stork foraging areas would be protected and foraging conditions enhanced under all alternatives. Therefore, the implementation of any Plan alternative is not likely to adversely affect the wood stork.

Gray bat (*Myotis grisescens*)

Affected Environment

The gray bat occupies a limited geographic range in limestone karst areas of the southeastern U.S. (U.S. Fish and Wildlife Service 1982). The bat is more narrowly restricted to cave habitats than any other mammal occurring in the U.S., and occupies caves year-round. Most individuals migrate seasonally between maternity and hibernating caves. About 95 percent of the known populations inhabit nine winter caves. A key cause of decline appears to be human disturbance and loss of cave habitat quality. Limiting factors for the gray bat may include warm caves in the northern portion of its range, and cold caves in the southern portion. The Recovery Plan (U.S. Fish and Wildlife Service 1982) recommends actions focused on cave acquisition and gating.

Deforestation of areas around occupied cave entrances and in between caves and large water sources (feeding corridors) may have a detrimental effect on the species. Forest cover provides protection from predators, especially for young bats. Retention of forested corridors around cave entrances, along river and perennial stream edges, and along reservoir shorelines within 25 km of known gray bat maternity caves is important (U.S. Fish and Wildlife Service 1982, LaVal et al. 1977, Best et al. 1995).

Although the gray bat is currently listed as endangered, some bat researchers have endorsed a proposed status change to threatened due to population increases and successful protection of many inhabited caves (Currie and Harvey 2002). Gray bats are now estimated to number over 2.6 million individuals.

Because of the land ownership patterns, the Chattahoochee-Oconee does not have the limestone karst areas that could provide potential cave habitat for the gray bat, and no hibernacula or maternity caves have been found on the National Forest. During 88 total net nights of forestwide sampling in 2001 and 2002, there were five confirmed captures of male gray bats along Armuchee Creek (Loeb 2001, 2002), approximately 9 miles from a known bachelor cave present on private land.

Direct, Indirect, and Cumulative Effects

Based on Dr. Loeb's inventories, the Forest provides riparian foraging habitat for nearby gray bat colonies. This foraging habitat will be managed through the Riparian Corridor Prescription (11) objectives and standards, as well as other standards discussed below.

Riparian corridors will be managed and protected under standards discussed in the Riparian Corridor Prescription (11) to retain, restore or enhance ecological processes and functions of these systems. The prescription will not only provide forest cover for foraging and protection from predation, but will also ensure high water quality to support the aquatic insect prey base. If maternity sites are found in Georgia, site-specific consultation with U.S. Fish and Wildlife Service will be required for projects

within 20 miles of known maternity sites, if those projects were to affect canopy cover along perennial streams or forested lake shorelines. Because of these standards, there are expected to be no effects to foraging habitat as a result of implementation of any alternative in the Revised Plan.

Within the Rare Community Prescription (9.F), there are several standards for caves and mines that protect bats from adverse impacts. These are:

- Accessible caves and mines will be surveyed to determine use by bats as soon as possible following discovery.

- For all caves and mines suitable for supporting cave-associated species, a minimum buffer of 200 feet is maintained around portals, and any associated sinkholes and cave collapse areas. Prohibited activities within this buffer include use of wheeled or tractor vehicles (except on existing roads or as needed for cave protection and maintenance activities), mechanical site preparation, vegetation cutting, recreation site construction, tractor-constructed fire lines, livestock grazing, herbicide application, and construction of new roads (including temporary roads), skid trails, and log landings. Wider buffers are identified through site-specific analysis, when necessary to protect cave and mines from subterranean and surface impacts such as recreational disturbance, sedimentation and other adverse effects to water quality, and changes in air temperature and flow.

- Use of caves for disposal sites or alteration of cave entrances is prohibited, except for construction of appropriate cave gates or closures. Where previously modified entrances are causing adverse impacts to cave fauna, entrances are restored to eliminate impacts.

To protect rare species occurring in cliff communities, including bats, there is a standard in the Rare Community Prescription that states:

- Mature forest cover is maintained within 100 feet slope distance from the top of cliffs, and 200 feet slope distance from the base of cliffs to provide habitat for cliff-associated species. Within this zone, activities are limited to those needed to ensure public safety or to maintain or improve habitat for federally-listed species or other species whose viability is at risk.

For each alternative, standards will protect all hibernacula and maternity colony sites that are discovered or purchased. Although no hibernacula or maternity caves have been identified on the Chattahoochee-Oconee National Forest to date, if they are found, additional forestwide standards will require installation of gates or other protective structures at entrances of all caves and mines occupied by significant populations of all bats (i.e. not restricted to T&E bats). Public access routes will be closed within 0.25 miles of these sites when bats are present, and camping and fire building at the entrance to these caves and mines will be prohibited. Standards also will require development of prescribed burning plans that identify caves and mines occupied by bats as smoke-sensitive targets, and plans that avoid smoke entering

cave or mine openings when bats are present. In addition, an objective of all prescribed fire burn plans will be to protect snags and cavity trees.

The Forest Plan and its alternatives are not likely to adversely affect this species, because management direction as discussed above addresses the critical needs for habitat and protection of the gray bat, and should improve or maintain foraging, roosting, and if found, maternity/hibernacula habitat conditions for the species. In addition, site-specific analysis will be conducted on all projects with the potential to affect the bat, and U.S. Fish and Wildlife Service will be consulted as appropriate.

THREATENED AND ENDANGERED AQUATIC SPECIES

The following federally-listed aquatic species occur within watersheds which have some Forest Service ownership. For all species, occurrence locations are given, and either noted as occurring on or off Forest Service lands. All watersheds have been inventoried for the occurrence on the Forests of federally-listed species. Species are considered to occur on Forest Service lands if they occur on public lands or are within one mile downstream of the furthest Forest Service boundary. Those occurring farther than one mile downstream are considered off Forest Service lands. The Forest Service may influence habitat conditions on public lands for species which occur on the Forest, which will help keep them well distributed where their associated habitats occur on Forest Service lands. For those species which occur off the Forest, the ability of the Forest Service to influence the species is limited. Direct impacts to species off the forest will not be a result of Forest Service activities. However, inventories will continue on public lands within suitable or marginal habitats. In addition, the Forest Service is a stakeholder within the watersheds where there is public ownership. The Forest Service will continue to work cooperatively with other stakeholders to improve conditions on public and private lands, where possible, for the overall health of the watershed.

Amber Darter (*Percina antesella*)

Affected Environment

The amber darter was federally-listed as endangered in 1985 (U.S. Fish and Wildlife Service 1985). The species is endemic to the upper Coosa River system and occurs in the Conasauga River, Etowah River, and Shoal Creek (a tributary to the Etowah River in Cherokee County, Georgia). When the amber darter was originally listed, 33.5 miles of the Conasauga River were designated as critical habitat. The population in the Conasauga River has been documented 0.7 miles down stream of the Cherokee National Forest in Polk County, but has not been collected in the upper Conasauga River or Jacks River on the Chattahoochee National Forest. Populations of amber darters do occur in the main stem of the Conasauga River in Georgia at distances greater than one mile from the Chattahoochee National Forest. Tributaries that flow from the Chattahoochee National Forest and flow into the Conasauga River in the critical habitat area are Sumac Creek and Mill Creek (Murray County, Georgia). The uppermost known populations in the Etowah River are found in Dawson County, approximately one mile upstream of the confluence with the Amicalola River. These populations are more than five miles downstream of Forest Service lands.

The amber darter is typically found in riffle and run habitat in the main stem of the Conasauga and Etowah rivers. Amber darters are microhabitat specialists and prefer areas of swift current over loose, shifty gravel and cobble substrate. Amber darters deposit their eggs directly in gravel on the stream bed and provide no parental care for their offspring (Freeman 1996). Primary food items include snails, limpets, and immature aquatic insects.

The loss of occupied habitat for amber darters may be attributed to siltation from agriculture, development, logging, and the associated road building. Amber darters are considered sensitive to sedimentation because they require clean gravel for spawning and they rely heavily on aquatic macroinvertebrates for food.

Direct, Indirect and Cumulative Effects

Current inventories have not found amber darter on streams within Forest Service lands. This is due to the lack of their associated habitat on the forest. This darter prefers the main stem of large rivers found downstream of the Forest Service boundary. The activities responsible for the decline of the amber darter relate to habitat destruction primarily through siltation. Streams within National Forest lands will be protected from the sediment generated during authorized ground disturbing activities by Best Management Practices for forestry, and the Riparian Prescription and applicable forestwide standards. Implementation of these standards will be monitored and corrected as needed.

The population of amber darter downstream of the Chattahoochee National Forests may be unstable due to activities resulting in sedimentation on private lands. Surveying for potential populations will be our primary recovery objective. Suitable and marginal habitat will be sampled for the species. The results will be reported in the annual Monitoring and Evaluation Reports.

Based on analysis above, the amber darter will be protected in the selected alternative by: 1) the Riparian Corridor Management Prescription; 2) additional forestwide objectives and standards for aquatic species, including those with specific emphasis on watersheds with listed species, and 3) implementing Georgia BMPs for forestry when applicable. Implementation of any alternative in the Plan Revision is not likely to adversely affect the amber darter.

Goldline darter (*Percina aurolineata*)

Affected Environment

The goldline darter is a federally-listed threatened species endemic to the Alabama River drainage (U.S. Fish and Wildlife Service 2000). Two disjunct populations are extant, one in the Cahaba River system in Alabama and one in the Coosawattee River system in Georgia. Goldline darters have been collected near the Chattahoochee National Forest lands in the Ellijay, Cartecay, and Coosawattee rivers as well as Mountaintown, Boardtown, and Kells creeks. In addition, one specimen was collected in 1998 in the Coosawattee River downstream of Carters Lake and near Sugar Creek, a tributary that drains Chattahoochee National Forest lands. All known populations are from two to eight miles downstream of the furthest Forest Service boundary.

Goldline darters are found in medium sized streams and small rivers. They are typically associated with cobble, small boulder and bedrock substrates in riffle and run habitats with moderate to swift current. Presumably, they feed primarily on aquatic macroinvertebrates and spawn in gravel habitats like other members of the genus *Percina*. Water quality degradation, particularly due to sedimentation, is considered the primary threat to the species (U.S. Fish and Wildlife Service 2000). Populations outside of the Chattahoochee National Forest are increasingly threatened by sedimentation from road construction and second home/rental cabin development.

Direct, Indirect and Cumulative Effects

Current inventories have not found goldline darter on Forest Service lands within Forest service streams. This is due to the lack of their associated habitat on the forest. This darter prefers the main stem of larger streams downstream of Forest Service lands. The activities responsible for the decline of the goldline darter relate to habitat destruction primarily through siltation. Streams within National Forest lands will be protected from the sediment generated during authorized ground disturbing activities by Best Management Practices for forestry, the Riparian Prescription, and applicable forestwide standards. Implementation of these standards will be monitored and corrected as needed.

The population of goldline darter downstream of the Chattahoochee National Forests may be unstable due to activities resulting in sedimentation on private lands. Monitoring of potential populations within suitable and marginal habitats will be our primary recovery objective. The results will be reported in the annual Monitoring and Evaluation Reports.

Based on analysis above, the goldline darter will be protected in the selected alternative by: 1) the Riparian Corridor Management Prescription; 2) additional forestwide objectives and standards for aquatic species, including those with specific emphasis on watersheds with listed species, and 3) implementing Georgia BMPs for forestry when applicable. Implementation of any of the alternatives in the Plan Revision is not likely to adversely affect the goldline darter.

Etowah darter (*Etheostoma etowahae*)

Affected Environment

The Etowah darter is endemic to the upper Etowah River system and is federally-listed as endangered (U.S. Fish and Wildlife Service 2000). The Etowah darter is found in the Etowah River and its tributaries upstream of Allatoona Reservoir in Cherokee, Dawson, and Lumpkin counties. The Etowah darter has been documented on Chattahoochee National Forest lands in the Etowah River and Jones Creek. Populations in the Etowah River extend as far upstream as Montgomery Creek. Etowah darters have not been collected in Ward and Nimblewill creeks, two streams draining National Forest lands that are of suitable size to support Etowah darters.

The Etowah darter is found in small rivers and medium-sized creeks and is typically associated with gravel and cobble riffles and runs with moderate to swift current. Little is known about Etowah darter life history, but it is assumed that they feed primarily on aquatic macroinvertebrates, as does the closely related greenbreast darter, *Etheostoma jordani*. Etowah darters belong to the subgenus *Nothonotus*, which are known to bury themselves in gravel during spawning. Eggs are laid directly in the gravel and no parental care is provided.

The loss of occupied habitat for Etowah darter may be attributed to siltation from agriculture, development, logging, and the associated road building. In addition, populations outside of the Chattahoochee National Forest are increasingly impacted by urbanization. Dawson and Cherokee counties have consistently ranked among the nation's fastest growing counties over the past decade.

Direct, Indirect and Cumulative Effects

The activities responsible for the decline of the Etowah darter relate to habitat destruction primarily through siltation. Streams on public lands will be protected from the sediment generated during authorized ground disturbing activities by Best Management Practices for forestry, the Riparian Prescription and applicable forestwide standards. Implementation of these standards will be monitored and corrected as needed.

The population of Etowah darter on the Chattahoochee National Forests may be unstable due to activities resulting in sedimentation on private lands. Biologists and/or technicians will conduct and/or assist with annually monitoring the species and its habitat. Suitable and marginal habitat will be sampled for the species. An index using the numbers of Etowah darters per hour of survey has been developed and is being used to assess the status (age distribution) and trend for the Etowah River population on public lands. The results will be reported in the annual Monitoring and Evaluation Reports.

Based on analysis above, the Etowah darter will be protected in the selected alternative by: 1) the Riparian Corridor Management Prescription; 2) additional forestwide objectives and standards for aquatic species, including those with specific emphasis on watersheds with listed species, and 3) implementing Georgia BMPs for forestry when applicable. Implementation of any of the alternatives in the Plan Revision is not likely to adversely affect the Etowah darter.

Blue shiner (*Cyprinella caerulea*)

Affected Environment

The blue shiner was federally-listed as threatened in 1992. The species is endemic to the Cahaba and Coosa River systems (U.S. Fish and Wildlife Service 1995). The blue shiner is considered as extirpated from the entire Coosawattee River Basin. The blue shiner occurs in the upper Conasauga River on the Chattahoochee National Forest and within one mile downstream of the furthest Forest Service boundary in Holly Creek. Five extant populations persist:

In Alabama streams:

1) Weogufka Creek (Coosa County, AL);
2) Choccolocco Creek and its tributary Shoal Creek (on the Talladega National Forest in Calhoun County, AL);
3) Little River (Cherokee County, AL);
4) Cahaba Rivera (Jefferson, Shelby and Bibb Counties, AL; part of the Bibb County stretch is on the Talladega National Forest);

In Tennessee and Georgia streams:

5) Conasauga River (Polk and Bradley Counties, TN; part of the Polk County stretch is on the Cherokee National Forest; Murray and Whitfield Counties, GA on the Chattahoochee National Forest); and Holly and Perry Creeks (Murray County, GA down stream of the Chattahoochee National Forest) and Rock Creek (Murray County, GA);

The blue shiner is found in small rivers and large streams with moderate gradients over a sand or sand and gravel substrate. Water willow beds are often present. Spawning occurs in the crevices of rocks or logs with no parental protection provided after spawning is completed. Food items are dominated by terrestrial insects. Silt free water and a substrate free of fine sediments that could fill in spawning crevices are extremely important.

The loss of occupied habitat for blue shiners may be attributed to siltation from agriculture, development, logging, and the associated road building; nutrient enrichment and water withdrawal for home site development; and inundation from dam construction. Dam construction has also resulted in the isolation of some blue shiner populations.

Direct, Indirect and Cumulative Effects

The blue shiner occurs on the Chattahoochee National Forest within the Conasauga River and within one mile of the furthest downstream Forest Service boundary in Holly Creek. In suitable habitats on public lands in the Conasauga River, the blue shiner is one of the most abundant shiners. This shiner prefers low gradient pool habitat, which is generally absent in the predominately high gradient streams on the

Chattahoochee National Forest. The activities responsible for the decline of the blue shiner relate to habitat destruction primarily through siltation. Streams on public lands will be protected from the sediment generated during authorized ground disturbing activities by Best Management Practices for forestry, the Riparian Prescription and applicable forestwide standards. Implementation of these standards will be monitored and corrected as needed.

The population of blue shiners in the Conasauga River on the Cherokee and Chattahoochee National Forests appear to be stable. The population of blue shiner downstream of the Chattahoochee National Forests may be unstable due to activities resulting in sedimentation on private land. Biologists and/or technicians will conduct and/or assist in annually monitoring the species, and its habitat and suitable habitat will be sampled for the species. An index using the numbers of blue shiners per hour of survey has been developed, and is being used to assess the status (age distribution) and trend for the Conasauga River population on public lands. Results will be reported in the annual Monitoring and Evaluation Reports.

Based on analysis above, the blue shiner will be protected in the selected alternative by: 1) the Riparian Corridor Management Prescription; 2) additional forest-wide objectives and standards for aquatic species, including those with specific emphasis on watersheds with listed species, and 3) implementing Georgia BMPs for forestry when applicable. Implementation of any of the alternatives in the Plan Revision is not likely to adversely affect the blue shiner.

Conasauga logperch (*Percina jenkinsi*)

Affected Environment

The Conasauga logperch was federally-listed as endangered in 1985 (U.S. Fish and Wildlife Service 1985). Concurrent with the listing was the designation of 11 miles of critical habitat. The species is endemic to the Conasauga River. The Conasauga logperch has been documented upstream of the designated critical habitat on the Cherokee National Forest and the Chattahoochee National Forest of Georgia (Murray County) in both the Conasauga and Jacks Rivers.

The Conasauga logperch is found in flowing pools of this small river over a gravel to cobble substrate. Spawning behavior is unknown but other member of this genus deposit their eggs in gravel substrate with no nest building or parental care. Food items consist of invertebrates, which are obtained by flipping rocks with their noses and grabbing the dislodged organisms. Silt free water and a substrate free of fine sediments are extremely important habitat elements for the logperch. The loss of occupied habitat for Conasauga logperch may be attributed to siltation from agriculture, development, logging, and the associated road building.

Direct, Indirect and Cumulative Effects

The Conasauga logperch occurs on the Chattahoochee National Forest in the upper Conasauga River and Jacks River. The activities responsible for the decline of the Conasauga logperch relate to habitat destruction primarily through siltation. The Conasauga River will be protected from the sediment generated during authorized ground disturbing activities by Best Management Practices for forestry, the Riparian Prescription and applicable forestwide standards. Implementation of these standards will be monitored and corrected as needed.

The population of Conasauga logperch on the Cherokee and Chattahoochee National Forests appears to be stable. Biologists and/or technicians will conduct and/or assist with annually monitoring the species and its habitat. Suitable and marginal habitat will be sampled for the species. An index using numbers of Conasauga logperch per hour of survey has been developed and is being used to assess the status (age distribution) and trend for the Conasauga River population. These results will also be reported in the annual Monitoring and Evaluation Reports.

Based on analysis above, the Conasauga logperch will be protected in the selected alternative by: 1) the Riparian Corridor Management Prescription; 2) additional forestwide objectives and standards for aquatic species, including those with specific emphasis on watersheds with listed species, and 3) implementing Georgia BMPs for forestry when applicable. Implementation of any of the alternatives in the Plan Revision is not likely to adversely affect the Conasauga logperch.

Alabama moccasinshell (*Medionidus acutissimus)*

Affected Environment

The Alabama moccasinshell was federally-listed as endangered in 1993 (U.S. Fish and Wildlife Service 1993). It is a small freshwater mussel or bivalve mollusk that attains an average adult size of 30mm (1.2 in.) in length. It was historically widespread throughout the Mobile basin, but now occurs sporadically in low numbers, with the best populations occurring in the Sipsey Fork drainage in Alabama, where they appear stable. Elsewhere, the status is uncertain and is thought to be declining (Paul Johnson, pers. obs. 2003).

The current range of the species includes the Luxapalila Creek, Buttahatchie and Sipsey Rivers in the Tombigbee River drainage; the headwaters of the Sipsey Fork (Brushy Creek) in the Black Warrior River drainage; and the Conasauga River (U.S. Fish and Wildlife Service, 1993). In Georgia, the moccasinshell was found in the upper Conasauga River in surveys from 1990-1997 but are no longer known from this watershed. The only known location where this mussel still occurs is in Holly Creek. All occurrences for this shell are downstream of the forest.

This species is usually found in sand on the margins of streams with a typical sand and gravel substrate in clear water of moderate flow (Doug Shelton, pers. obs. 1995). Freshwater mussel larvae (glochidia) are brooded in the gills of the female and when mature are released into the water where they spend a brief period as obligate parasites on the gills, fins, or other external parts of fish until they drop off to the benthos. In the laboratory, Haag and Warren (1997) identified the following fish hosts: *Fundulus olivaceus, Etheostoma douglasi, Etheostoma whipplei, Percina nigrofasciata and Percina* sp.cf. *caprodes*. Females were found gravid with mature glochidia from late February to mid March in water temperatures of 8-13 degrees C (Haag and Warren, 1997).

Habitat modification, sedimentation, water quality degradation and eutrophication are the primary reasons for decline of this species. Runoff and discharge from urban and agricultural practices, surface mines and sewage treatment plants, as well as small stream impoundments, also threaten the mussel (U.S. Fish and Wildlife Service, 2000).

Direct, Indirect and Cumulative Effects

No populations of the Alabama moccasinshell are known to occur on the Chattahoochee National Forest. The Conasauga River on public lands will be protected from the sediment generated during authorized ground disturbing activities by Best Management Practices for forestry, the Riparian Corridor Prescription and applicable forestwide standards. Implementation of these standards will be monitored and corrected as needed.

Annually, surveys will be conducted to search for the Alabama moccasinshell on the Chattahoochee National Forest. The results will be reported in the Forest Monitoring and Evaluation Report. At least once every five years, a professional malacologist will survey the entire suitable and marginal habitat managed by the Chattahoochee National Forest to evaluate the expansion or contraction in habitat being utilized.

Based on analysis above, the Alabama moccasinshell will be protected in the selected alternative by: 1) the Riparian Corridor Management Prescription; 2) additional forestwide objectives and standards for aquatic species, including those with specific emphasis on watersheds with listed species, and 3) implementing Georgia BMPs for forestry when applicable. Implementation of any of the alternatives in the Plan Revision is not likely to adversely affect the Alabama moccasinshell mussel.

Coosa moccasinshell (*Medionidus parvulus)*

Environmental Baseline

The Coosa moccasinshell was federally-listed as endangered in 1993 (U.S. Fish and Wildlife Service 1993). The type locality for Coosa moccasinshell is listed as the Coosa River, Alabama and the Chattooga River in northwest Georgia. Additional records include the Cahaba River, the Sipsey Fork of the Black Warrior River, and the Coosa River and its tributaries (Choccolocco Creek, Chattooga, Conasauga and Little Rivers). Recent records include a single specimen in the headwaters of the Sipsey Fork in 1985; a single specimen taken by Hanley from the Little River in 1981; and the Conasauga River. Recent surveys did not find the species in the Cahaba River (U.S. Fish and Wildlife Service, 1993). This moccasinshell was found in the upper and middle Conasauga River in surveys from 1990-1997, but are no longer known from these watershed. The only known location where this mussel still occurs is in Holly Creek. All occurrences for this shell are downstream of the forest.

Habitat is sand and gravel in highly oxygenated, clear streams with moderate flow (Doug Shelton, pers. obs. 1997). The fish host for the glochidia is unknown.

Habitat modification, sedimentation, water quality degradation, and eutrophication are the primary reasons for decline of this species. Runoff and discharge from urban and agricultural practices, surface mines and sewage treatment plants, as well as small stream impoundments, also threaten the mussel (U.S. Fish and Wildlife Service, 2000). Unrestricted cattle access is a direct threat in portions on the Conasauga River in Bradley and Polk Counties, Tennessee. During recent surveys a gravid female was found crushed, in the center of the stream. This site was in an area bordered by grazing land and unrestricted cattle access (Doug Shelton, pers. obs. 1997).

Direct, Indirect and Cumulative Effects

No populations of the Coosa moccasinshell are known to occur on the Chattahoochee National Forest. The Conasauga River and Holly Creek watersheds on public lands will be protected from the sediment generated during authorized ground disturbing activities by Best Management Practices for forestry, the Riparian Prescription and applicable forestwide standards. Implementation of these standards will be monitored and corrected as needed.

Annually, surveys will be conducted to search for the Coosa moccasinshell on the Chattahoochee National Forest. The results will be reported in the Forest Monitoring and Evaluation Report. At least once every five years, a professional malacologist will survey the entire suitable and marginal habitat managed by the Chattahoochee National Forest to evaluate the expansion or contraction in habitat being utilized.

Based on analysis above, the Coosa moccasinshell will be protected in the selected alternative by: 1) the Riparian Corridor Management Prescription; 2) additional forestwide objectives and standards for aquatic species, including those with specific emphasis on watersheds with listed species, and 3) implementing Georgia BMPs for forestry when applicable. Implementation of any of the alternatives in the Plan Revision is not likely to adversely affect the Coosa moccasinshell mussel.

Fine-lined pocketbook (*Lampsilis altilis*)

Affected Environment

The fine-lined pocketbook was federally-listed as threatened in 1993 (U.S. Fish and Wildlife Service 1993). The species occurred in the Alabama, Tombigbee, Black Warrior, Cahaba, Tallapoosa, Coosa River systems, and their tributaries. Extant populations on or near National Forests in Georgia and Tennessee are on the Conasauga River (Polk and Bradley Counties, TN; Murray and Whitfield, Counties, GA) on the Cherokee and Chattahoochee National Forests; and Holly Creek (Murray County, GA) downstream of the Chattahoochee National Forest.

This species is found in moderate to swift currents over stable sand, gravel, and cobble substrates in large rivers to small creeks. The largemouth, redeye, and spotted bass may serve as the fish host for the glochidia.

The decline and extirpation of most populations of fine-lined pocketbook mussels may be attributed to habitat modification, sedimentation, eutrophication, and other forms of water quality degradation (U. S. Fish and Wildlife Service, 2000).

Direct, Indirect and Cumulative Effects

The fine-lined pocketbook mussel does occur on the Chattahoochee National Forest. The Conasauga River and Holly Creek watersheds on public lands will be protected from the sediment generated during authorized ground disturbing activities by Best Management Practices for forestry, the Riparian Corridor Prescription and applicable forestwide standards. Implementation of these standards will be monitored and corrected as needed.

Protection, monitoring, and augmentation will be the primary recovery objectives. Annually the fine-lined pocketbook population on the forest will be monitored by biologists and/or technicians. An index of mussels per hour of survey will be developed to document the status (age distribution) and trend of the population. The results will be reported in the Monitoring and Evaluation Reports. At least once every five years, a professional malacologist will survey all suitable and marginal habitat managed by the Chattahoochee National Forest to evaluate the expansion or contraction in habitat being utilized.

Based on analysis above, the fine-lined pocketbook will be protected in the selected alternative by: 1) the Riparian Corridor Management Prescription; 2) additional forestwide objectives and standards for aquatic species, including those with specific emphasis on watersheds with listed species, and 3) implementing Georgia BMPs for forestry when applicable. Implementation of any of the alternatives in the Plan Revision is not likely to adversely affect the fine-lined pocketbook mussel.

Southern pigtoe (*Pleurobema georgianum*)

Affected Environment

The southern pigtoe was federally-listed as endangered in 1993 (U.S. Fish and Wildlife Service 1993). This is a medium-sized freshwater mussel with a yellow to yellow-brown shell. It is presumably a Coosa River system endemic found in Alabama, Georgia, and Tennessee. Museum records indicate its presence in the Coosa River, Shoal Creek, and the Chattooga and Conasauga rivers. The only known location on the Chattahoochee National Forest is in the upper Conasauga watershed. It is downstream of the forest boundary in the middle Conasauga and Holly Creek watersheds.

This species is found in sand, gravel, and cobble shoals and runs in small rivers and large streams. The fish host for the glochidia is unknown. The decline and extirpation of most populations of southern pigtoe mussels may be attributed to habitat modification, sedimentation, eutrophication, and other forms of water quality degradation (U.S. Fish and Wildlife Service, 2000).

Direct, Indirect and Cumulative Effects

The southern pigtoe does occur on the Chattahoochee National Forest. The Conasauga River and its tributaries will be protected from the sediment generated during authorized ground disturbing activities by Best Management Practices for forestry, the Riparian Prescription and applicable forestwide standards. Implementation of these standards will be monitored and corrected as needed.

Protection, monitoring, and augmentation will be the primary recovery objectives. Annually, this population on the Forest will be monitored by biologists and/or technicians. An index of mussels per hour of survey will be developed to document the status (age distribution) and trend. The results will be reported in the Monitoring and Evaluation Report. At least once every five years, a professional malacologist will survey all of the suitable and marginal habitat managed by the Chattahoochee National Forest to evaluate the expansion or contraction in habitat being utilized.

Based on analysis above, the southern pigtoe will be protected in the selected alternative by: 1) the Riparian Corridor Management Prescription; 2) additional forestwide objectives and standards for aquatic species, including those with specific emphasis on watersheds with listed species, and 3) implementing Georgia BMPs for forestry when applicable. Implementation of any of the alternatives in the Plan Revision is not likely to adversely affect the southern pigtoe mussel.

Southern clubshell (*Pleurobema decisum)*

Affected Environment

The southern clubshell was federally-listed as endangered in 1993 (U.S. Fish and Wildlife Service 1993). Formerly widespread throughout the Mobile River basin, southern clubshell was known historically from the Alabama River and Bogue Chitto Creek; Tombigbee River and tributaries (Buttahatchie, East Fork Tombigbee, and Sipsey Rivers and Bull Mountain, Luxapalila, and Lubbub Creeks); Black Warrior River; Cahaba and Little Cahaba Rivers; two Tallapoosa tributaries, Uphapee and Chewacla Creeks; and the Coosa River and tributaries (Oostanaula, Conasauga, Etowah, Chattooga, and Coosawattee Rivers and Kelly, Talladega and Shoal Creeks).

Currently, the species is known from Bogue Chitto Creek in the Alabama River drainage; Buttahatchie, East Fork Tombigbee and Sipsey Rivers in the Tombigbee River drainage; and Chewacla Creek in the Tallapoosa River drainage (U. S. Fish and Wildlife Service 1993, McGregor et. al. 1999). It is thought to be extirpated from the Conasauga River watershed (U.S. Fish and Wildlife Service 1998).

This mussel is usually found in highly oxygenated streams with sand and gravel substrate; it may be found in sand and gravel in the center of the stream or in sand along the margins of the stream (Doug Shelton, pers. obs. 1995). Habitat modification, sedimentation, water quality degradation and eutrophication are the primary reasons for decline of this species. Runoff and discharge from urban and agricultural practices, surface mines and sewage treatment plants, as well as small stream impoundments, also threaten the mussel (U.S. Fish and Wildlife Service 2000).

Direct, Indirect and Cumulative Effects

There are no known populations of southern clubshell mussels on the Chattahoochee National Forest. Streams on public lands will be protected from the sediment generated during authorized ground disturbing activities by Best Management Practices for forestry, the Riparian Prescription and applicable forest-wide standards. Implementation of these standards will be monitored and corrected as needed.

No populations of southern clubshell mussels are known to occur on the Chattahoochee National Forest. Annually, surveys to search for the southern clubshell will be conducted. The results will be reported in the Monitoring and Evaluation Report. At least once every five years, a professional malacologist will survey all of the suitable and marginal habitat managed by the Chattahoochee National Forest to evaluate the expansion or contraction in habitat being utilized.

Based on analysis above, the southern clubshell will be protected in the selected alternative by: 1) the Riparian Corridor Management Prescription; 2) additional forest-wide objectives and standards for aquatic species, including those with specific emphasis on watersheds with listed species, and 3) implementing Georgia BMPs for forestry when applicable. Implementation of any of the alternatives in the Plan Revision is not likely to adversely affect the southern clubshell mussel.

Ovate clubshell (*Pleurobema perovatum*)

Affected Environment

The ovate clubshell was federally-listed as endangered in 1993 (U.S. Fish and Wildlife Service 1993). It is a small freshwater mussel or bivalve mollusk, which attains a maximum adult size of 50 mm (2.0 in.) in length. The outer shell varies from yellow to dark brown. Occasionally, broad green rays may cover most of the umbo and posterior ridge. The type locality for the ovate clubshell is in Greene County, Alabama. Historical records include the Tombigbee River and several tributaries (Buttahatchee and Sipsey Rivers; Luxapalila, Coalfire and Lubbub Creeks); Black Warrior River and tributaries (Locust Fork; Village, Prairie, Big Prairie, Brushy and Blackwater Creeks); Alabama River; Cahaba River and the tributary Buck Creek; Chewacla, Uphapee and Opintlocco Creeks in the Tallapoosa drainage; and the Coosa River and tributaries (Conasauga and Etowah Rivers, and Holly Creek).

The current known populations occur in the Buttahatchee River and Luxapilla Creek in Mississippi and the Sipsey River, Sucarnoochee River, Coalfire Creek, Chewacla Creek and Coosa River, all in Alabama (U.S. Fish and Wildlife Service 2000). This mussel was known in the upper Conasauga River in Georgia from 1990-1997 surveys, but are no longer found in this watershed. This mussel was known from 1998-1999 in the middle Conasauga, but is no longer known in this watershed (Evans 2001). Neither of these past occurrences are on the Chattahoochee NF.

This species is found in sand and fine gravel with moderate current at depths less than three feet. The fish host for the glochidia is unknown. Habitat modification, sedimentation, and water quality degradation are the major reasons for the current status of the ovate clubshell. Channelization and runoff from agriculture and household activities also threaten the species (U.S. Fish and Wildlife Service 2000).

Direct, Indirect and Cumulative Effects

There are no known populations of ovate clubshell mussels on the Chattahoochee National Forest. Streams will be protected from the sediment generated during authorized ground disturbing activities by Best Management Practices for forestry, the Riparian Prescription and applicable forestwide standards. Implementation of these standards will be monitored and corrected as needed.

Annually, surveys will be conducted to search for the ovate clubshell. The results will be reported in the Monitoring and Evaluation Report. At least once every five years, a professional malacologist will survey all of the suitable and marginal habitat managed by the Chattahoochee National Forest for the ovate clubshell and other rare mussels.

Based on analysis above, the ovate clubshell habitat will be protected in the selected alternative by: 1) the Riparian Corridor Management Prescription; 2) additional forestwide objectives and standards for aquatic species, including those with specific emphasis on watersheds with listed species, and 3) implementing Georgia BMPs for forestry when applicable. For these reasons and the fact that the ovate clubshell is not known to occur on the Forest, implementation of any of the alternatives in the Plan Revision is not likely to adversely affect the ovate clubshell mussel.

Triangular kidneyshell (*Ptychobranchus greeni)*

Affected Environment

The triangular kidneyshell was federally-listed as endangered in 1993 (U.S. Fish and Wildlife Service 1993). It is a freshwater mussel or bivalve mollusk which attains a maximum adult size of about 100 mm (4.0 in.) in length. The outer shell is straw yellow in young specimens, becoming yellow- brown in older specimens. Occasionally, it may have fine and wavy or wide and broken green rays anterior to the posterior ridge. The type locality for the triangular kidneyshell is the headwaters of the Black Warrior River, Alabama. Additional records include the Black Warrior River and tributaries (Mulberry Fork, Locust Fork, North and Little Warrior Rivers, Brushy Creek, Sipsey Fork); Cahaba River; and the Coosa River and tributaries (Choccolocco Creek; Chattooga, Conasauga, and Etowah Rivers). The current range includes the Sipsey Fork and Little Warrior River in the Black Warrior River drainage; and the Conasauga River and Holly Creek in the Coosa River drainage (U.S. Fish and Wildlife Service, 1993). The known populations of triangular kidneyshell mussels are off the Chattahoochee National Forest.

This species is found in coarse gravel and sand. The fish host for the glochidia is unknown. Freshwater mussels are filter feeders taking organic detritus, diatoms, phytoplankton, and zooplankton from the water column. Loss of habitat due to impoundments is the primary reason for the decline of the species. It may also be threatened by over-utilization for commercial, recreational, scientific and educational purposes (U.S. Fish and Wildlife Service, 1993).

Direct, Indirect and Cumulative Effects

The populations of triangular kidneyshell mussels are off the Chattahoochee National Forest. The Conasauga River and Holly Creek on public lands will be protected from the sediment generated during authorized ground disturbing activities by Best Management Practices for forestry, the Riparian Prescription and applicable forestwide standards. Implementation of these standards will be monitored and corrected as needed.

The known populations of triangular kidneyshell mussels are off the Chattahoochee National Forest. Annually, surveys to search for the triangular kidneyshell will be conducted. The results will be reported in the Monitoring and Evaluation Report. At least once every five years, a professional malacologist will survey all of the suitable and marginal habitat managed by the Chattahoochee National Forest to evaluate the expansion or contraction in habitat being utilized.

Based on analysis above, the triangular kidneyshell will be protected in the selected alternative by: 1) the Riparian Corridor Management Prescription; 2) additional forestwide objectives and standards for aquatic species, including those with specific emphasis on watersheds with listed species, and 3) implementing Georgia BMPs for forestry when applicable. Implementation of any of the alternatives in the Plan Revision is not likely to adversely affect the triangular kidneyshell.

DEMAND SPECIES

Black Bear

Affected Environment

The black bear (*Ursus americanus*) uses a wide variety of habitats in the southern Appalachians, occurring primarily on National Forests and National Parks of the Southern Blue Ridge, Northern Cumberland, and Allegheny Mountains and the Northern Ridge and Valley. These public lands in Virginia, West Virginia, North Carolina, Tennessee, and Georgia connect to form a forested landscape of over six million acres where bears are generally distributed at low to medium densities. The increase of older oak forests in this large block of habitat, along with increased protection and conservative hunter harvest, has allowed bear populations throughout the southeastern mountain region to moderately increase over the past 30 years. Bears generally are absent from the Cumberland Plateau, Southern Cumberland Mountains, Southern Ridge and Valley and Piedmont (SAMAB 1996e:61).

Black bears are common on the Chattahoochee National Forest, and populations have increased significantly over the last 20 years (USDA Forest Service 2000). Black bears generally are absent from the Oconee National Forest, but occasional sightings have recently been reported (E. Caldwell, pers. comm.). Much of the forests on and around the Oconee were converted to agricultural lands in the 1800's, which eliminated bears from most of the region. Over time, some limited bear populations may become established on the Oconee, especially along the major river systems.

In the Southern Appalachians, including the Chattahoochee National Forest, important habitat elements for black bears are habitat diversity, den site availability, availability of hard mast, and habitat remoteness.

Levels of human access within bear habitat determine the degree of negative effects on bears (Beringer 1986; Brody and Pelton 1989). Generally, high bear population densities are associated with areas of low open road density (SAMAB 1996e:87). Low-traffic roads and trails are used by bears as travel ways and provide the benefit of additional edge and associated soft mast, whereas high traffic volumes have a negative impact (B. Fletcher, pers. comm.). Effects vary based the duration and time of year the road or trail is open for use and the number and type of recreation users present. Recreation trails (hiking, mountain biking, ATV, or horseback) can potentially provide similar disturbance.

Black bears are opportunistic omnivores and consume a variety of seasonal plant and animal foods including flowering plants, grasses, various roots and tubers, and especially soft mast (grapes, berries, apples, etc.). However, availability of hard mast (acorns and hickory nuts) is critical throughout the winter, and reproductive success is closely related to this habitat factor (Eiler 1981; Wathen 1983; Eiler et al. 1989). Total production of hard mast and production by individual trees can fluctuate from

year to year due to climatic and other factors (Downs and McQuilkin 1944; Fowells 1965).

Under general southern Appalachian forest conditions, most oaks produce acorns from 40 years of age until death (150-200+ years), although production drops off in later years (USDA Forest Service 1990). Average annual white oak acorn production begins to decline when trees reach about 30 inches dbh (diameter at breast height) (Greenberg 1999; Johnson 1994), and northern red oak acorn production declines at about 30 inches (Greenberg 1999). Black and scarlet oaks are prolific producers at smaller size classes. Chestnut oaks production peaks at about 20 inches dbh and production remains relatively stable after that (Johnson 1994). Acorn production can be sustained over time by ensuring adequate regeneration of oaks, releasing super-canopy highly productive white oaks and providing a wide variety of species and age classes of oaks across the landscape.

Since bears utilize nearly any abundant plant or animal food, they are likely to thrive when a diversity of forest age classes and food sources are available. Vegetation management can provide much of this diversity (Reagan 1990). Prescribed fire also can be used to enhance black bear habitat and may provide a complimentary habitat management technique to traditional silvicultural treatments (Weaver 2000). Naturally occurring events such as ice storms, wildfires, and hurricanes provide habitat diversity, but at random intervals and locations; benefits may be limited and unreliable.

Bears den in a wide variety of sites including road culverts, abandoned buildings, and in vegetation (Carlock et al. 1983). Traditional dens are found on the ground in caves, rockfalls, or under the root mass of uprooted trees, and in hollow trees. Carlock et al. (1983) and M. Vaughan (pers. comm.) found that hollow trees are preferred dens. Brody (1984) found that ground dens are preferred in the North Carolina Mountains. Preference may be related to availability and may be a learned behavior (Brody 1984).

As a hunted species, the black bear has been selected as an MIS to help assess the effects of management of the national forest on meeting the public demand for consumptive uses. Drawing inference about the effect of national forest management on this species is difficult because, in large part, their populations are regulated through harvest regulations. Nevertheless, black bear is appropriate as a MIS since the role of harvest regulation and demand can be evaluated along with habitat trends. Key habitat attributes regulated by Forest Service management include the availability of den trees and hard and soft mast, and remoteness. Georgia DNR tracks annual bear harvest and conducts annual bait station index surveys along with mast availability surveys. Population viability of Southern Appalachian black bear populations is uniquely tied to attributes provided almost exclusively by Federal lands, including the Chattahoochee National Forest.

Direct and Indirect Effects

Actions of the state wildlife agencies, especially regulation of hunter harvest are primary influences on bear population levels. However, National Forest management

determines habitat features such as levels of public access, levels of vegetation diversity, and availability of mast and den trees.

Availability of potential den trees on the Chattahoochee National Forest is augmented by a forestwide standard requiring their retention during all vegetation management treatments. Potential dens are trees greater than 20 inches dbh that are hollow with broken tops (Carlock et al. 1983). An additional forestwide standard also has been established that protects all known den sites for as long as they remain suitable. These standards apply across all alternatives. Dens are addressed under *Terrestrial Habitats, Snags, Dens, and Downed Wood*. Recruitment of den trees is most dependent on providing abundant late successional forests. As compared to current conditions, the quantity of late successional habitats would decrease at year 10 but increase by year 50 for all alternatives. Alternatives G and E would provide the greatest amount of late successional habitat and as a result the greatest potential for dens, while Alternatives F and D would provide the least. All alternatives would maintain at least 50 percent of the forested acres in late successional conditions. Although den trees are also expected to increase in abundance as forests age, restoring an abundance of very large diameter den trees will require longer than 50 years of forest growth in many forest community types.

Due to the current healthy status of the Chattahoochee's forestwide bear population (USDA Forest Service 2000), the assumption is made that sustaining existing levels of habitat remoteness is acceptable. Table 3- 122 displays the expected quantity of remote habitat by Alternative. Alternatives G, E and A would provide highest total acres of remote habitats, and Alternatives D and B would provide least acres.

Table 3- 122. Expected Acres Of Remote Habitat For Forest Plan Alternatives On The Chattahoochee National Forest[1]

MRx	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Rx 1A, 1B, 12A, 12B	170,163	136,041	135,863	175,895	159,270	181,605	153,791

[1]Source: Plan Revision GIS Management Prescription Allocations data layer, Alt A-G as of 09/12/02; Alt I as of 8/25/03.

Also related to human access are issues of inappropriate food and trash disposal and occurrence of "nuisance bear" activity (Stiver 1988; Rogers 1976). The Chattahoochee National Forest developed a forestwide objective to provide recreation facilities, recreation services, public information, and enforcement to minimize wildlife access to human food and trash where appropriate. This would minimize bear mortality and injury related to "nuisance" behavior.

Habitat diversity is addressed under the Successional Forests topic. As compared to current conditions, the quantity of late successional habitats would decrease at year 10, but increase by year 50 for all alternatives. At year 10, all alternatives would increase the quantity of early-successional habitat over what is currently available and all alternatives except Alternative G and E would increase the quantity of early-successional habitats at year 50.

Hard mast issues are addressed in the Oak and Oak-Pine Forests section. Acorn production is greatest in mid and late successional oak forests. The expected quantity of mid- and late successional oak forests will vary among alternatives as will the availability of oak mast. The quantity of mid- and late-successional oak forests and consequently acorn availability is expected to increase through year 50 under all alternatives except Alternatives B, D, and F. While the quantity of these habitats provided will vary among alternatives, because of the abundance of mature oak forests, hard mast is expected to be abundant and well distributed in all alternatives.

To varying degrees, all alternatives would provide a diversity of habitat conditions that would benefit black bear populations on the Chattahoochee National Forest. Alternatives A and I are expected to provide the most desirable mix of habitat conditions, but black bear populations are expected to increase under all alternatives (Table 3- 123). On the Chattahoochee National Forest, bear populations would remain viable throughout implementation of any of the alternatives.

Table 3- 123. Expected Population Trend[1] Of Black Bear On The Chattahoochee National Forest Under Forest Plan Revision Alternatives 10 And 50 Years Following Plan Adoption. Population Trend Estimates Are Based On Expected Trends In Habitat Quantity And Quality.

Time Period	Alternative						
	A	B	D	E	F	G	I
10 years	+	+	+	+	+	+	+
50 years	++	+	+	+	+	+	++

[1] *Population trend expressed as expected change from current levels: "++" = relatively large increase, "+" = increase, "=" = little to no change, "-" = decrease, "- -" = relatively large decrease.*

Cumulative Effects

The current status of black bear population on the Chattahoochee National Forest is good (USDA Forest Service 2000). The overall regional forecast is for potential bear habitat to remain stable on public land, including the Chattahoochee National Forest and adjacent public lands in North Carolina, Tennessee, and South Carolina. Decreases are expected on private lands due to continued loss of forested habitats and increased development (SAMAB 1996e:87). As a result, public lands, including the Chattahoochee National Forest will further increase in their importance to regional black bear populations.

White-tailed Deer

Affected Environment

White-tailed deer (*Odocoileus virginianus)* use a variety of forest types and successional stage to meet their year-round needs. In the Southern Appalachians, regeneration areas and older forests provide complementary benefits to deer (Johnson et al. 1995). Older forests generally are most important in the fall and winter. When available, acorns are the dominant fall and winter food item (Wentworth et al., 1990a). When acorns are scarce, the bulk of the diet consists of leaves of broadleaf evergreen shrubs, primarily rhododendron (*Rhododendron maximum*). Deer nutrition, reproduction, weights, and antler characteristics are influenced by the availability of acorns (Harlow et al. 1975, Feldhammer et al. 1989, Wentworth et al. 1990a, 1992). Use of even-aged regeneration areas was very low in winter (Wentworth et al. 1990b). However in the spring and summer, regeneration areas provide an abundance of food and are heavily utilized (Wentworth et al.1990b, Ford et al. 1993). Young regenerating stands contain substantial quantities of woody browse, herbs, fungi, and soft mast, all of which are limited in older forests (Johnson et al. 1995). Food plots, especially those containing clover-grass mixtures, are used most intensively in early spring. They also are an important source of nutritious forage in winter, especially when acorns are in short supply (Wentworth et al. 1990b).

In eastern hardwood forests, Barber (1984) recommended that at least 50 percent of the acreage should consist of mature mast trees with the remainder containing an interspersion of evergreens, shrubs and vines, and openings with herbaceous and young-growth woody vegetation. Based on utilization data, current deer densities in the Southern Appalachians can be maintained by providing approximately 5 percent in regenerating stands (Wentworth et al. 1990b). Wentworth et al. (1989) concluded that approximately 2 percent of the area in high quality wildlife openings would be necessary to adequately buffer the effects of a poor acorn year.

Acorns also are important for deer in the Piedmont (Harlow and Hooper 1971). However, because of the availability of alternative high quality foods, especially Japanese honeysuckle and agricultural crops, deer are less mast dependent than in the mountains. Prescribed burning, thinning, and regulated timber harvest all can be used to improve habitat conditions for deer. Whittington (1984) described a management system where pine forests are managed on an 80- year rotation with a 8-year cutting cycle. Each entry, 85 percent of the area is thinned, 10 percent is regenerated and 5 percent is retained in wildlife openings. Approximately 20 percent is maintained in mast-producing hardwood stands.

Dormant season burning results in a temporary increase in crude protein and phosphorous in forage. It also increases the abundance of fire-tolerant woody plant stems, forbs, grasses and legumes for up to 3 years after burning, but causes a temporary decrease in production of fruits the first year after burning. (Stansky and Harlow 1981). Burning not only improves browse quality, but it reduces competing species such as white pine that inhibit browse production and advanced oak regeneration.

A prescribed burning interval for deer will depend on desired outcome. Burning to increase browse production and quality would be at 3-5 year intervals, while burning for oak regeneration would be similar, but there would be a 5-10 year lull after establishment to allow the oak regeneration to become tall enough to withstand a low intensity burn (K. Wooster, pers. comm.).

White-tailed deer are present throughout the Southern Appalachian Assessment area. Population densities generally are medium to high in the Northern Ridge and Valley, Allegheny Mountains, Northern Cumberland Mountains, and Southern Appalachian Piedmont Sections, and low to medium in the remainder of the SAA area (SAMAB 1996e: 50-60). High population densities are associated with greater amounts of cropland and lesser amounts of developed and coniferous forestland. Current deer densities generally are higher on private land, national forest, and state lands than other ownerships. Deer densities have greatly increased in the last 25 years. This increase likely is related to both non-habitat factors such as extensive restoration efforts, protection, and conservative harvest strategies as well as increased acorn capability resulting from the increase in mid-to late-successional oak forests.

Recreation generated by deer hunting produces $600 million annually in Georgia. Game harvest regulations and habitat improvement techniques – such as forest thinnings, prescribed burning, and wildlife opening development – have helped create healthy deer populations throughout the State. On the Chattahoochee and Oconee National Forests, deer densities generally range from 15 to 30 deer per square mile in the mountains and from 20 to 60 deer per square mile in the Piedmont (Kammermeyer 2000). There are 14 State Wildlife Management Areas (WMAs) on the Forest. Harvest data collected from each WMA are used to derive deer population estimates.

There are eleven WMAs in the Southern Appalachian portion (mountain, and ridge and valley WMAs) of the Chattahoochee NF. Deer populations on these WMAs have either been stable or increased slightly over the last 15 years (Kammermeyer 2000, USDA Forest Service 2000). All of the Southern Appalachian WMAs exhibit some degree of annual fluctuations in density, primarily in response to acorn availability (Wentworth et al., 1992).

Deer population densities are higher in the Piedmont of Georgia than in the mountains. In the late 1980s and early 1990s, the Georgia Game Management Section liberalized doe harvest to reduce the deer densities since they were at or above carrying capacities in many parts of the Piedmont. The liberalization of the doe harvest has reduced deer densities on many Piedmont WMAs. However, deer densities have remained relatively high on two of the three WMAs on the Piedmont portion of the forest (Oconee NF) (Kammermeyer 2000, USDA Forest Service 2000).

As a hunted species, white-tailed deer has been selected as a MIS to help assess the effects of management of the national forest on meeting the public demand for consumptive uses. Drawing inference about the effect of national forest management on this species is difficult because, in large part, their populations are

influenced by harvest regulations. Nevertheless, white-tailed deer is appropriate as an MIS since the role of harvest regulation and demand can be evaluated along with habitat trends. Key habitat attributes regulated by Forest Service management include the availability of early-successional habitat, permanent openings, and hard mast. Georgia DNR tracks annual deer harvest on the National Forest WMAs, and develops population density trends based on the data collected.

Direct and Indirect Effects

As discussed above, white-tailed deer require a mixture of forest/successional stage habitats to meet their year-round habitat needs. Key requirements include the interspersion of mature mast-producing stands during the fall and winter, early-successional habitats to provide browse and soft mast, and permanent openings. The effects of each of the alternatives on these key habitat features are discussed in detail in previous sections.

Hard mast issues are addressed under the Oak and Oak-Pine Forests topic. Acorn production is greatest in mid- and late-successional oak forests. The expected quantity of mid- and late-successional oak forests would vary among alternatives, as would the availability of oak mast. For the Chattahoochee National Forest, the quantity of mid- and late-successional oak forests and consequently acorn availability is expected to increase under all alternatives, except Alternatives B, D, and F through year 50. For the Oconee, acorn availability is expected to increase through year 50 for all alternatives except Alternative F. While the quantity of these habitats provided will vary among alternatives, because of the abundance of mature oak forests, hard mast is expected to be abundant and well distributed in all alternatives.

Early-successional habitats are addressed in the Successional Forest section. For the Chattahoochee National Forest, Alternatives G and E would provide the least amount of early-successional habitat, while Alternatives F and D would provide the most. In year 10, all alternatives would increase the quantity of early-successional habitat over what is currently available. All alternatives except Alternative G and E would increase the quantity of early-successional habitats at year 50. On the Chattahoochee National Forest, the quantity of early-successional habitat on the State-designated Wildlife Management Areas (WMAs), as a whole is similar to the rest of the Forest. However, as discussed previously, for some individual WMAs the projected quantity of early-successional habitats would be very limited. This suggests that although the availability of early-successional habitats would be adequate for the Chattahoochee National Forest as a whole for most alternatives, in some cases it would be poorly distributed. This is especially true for Alternatives E and G where early-successional habitats would be very limited for a number of the WMAs.

For the Oconee National Forest, in year 10, all alternatives would maintain or increase the quantity of early-successional habitat over what is currently available. All alternatives except Alternatives B and I would increase the quantity of early-successional habitats at year 50. On the Oconee National Forest, the quantity of early-successional habitat for the WMAs is similar to the rest of the Forest.

The availability of wildlife openings is addressed in the *Permanent Openings and Old Fields, Right-of-way, Improved Pastures* section. In all alternatives except Alternative G, over 65 percent of the Chattahoochee National Forest would be allocated to prescriptions that would allow the construction of new wildlife openings. Alternative F would allocate the most acres to prescriptions that would allow new openings. Alternative G and E would result in the greatest loss of existing permanent openings. The openings that would be abandoned occur both on and off the WMAs. WMA openings would be most heavily impacted in Alternatives G and E, and include openings on the Cohutta, Chestatee, Rich Mountain, Swallows Creek, Warwoman, Lake Burton, and Chattahoochee WMAs. The openings off the WMAs would be most impacted in Alternatives G and B. WMAs generally are allocated to prescriptions that allow the construction of new wildlife openings to a lesser degree than for the Forest as a whole. On the Oconee National Forest, all alternatives would allocate the majority of the forest to prescriptions that would allow new openings. Alternatives E and G would result in the abandonment of the largest acreage of existing openings, all of which are on Redlands WMA.

Expected population trends for white-tailed deer are shown in Table 3- 124 and Table 3- 125 for the Chattahoochee and Oconee National Forests, respectively. Population trend estimates are based on expected trends in habitat quantity and quality. For the Chattahoochee National Forest, deer populations are expected to be maintained at current levels or increase for all alternatives except Alternatives E and G at both year 10 and 50. Alternatives G and E would provide less favorable habitat conditions for deer due to the large proportion of the forest allocated to prescriptions that prohibit the construction of new permanent openings, the greatest impact to existing openings, and the limited quantity of early-successional habitats created. To a large degree, these limitations would be most significant on several of the WMAs, which could adversely affect deer hunting opportunities on these areas. For the Oconee National Forest, deer populations are expected to be maintained at current levels or increase for all alternatives at both year 10 and 50. The increases are expected to be greatest in Alternatives F and D due to the greater availability of early-successional habitats. Although some differences are evident, to varying degrees, all alternatives would provide a diversity of habitat conditions that would benefit white-tailed deer populations on the Chattahoochee and Oconee National Forests. Deer population levels are expected to be adequate to meet hunter demands on these forests in all alternatives.

Table 3- 124. Expected Population Trend[1] Of White-Tailed Deer On The Chattahoochee NF By Alternative 10 And 50 Years Following Plan Adoption.

Time Period	Alternative						
	A	B	D	E	F	G	I
10 years	+	+	=	=	+	-	+
50 years	+	+	=	-	+	-	+

[1] *Population trend expressed as expected change from current levels: "++" = relatively large increase, "+" = increase, "=" = little to no change, "-" = decrease, "- -" = relatively large decrease.*

Table 3- 125. Expected Population Trend[1] of White-Tailed Deer on the Oconee NF by Alternative 10 and 50 Years Following Plan Adoption

Time Period	Alternative						
	A	B	D	E	F	G	I
10 years	+	=	+	=	+	=	=
50 years	+	=	+	+	+	=	=

1. Population trend expressed as expected change from current levels: "++" = relatively large increase, "+" = increase, "=" = little to no change, "-" = decrease, "- -" = relatively large decrease.

Cumulative Effects

White-tailed deer populations on the Chattahoochee and Oconee National Forests have been relatively stable over the last 15 years (USDA Forest Service 2000). Factors such as insect and disease outbreaks could influence the future availability of key habitat features such as hard mast and early-successional habitats. However, all alternatives should provide habitat conditions that will provide for healthy deer populations. Although national forest management will strongly affect habitat conditions for deer, in large part, their population levels will be influenced by harvest regulations established by Georgia DNR.

Eastern Wild Turkey

Affected Environment

Wild turkeys (*Meleagris gallopavo*) occupy a wide range of habitats, with diversified habitats providing optimum conditions (Schroeder 1985). This includes mature mast-producing stands during fall and winter, shrub-dominated stands for nesting, and herb-dominated communities, including agricultural clearings for brood rearing. Habitat conditions for wild turkey can be enhanced by management activities such as prescribed burning and thinning (Hurst 1978; Pack et al., 1988), and the development of herbaceous openings (Nenno and Lindzey 1979, Healy and Nenno 1983).

For the eastern hardwood region, Wunz and Pack (1992) recommended maintaining 50 to 75 percent of the area in mast producing condition and approximately 10 percent in widely distributed permanent herbaceous openings in addition to the temporary openings that result from timber harvest and other activities. They suggest that regeneration area should be 30 acres in size or less. Light thinnings (less than 20 percent of basal area) are recommended to enhance the herbaceous component of the stands. Heavier thinnings, which increase the quantity of woody species, are less desirable. Prescribed burning in conjunction with thinning in oak forests can be used to enhance brood habitat. Other important habitat components include spring seeps, especially in area with regular snow cover, and a diversity of soft mast producing plants (e.g. dogwood, black gum, grape, blueberries, etc).

For the southern pine region, Hurst and Dickson (1992) recommended that at least 15 percent of the area should be kept in mature hardwoods such as streamside zones or pine-hardwood corridors. Forest openings and soft mast species also are important habitat components. Pine plantations should be thinned frequently and burned on a 3-to-5 year rotation to enhance herbaceous vegetation and soft mast production.

Eastern wild turkeys are present throughout the Southern Appalachian Assessment area. Population densities generally are medium to high in the Northern Ridge and Valley, Allegheny Mountains, Northern Cumberland Mountains, and Southern Appalachian Piedmont Sections, and low to medium in the remainder of the SAA area (SAMAB 1996e: 60-61). High population densities are associated with greater amounts of oak forest and cropland, and lesser amounts of developed and coniferous forestland. Current turkey densities generally are higher on private land, state, and national forest lands than other ownerships. Wild turkey populations have expanded in range and density in the last 25 years. As with deer, this increase likely is related to both non-habitat factors such as extensive restoration efforts, protection, and conservative harvest strategies as well as increased acorn capability resulting from the increase in mid-to late-successional oak forests.

Current density estimates for the Chattahoochee NF are 6–15 turkey per square mile, with a total population for the forest estimated to be about 12,000 turkeys (Carlock 1999). Densities estimates for the about 10–16 turkeys per square mile are

estimated for the Oconee NF (Thackston 1998). Data derived from the Hunting Population Index Survey conducted annually by Georgia DNR indicate that wild turkey populations have increased across the forest during the last 15 years (VanBrackle 2000, USDA Forest Service 2000).

Direct and Indirect Effects

As discussed above, wild turkeys require a mixture of forest/successional stage habitats to meet their year-round habitat needs. Key requirements include the interspersion of mature mast producing stands during fall and winter, shrub dominated stands for nesting, and herb dominated communities, including permanent openings for brood rearing. The effects of each of the alternatives on these key habitat features are discussed in detail in previous sections.

Hard mast issues are addressed in the section on *Oak and Oak-Pine Forests*. Acorn production is greatest in mid and late successional oak forests. The expected quantity of mid- and late successional oak forests will vary among alternatives as will the availability of oak mast. For the Chattahoochee National Forest, the quantity of mid- and late-successional oak forests and consequently acorn availability is expected to increase under all alternatives, except Alternatives B, D, and F through year 50. For the Oconee, acorn availability is expected to increase through year 50 for all alternatives except Alternative F. While the quantity of these habitats provided will vary among alternatives, because of the abundance of mature oak forests, hard mast is expected to be abundant and well distributed in all alternatives.

Habitat diversity is addressed in the *Successional Forests* section. For the Chattahoochee National Forest, Alternatives G and E would provide the least amount of early-successional habitat while Alternatives F and D would provide the most. Alternatives G and E would provide the greatest amount of late successional habitat while Alternatives F and D would provide the least. As compared to current conditions, the quantity of late successional habitat would decrease at year 10 for all alternatives but increase by year 50. In year 10, all alternatives would increase the quantity of early-successional habitat over what is currently available. All alternatives except Alternative G and E would increase the quantity of early-successional habitats at year 50.

On the Oconee National Forest, for all alternatives, the quantity of late successional habitat would decrease at year 10 as compared to current conditions. However, at year 50, the availability of late successional habitats would increase substantially under all alternatives. In year 10, all alternatives would maintain or increase the quantity of early-successional habitat over what is currently available. All alternatives except Alternatives B and I would increase the quantity of early-successional habitats at year 50.

The availability of wildlife openings is addressed in the *Permanent Openings and Old Fields, Right-of-way, Improved Pastures* section. In all alternatives except Alternative G, over 65 percent of the Chattahoochee National Forest would be allocated to prescriptions that would allow the construction of new wildlife openings. Alternative F would allocate the most acres to prescriptions that would allow new openings.

Alternative G and E would result in the greatest loss of existing permanent openings. The openings that would be abandoned occur both on and off the WMAs. WMA openings would be most heavily impacted in Alternatives G and E, and include openings on the Cohutta, Chestatee, Rich Mountain, Swallows Creek, Warwoman, Lake Burton, and Chattahoochee WMAs. The openings off the WMAs would be most impacted in Alternatives G and B. WMAs generally are allocated to prescriptions that allow the construction of new wildlife openings to a lesser degree than for the Forest as a whole.

On the Oconee National Forest, all alternatives would allocate the majority of the forest to prescriptions that would allow new openings. Alternatives E and G would result in the abandonment of the largest acreage of existing openings, all of which are on Redlands WMA.

On the Chattahoochee National Forest, Alternatives G and E would provide less favorable habitat conditions for turkey due to: (a) the large proportion of the forest allocated to prescriptions that prohibit the construction of new permanent openings, (b) having the greatest impact to existing openings, and (c) the limited quantity of early-successional habitats created. To a large degree, these limitations would be most significant on several of the WMAs, which could adversely affect turkey-hunting opportunities on these areas. Although some differences are evident, to varying degrees, all alternatives would provide a diversity of habitat conditions that would benefit wild turkey populations on both the Chattahoochee and Oconee National Forests. Turkey population levels are expected to be adequate to meet hunter demands on the Forests in all alternatives.

Cumulative Effects

Wild turkey populations on the Chattahoochee and Oconee National Forests have increased over the last 15 years (USDA Forest Service 2000). Factors such as insect and disease outbreaks could influence the future availability of key habitat features such as hard mast and early-successional habitats. However, all alternatives should provide habitat conditions that will provide for healthy turkey populations. Although national forest management will strongly influence habitat conditions for turkey, in large part, their populations are regulated by factors outside the control of national forest management such as weather conditions during the nesting season and to a lesser degree, harvest regulations established by Georgia DNR.

Ruffed Grouse

Affected Environment

Ruffed grouse (*Bonasa unbellus)* utilize a variety of forest habitats and successional stages. Nesting cover generally is located in poletimber or larger hardwood stands (Harris 1981, Thompson and Dessecker 1997). Haney (1996) also reported use of old-growth cove hardwood forests in the Southern Appalachians for nesting and brood rearing. While nesting habitat does not appear to be limiting, close interspersion with secure adult cover and brood habitat is important (Thompson and Dessecker 1997).

Key features of brood cover are security and an abundant high protein food source. Insects are most abundant in habitats characterized by lush herbaceous vegetation (Dimmick et al. 1996). Thompson and Dessecker (1997) describe brood cover as 3-7 year-old regenerating stands containing significant herbaceous component and shrub-dominated old fields and herbaceous openings. In Georgia, broods preferred upland hardwood sapling (greater than 10 year-old) and poletimber habitats, but also used sawtimber stands, although not in proportion to availability (Harris 1981). Regeneration areas (less than 6 years-old) and evergreen shrub thickets were avoided. Brood habitats were characterized by dense and diverse herbaceous vegetation that provided low overhead cover with freedom of movement beneath. Dimmick et al. (1996) suggest that the lack of interspersion of areas with a well developed herb layer and areas of high stem density for protective cover may be one of the limiting factors in southeastern grouse populations. They suggest that brood habitat could be enhanced by the conversion of logging roads and log landings to linear food plots by planting clover/grass mixtures, which will provide bugging areas in close proximity to secure cover.

Adult cover, including drumming habitat usually consists of young regenerating forest (6-15 year-old) or shrub cover (Thompson and Dessecker 1997). The dense cover provides protection from both avian and mammalian predators. Secure cover is provided in habitats with good vertical structure (8,000+ stems/acre) of 15-20 foot saplings (Kubisiak 1989). Dimmick et al. (1996) reported that males began to orient their drumming sites around or in clearcuts within 3 years post harvest. In Georgia, drumming habitat was associated with the presence of a relatively dense understory of heath shrubs; primarily flame azalea and mountain laurel (Hale et al. 1982). No strong preference for timber types or stand condition classes was evident. Harris (1981) found that males preferred upland hardwood sawtimber, generally associated with evergreen shrub thickets during the breeding and post-breeding seasons.

Dimmick et al. (1996) found that breeding male density (based on drumming counts) increased significantly in response to clearcutting in Tennessee. A similar response to timber harvest was reported from oak-dominated forests in Missouri (Wiggers et al. 1992). Highest grouse densities occurred where 7-to-15 year-old hardwood regeneration comprised greater than 14 percent of the area.

In oak forests of the Central Hardwood region, Thompson and Dessecker (1997) recommended managing on an 80-year rotation, which would maintain approximately 15 percent of the forest in brood or adult cover (3-15 years old). Appropriate regeneration methods include clearcut, seed tree, and shelterwood methods.

Residual basal areas should not exceed 20 ft^2/acre. Cutting units should be greater than 5 acres, and preferably 10-40 acres in size. Group selection is not recommended since the regeneration patches are too small to provide large enough patches of contiguous habitat. In Missouri, Kurzejeski et al. (1987) also recommended managing oaks on an 80-year rotation, but suggested harvest units should be less than 20 acres in size. In another study in Missouri oak forests, Wiggers et al. (1992) recommended maintaining more than 14 percent in 7- to 15-year-old hardwood regeneration. Kubisiak (1985) recommended the use of shelterwood cuts or clearcuts of 20 acres or less, leaving designated groups or scattered oaks (residual basal area less than 20 ft^2) with potential as mast-bearers or den trees. Larger cuts up to 40 acres are acceptable if in linear strips.

Dominant fall and winter foods in the Southern Appalachians include leaves and fruits of greenbrier (*Smilax* spp.), the leaves of mountain laurel (*Kalmia latifolia*), fruits of grapes (*Vitis* spp.) and oaks (*Quercus* spp.), and Christmas fern (*Polystichum acrostichoides*) (Seehorn et al. 1981). Similarly, Stafford and Dimmick (1979) reported that greenbrier, mountain laurel, and Christmas fern were the dominant fall and winter food items in the Southern Appalachian region of Tennessee and North Carolina. When available, acorns comprise a significant proportion of the diet (Seehorn et al. 1981, Servello and Kirkpatrick 1987, Kirkpatrick 1989, Thompson and Dessecker 1997). They provide a high-energy food source during the critical winter period when forage quality is limited (Servello and Kirkpatrick 1987, Kirkpatrick 1989). However, lack of secure cover in open oak stands may limit their use by grouse (Stafford 1989, Thompson and Dessecker 1997). Kubisiak (1985) suggested that 40-60 percent of a compartment be maintained in stands of mast-bearing age.

Ruffed grouse are found primarily in the Northern Ridge and Valley, Allegheny Mountains, Northern Cumberland Mountains, Blue Ridge Mountains, Northern Cumberland Plateau, and Southern Cumberland Mountains (SAMAB 1996e:66-67). Low-density populations also extend into the adjacent portions of the Central Ridge and Valley, Southern Cumberland Plateau, Southern Ridge and Valley, and Southern Appalachian Piedmont. Population densities generally are moderate in the Blue Ridge Mountains and low to moderate elsewhere. Current grouse densities generally are higher on national forest lands, national parks, and the Cherokee Indian Reservation than on other ownerships. Grouse population densities have declined over the last 25 years. The declining trend likely is largely due to the reduction of forest cover in the sapling-pole successional class, which is important to this species.

Ruffed grouse populations on the forest generally have declined during the last two decades, as they have throughout the Southern Appalachians. The Grouse Hunting Population Index Survey, conducted annually by Georgia DNR, is the primary technique used by the Forest to monitor ruffed grouse populations. Both flush rates

and harvest have declined significantly since the 1977–1978 season (Bearden and Waters 1999, USDA Forest Service 2000). Much of this decline is attributable to reduced availability of hardwood shrub-seedling habitat due to reductions in timber harvest levels.

Direct and Indirect Effects

Although ruffed grouse use a variety of forest habitats and successional stages, population responses are most strongly tied to the availability of early-successional habitat, particularly hardwood shrub-seedling habitat. Optimal conditions occur where 15 percent or more of the forest is maintained in early-successional conditions. Prescriptions assigned to early-successional option 4 (see *Successional Forests* Section) place an emphasis on providing early early-successional forests. These prescriptions have objectives to maintain 10 to 17 percent of forested acreage in early-successional stages and would provide conditions favorable for grouse.

Table 3- 126 shows the acres allocated to management prescriptions with successional stage option 4 by alternative for the Chattahoochee National Forest. Alternatives F and D would provide the greatest quantity of optimal habitat conditions for grouse. These habitat conditions would be much more limited in the other alternatives. Alternative G would not allocate any of the forest to prescriptions that would provide optimal conditions for grouse.

Table 3- 126. Acres Allocated To The Management Prescriptions With Successional Stage Option 4 By Alternative[1]

Chattahoochee National Forest Alternative	Acres
Alternative A	13,764
Alternative B	17,657
Alternative D	191,520
Alternative E	35,619
Alternative F	510,851
Alternative G	0
Alternative I	6,604

[1]*Source: Plan Revision GIS Management Prescription Allocations data layer, Alt A-G as of 09/12/02; Alt I as of 8/25/03.*

In general, only a limited number of acres are specifically allocated to the prescriptions that will provide optimal grouse habitat. However, many of the other prescriptions will provide at least suitable conditions for grouse through the development of lesser amounts of early-successional habitat. The effects of each of the alternatives on this key habitat feature is discussed in detail in the *Successional Forests* section. In year 10, all alternatives would increase the quantity of early-successional habitat over what is currently available. All alternatives except Alternative G and E would increase the quantity of early-successional habitats at year 50. Alternatives D and F would provide the greatest quantity of early-successional habitat, maintaining approximately 4-5 percent of the forest in early-successional conditions at year 50. Alternatives A, I, and B would provide more moderate levels of

early-successional habitat (2-3 percent at year 50) and Alternatives G and E would provide the least (greater than 1 percent at year 50).

Because of the limited amount of early-successional habitats expected, Alternatives G and E would provide the least desirable habitat conditions for ruffed grouse. To varying degrees, the remaining alternatives would provide suitable habitat conditions for grouse. Grouse population levels are expected to be adequate to meet hunter demands on the Chattahoochee National Forest for all alternatives except Alternatives G and E.

Cumulative Effects

Ruffed grouse populations on the Chattahoochee National Forest generally have declined during the last two decades (USDA Forest Service 2000). All alternatives except G and E will to some degree increase the level of early-successional habitat on the forest. However, in all alternatives the majority of the forest will be in mid- and late-successional conditions, which will limit the availability of quality grouse habitat. Throughout the eastern United States, factors such as increased urbanization, changing land ownership patterns, landowner attitudes, and management objectives on private and public lands likely will limit the amount of active forest management. As a result, long-term population declines for grouse and other early-successional species are expected (Dessecker and McAuley 2001).

Northern Bobwhite

Affected Environment

Northern bobwhite numbers have declined steadily throughout their range for over 40 years. From 1980 to 1999, fall bobwhite populations declined 65.8 percent and projected trends indicate a further decline of approximately 53.9 percent over the next two decades (Dimmick et al. 2002).

A lack of nesting and brood-rearing cover is considered the major limiting factor over much of the range of the northern bobwhite. The loss of native warm season plant communities caused by planting exotic grasses, planting dense pine forests, and intensive production of row crops is principally responsible for limiting bobwhite populations as well as other species such as loggerhead shrike, dickcissel, bobolink, Henslow's sparrow, Bachman's sparrow, and field sparrow. Managed warm season grasses with an adequate component of forbs provide good to excellent nesting and brood-rearing habitat. Southern pines can be managed to encourage development of habitat conditions favorable for northern bobwhite. Hardwood forests provide important winter habitats for bobwhite throughout much of its range. Hardwood savanna management provides habitat conditions that promote bobwhite productivity and survival.

The northern bobwhite has specific seasonal needs that vary throughout the year. This species favors abandoned fields and brushy areas such as wood margins, hedgerows, thickets and open woods (Hamel 1992). Summer nesting cover and summer brood habitat consisting of grassy areas (preferably bunch grasses) and weedy patches with exposed bare ground are needed to provide for the recruitment within a population. Winter food and winter cover of seed producing plants and shrubby thickets are needed to carry populations through the dormant season (Rosene 1985). Habitat conditions for bobwhite quail require disturbances from burning and mowing or discing on two to three year intervals.

Good northern bobwhite habitat requires good interspersion of food species and cover that is not too dense. Good habitat can support about one bird per acre (2.5/ha) according to Murray and Frye (1957). In a habitat improvement experiment in Florida, pine forests were cleared and subterranean clover (*Trifolium subterraneum*) planted to encourage the establishment of arthropods, an important food for chicks (Ribbeck et al.1987). Areas that were sharecropped and burned during winter and spring at two-year intervals produced more quail than areas planted with food patches or areas that were sharecropped, but not burned (Ellis et al. 1969).

Rosene (1985) recommended managing forests on an uneven-aged rotation basis, and thinning after 20 years to maintain an open canopy. He also suggested creating park-like woodlands in the South with high open canopies and a thin, spotty pattern of shrubs in the understory.

Predators of adult northern bobwhite include hawks and eagles (Accipitridae), falcons (Falconidae), foxes (Vulpes, Urocyon), bobcat (*Lynx rufus*), and domestic cats (*Felis sylvestris*) and dogs (*Canis domesticus*). Predators of chicks and eggs include weasels and skunks (Mustelidae), raccoons (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), snakes (*Coluber* spp.; *Elaphe* spp.), crows and ravens (*Corvus* spp.), rats (*Ratus norvegicus*), squirrels, and chipmunks (Sciuridae) (Klimstra and Roseberry 1975, Murray and Frye 1957, Terres 1980). The bobwhite quail is also a popular game bird throughout much of its range, with days spent afield by hunters also in decline in recent years.

The recovery of bobwhite quail may be difficult with an accelerating loss of available land to create and maintain quail habitat throughout its range. Restoring bobwhite populations range-wide will depend upon:

- the amount of agricultural lands that are enhanced to provide nesting, brood rearing, and roosting habitats for quail and other grassland species;
- the amount of pine-dominated and mixed pine hardwood lands that are managed to provide open grass- and forb-dominated ground cover through thinning, harvesting, and periodic burning; and
- the amount of rangeland that is managed to improve native plant communities and provide quail food and cover.

According to the total number of bobwhite quail heard or seen on breeding routes surveys conducted throughout the state of Georgia, populations trends of northern bobwhite quail in Georgia have been steadily decreasing since 1983, as illustrated by Table 3- 127.

Table 3- 127. Numbers of Bobwhite Quail Recorded During Breeding Bird Route Survey in Georgia.

Year	Number of Birds	Year	Number of Birds
1983	1,984	1993	954
1984	1,871	1994	903
1985	1,323	1995	842
1986	1,633	1996	822
1987	1,673	1997	708
1988	1,550	1998	566
1989	1,276	1999	465
1990	1,363	2000	402
1991	1,001	2001	451
1992	1,250		

Source: Sauer et al. 2002

Statewide in Georgia, bobwhite quail hunting has experienced a drastic decline. From mail-in survey responses from Georgia hunters, the numbers of hunters pursuing quail has dropped from 115,000 estimated hunters in 1970, to 41,900 in 1998. This represents an estimated 64 percent decline over nearly three decades in Georgia (Georgia Outdoor News, 2002).

More recently, from a small-game hunter phone survey, the number of quail hunters from the 2001-2002 survey was only 16,100 hunters. This represents about 62 percent of the number that was thought to be hunting in 1998 and about 86 percent below the estimates thought to be pursuing quail in 1970 (GON 2002).

According to Hamel (1992), overall potential for bobwhite quail is much greater in the Piedmont (Oconee National Forest) than in the Mountain Physiographic Region Chattahoochee National Forest. The relationship between fire and bobwhite quail ecology has been the subject of numerous studies. Research indicates bobwhite habitat is enhanced by dormant season burning to provide foods (insects during the summer and seeds during the fall and winter) and brood habitat. Fire exclusion for two to three years provides nesting habitat and summer fruit production, as well as escape cover. The hard mast component that is encouraged by fire also benefits the bobwhite quail (Landers 1981). More intense prescribed fire and active red-cockaded woodpecker habitat management activities has also resulted in more habitat diversity and contributed to increased quail numbers on the Oconee National Forest.

Northern bobwhite quail populations are not just declining in Georgia. Throughout the Southeastern United States over the past 25 years, 50 percent of the region had a low bobwhite density in 1970. By 1995, over 70 percent of this same region had a low density (Southern Appalachian Man and the Biosphere 1996). This decline is reflected in all land ownership types and it is primarily attributed to the loss of agricultural lands and changes in agricultural practices.

The 2003 MIS report for the Chattahoochee-Oconee National Forest concludes that there is evidence of declining populations of northern bobwhite quail on the Forest. Bird route surveys and point counts for the past 12 years show no drastic changes, but the number of occurrences reported remains very low.

Direct and Indirect Effects

Habitat needs for northern bobwhite were considered during development of habitat management provisions included in the revised forest plan by reviewing and incorporating elements of the Northern Bobwhite Conservation Initiative (Dimmick et al. 2002), a report by the Southeast Quail Study Group Technical Committee. Habitat provisions that are expected to lead to improved conditions for quail include those for restoration of woodlands, savannas, and grasslands, restoration and maintenance of open pine forests, creation of early-successional forests, and maintenance of permanent openings. In general, alternatives that provide for higher levels of prescribed fire and vegetation management would favor quail habitat and populations. Grass/forb and seedling/sapling stages of oak forest regeneration have also been shown to provide quality habitat (nesting and foraging) for northern bobwhite quail and other early-successional bird species (Hunter et al. 1999).

The EIS section on *Permanent Openings, Old Fields, Rights of Way and Improved Pastures* describes a habitat with herbaceous conditions that directly and indirectly benefit northern bobwhite quail. These areas contain seedling/sapling/shrub and grass/forb habitats that are important elements for species preferring early-successional habitat. These areas with permanent openings are maintained for wildlife habitat on an annual or semi-annual basis. They areas are mowed, cultivated, burned and receive vegetative management treatment to benefit many wildlife species. The same is true for Temporary Openings allocations, but to a lesser extent, due to limited longevity.

Early-successional rights-of-way also provide some benefits to bobwhite quail and other early-successional habitat species. These areas should be managed to enhance their wildlife habitat as much as possible. A number of vegetation manipulation treatments to maintain early succession may be used, but site-specific analysis may be necessary before treatment.

Improved pastures are also very beneficial to northern bobwhite quail. Preferring open, agricultural habitat settings, quail are naturally attracted to pasture lands. However, improved pastures are limited in numbers and size on national forests. There are some of these areas currently being managed on the Forest, mainly on the Oconee range allotments. Emphasis to convert these areas to native warm-season grasses, and controlling noxious weeds should be considered whenever possible.

Table 3- 128. Acres Available for Bobwhite Quail Habitat Management by Alternative

Alternative	Option 3 Acres	Option 4 Acres	Total Acres Available For Bobwhite Quail Habitat Management
A	305,965	31,095	337,060
B	460,541	17,402	477,943
D	276,891	210,064	486,955
E	92,619	46,645	139,264
F	24,404	593,280	617,684
G	99,983	0	99,983
I	363,357	6,604	369,961

Source: Plan Revision GIS Stands Data Layer as of September 2, 2003

Table 3- 128 shows the total acres allocated to management prescriptions with two different successional stage options by Alternatives. Option 3 prescriptions allow for up to 10 percent of the prescription area to be in early-successional stages. This would be considered suitable habitat for bobwhite quail. However, more optimal habitat would more likely be found to occur under option 4 since it allows up to 17 percent of the prescription area to be in early succession. Therefore, the additions of the suitable and optimal acres (Options 3 and 4) could be considered potential habitat for the bobwhite quail.

The management prescriptions for RCW habitat (8.D. and 8.D.1.) would also provide beneficial habitat for bobwhite quail on the Oconee National Forest. However, the acreage allotments for RCW do not vary significantly between alternatives. Many other prescriptions will provide some habitat for quail. Effects of each of the alternatives on this habitat feature (early-successional) are discussed in more detail in the Successional Forests topic. Alternatives F, D and B would provide the greatest amounts of early-successional habitat for bobwhite. Alternatives A and I would provide moderate levels of early-successional habitat, and Alternatives G and E would provide the least amount of potential habitat for the bobwhite.

Cumulative Effects

Cumulatively, trends in habitat quality and quantity on nearby private lands are likely to continue. In farmland or grasslands habitats, the northern bobwhite quail is a species of both regional importance and conservation concern. Under the Partners in Flight Conservation Plan for the Southern Piedmont area, the northern bobwhite was chosen as an umbrella species for the following reasons:

- It is declining, and is believed to be representative of an early-successional habitat species suite associated with agricultural landscapes.
- It is economically important as a demanded game species.
- There have already been some serious management efforts to restore this species (such as Farm Bill Reform efforts).
- The habitat requirements for this species have been well-studied, and recommendations can be made for habitat enhancements (Cooper 2000).

Specific management recommendations to promote habitat improvements for bobwhites would include promotion of warm-season grasses, alternative burning regimes, or more diverse site preparation techniques. Support of maintaining early-successional habitat within the region will depend on the cooperation of private landowners as well as the establishment and maintenance of early-successional habitats on the national forest. Enhancement of intensively managed private agricultural areas will depend in part on incentive programs for private landowners (Cooper 2000).

American Woodcock

Affected Environment

Although classed as a game bird, populations of woodcock have shown large declines in the Eastern U.S. since surveys began in 1968 (Krementz and Jackson 1999). In the Southern Appalachians and Piedmont, breeding populations are highly variable in density and spotty in distribution. Wintering population densities vary from year to year, but the species is much more common and widely distributed in winter than in summer in the South. According to conservation status rankings, the woodcock is 'apparently secure' in Alabama and Tennessee, and 'secure' in Virginia and Georgia; its status is unranked in South Carolina (NatureServe 2001). The woodcock is listed as a priority species under the Forest Service's southern national forest migratory and resident landbird conservation strategy (Gaines and Morris 1996).

The American woodcock is closely associated with young, second-growth hardwoods and other early-successional habitats that are a result of periodic forest disturbance (Straw et al. 1994). Ideal habitat consists of young forests and abandoned farmland mixed with forested land (Keppie and Whiting 1994). These include forest openings or clearings for singing displays in spring, shrubby thickets or other young hardwoods on moist soils for feeding and daytime cover, young second-growth hardwoods for nesting, and large fields for night-time roosts (Mendall and Aldous 1943, Andrle and Carroll 1988, Boothe and Parker 2000). European settlement and subsequent clearing presumably favored this species (Foss 1994).

To support woodcock populations, habitat structure appropriate for feeding, display/ roosting, and nesting all must be provided in suitable areas and in adequate configurations. Feeding habitat is much less open than display/roosting habitat and consists predominantly of second-growth (15 to 30 years old) hardwood or mixed woods with shrubs, but also includes bottomland hardwoods, upland mixed pine-hardwoods, and mature longleaf pine after recent burning (Keppie and Whiting 1994). Dense thickets less than 20 years of age are especially important throughout much of the woodcock's range. Typical overstory canopy cover in daytime sites during breeding season is 53 to 64 percent (Dunford and Owen 1973). Shrub cover is also typically high at 75 to 87 percent (Morgenweck 1977), and it is often adjacent to more open display habitat. Moist, generally loamy, soils are important for foraging, because they provide abundant and available earthworms, the woodcock's primary food.

Roosting and display habitat is typically open fields or regenerating forests. Maintenance of old fields for roosting and display habitat can be accomplished through discing, mowing, use of herbicides, and prescribed burns, although maintaining some small trees and shrubs is desirable. The goal is to create open habitats that are 'patchy,' rather than uniform in structure. As the ground and mid-story vegetation disappear through succession, woodcock will cease using the site (Krementz and Jackson 1999).

Silvicultural practices can also enhance habitat (Sepik et al. 1981, Rosenberg and Hodgman 2000). Clearcuts can provide good nocturnal roosting habitat. Further, clearcutting small strips and blocks in mature woods in Maine has been shown to increase numbers (Dwyer et al. 1982a); new blocks or strips are cut every 8 to 10 years on a 40- to 50-year rotation to provide a continuous supply of young growth. McAuley et al. (1996) recommend maintaining at least 25 percent of land in early-successional habitat by clearcutting blocks at least 2 ha, or 30 m-wide strips, in mature forest on a 40-year rotation. Stands dominated by shrub species may be encouraged and maintained by strip-cutting on a 20-year rotation for woodcock (Sepik et al. 1981). Shelterwood and seed trees left in partial timber harvests help to retain the patchy structure that woodcock prefer. Thinning and selection harvests can also improve dense forests for woodcock by allowing light to reach the ground. Boothe and Parker (2000) recommend burning slash from clearcuts to enhance these openings for woodcock nesting, courting and roosting. Shifts away from even-aged forest management may be detrimental to populations (Keppie and Whiting 1994, Rosenberg and Hodgman 2000).

Natural disturbances historically responsible for creation of early-successional habitat also improve woodcock habitat. Beavers created extensive habitat, as did fire and possibly windstorms. In general, maintaining integrity of wetter sites such as springs, streams and creeks is beneficial to these species. Allowing thickets to grow in riparian areas will greatly improve habitat quality for woodcock (Krementz and Jackson 1999). Grassy areas near water provide prime nesting and display grounds.

Non-breeding or wintering habitat is similar to breeding habitat, but typically includes more open conditions such as sedge meadows, beaver pond margins, rice fields, upper reaches of estuaries and occasionally coastal meadows (del Hoyo et al. 1996). Winter habitats range from bottomland hardwoods to upland pine forests, young pine plantations, and mature pine-hardwood forests, though in some pine habitats the birds tend to focus their activities in lowlands dominated by hardwoods (Roberts 1993). Unlike during breeding, mature pine-hardwood and bottomland hardwoods are often preferred (Krementz and Pendleton 1994, Horton and Causey 1979). During the non-breeding season, woodcock generally occupy moist thickets in daytime, and shift to more open habitats such as pastures, fields (including agricultural), and young clearcuts at night. A diversity of habitat types and age classes may be especially important to survival when severe weather forces woodcock from preferred sites (Krementz and Pendleton 1994). Prescribed burning is a common forest management practice, and can be used to set back plant succession. A light, controlled fire can maintain habitat patchiness as well. Burns may also remove pine needle cover, opening the ground to woodcock foraging. Mowing can also be used to improve foraging habitat, but appropriate habitat should be maintained for nesting birds (Roberts 1993).

Direct and Indirect Effects

Habitat needs for American woodcock were considered during development of habitat management provisions included in the revised forest plan. Habitat provisions that are expected to lead to improved conditions for woodcock include those for maintenance of some level of early-successional riparian habitat, creation

of early-successional forests in general, and maintenance of permanent openings. Differing effects of alternatives on woodcock habitat are indicated under sections on *Riparian Areas, Successional Forests*, and *Permanent Openings*. In general, alternatives that provide for higher levels of early-successional forests would favor woodcock habitat and populations.

Table 3- 129 provides the basis to analyze different alternatives with regard to total acres of early-successional habitat conditions that can occur within management prescriptions with successional habitat option 3 (up to 10 percent) and option 4 (up to 17 percent) on the Chattahoochee-Oconee National Forest. Although woodcock utilize a variety of habitats, they are most commonly associated with early-successional habitat niches, and it is sometimes referred to as disturbance-dependent within its range. Therefore, we can total the acres in each alternative for both option 3 and 4 and show those as potential habitat acres for the American woodcock.

Table 3- 129. Acres Available for Woodcock Habitat Management by Alternative

Alternative	Option 3 Acres	Option 4 Acres	Total Acres Available For Woodcock Habitat Management
A	305,965	31,095	337,060
B	460,541	17,402	477,943
D	276,891	210,064	486,955
E	92,619	46,645	139,264
F	24,404	593,280	617,684
G	99,983	0	99,983
I	363,357	6,604	369,961

Source: Plan Revision GIS Stands Data Layer as of September 2, 2003

Alternatives F, D and B would provide the most acres of potential early-successional habitat for woodcock. Alternatives A and I would provide moderate levels of potential early-successional habitat for woodcock. Under Alternatives E and G, we can expect the least amount of early-successional habitat availability for the woodcock.

Figure 3 - 24 below indicates a declining woodcock population within its range inside the United States. This singing male annual index was taken from data collected from randomly chosen roadsides along lightly traveled roads in the central and northern portions of the breeding range, over almost three decades (Bruggink and Kendall 1995).

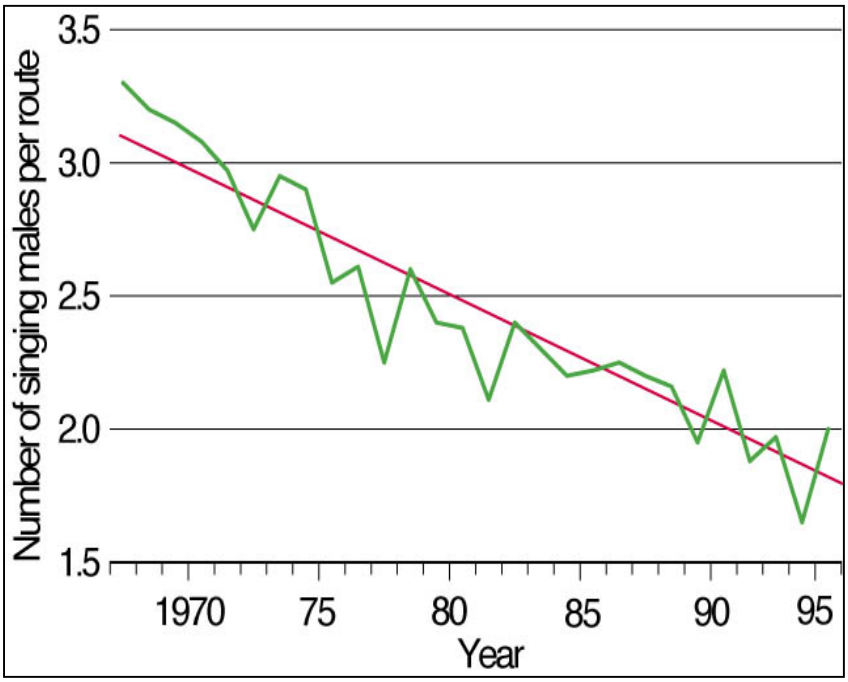

Figure 3 - 24. Long-Term Trend And Annual Indices Of The Number Of Woodcock Heard On The Woodcock Singing-Ground Survey in the Eastern Region, 1968 - 1995 (Bruggink And Kendall 1995).

Cumulative Effects

Cumulatively, trends in habitat quality and quantity on nearby private lands are likely to continue. Successional disturbances within riparian areas on private (agricultural and forested) lands could provide additional feeding, hiding cover, and resting areas for the American woodcock. A variety of successional stages and forest types on National Forests would also be expected to continue to provide habitat for this bird in the future.

According to the Southern Appalachian Man and the Biosphere (SAMAB 1996) report, woodcock populations generally are low in the Appalachian assessment area. The report goes on to say that woodcock densities have declined since 1970. Loss of agricultural land may have contributed to this decline, but the effects appear to be much less than with other small game such as bobwhite quail. Woodcock declines have occurred throughout most of the different ownership categories, including Federal and private lands (SAMAB 1996).

MIGRATORY BIRDS

Migratory birds have become a focus of conservation concern due to evidence of declining population trends for many species. To ensure that forest plan revision alternatives include provisions for migratory bird habitat, planning efforts included coordination with the Migratory Bird Office of the U.S. Fish and Wildlife Service and others under the umbrella of Partners in Flight (PIF). PIF is a cooperative effort involving partnerships among federal, state, and local government agencies, foundations, professional organizations, conservation groups, industry, the academic community and private individuals. It was launched in response to growing concerns about declines in populations of land bird species and to emphasize conservation of birds not covered by existing conservation initiatives.

PIF has developed Bird Conservation Plans for each physiographic area relevant to the national forest planning area. These plans are science-based, long-term, proactive strategies for bird conservation across all land ownerships and are designed to ensure long-term maintenance of healthy populations of native land birds. Forest Service biologists worked with PIF regional and local coordinators to identify key management issues and opportunities for high priority species on National Forest lands, and developed related goals, objectives, and standards for incorporation into the revised forest plan. In addition, *The Southern National Forest's Migratory and Resident Landbird Conservation Strategy* (Gaines and Morris 1996) was also reviewed and incorporated into planning efforts. This strategy identifies priority species and provides a framework for monitoring populations. The monitoring program described in this document is currently being implemented, and would continue under all alternatives.

Because migratory and resident landbirds are so ubiquitous and diverse, they are relevant to the majority of ecological communities and habitat elements considered during forest planning. As a result, provisions for these species are integrated into numerous plan objectives and standards focused on achieving desired habitat conditions. Effects of these provisions on ecological communities and associated species are addressed throughout the EIS. Effects to specific species of birds are addressed under appropriate sections for those chosen as Management Indicator Species. In addition, all relevant conservation priority species, as identified by the U.S. Fish and Wildlife Service, are assessed under the terrestrial species viability evaluation.

PIF Southern Blue Ridge Plan

Major Issues:

- Reduction of off-site white pine
- Creating structural diversity in mature mixed mesophytic forests (cerulean warbler)
- Creation of high elevation early-successional habitat/woodland restoration
- Restoration of native mountain pines

- Maintenance of oak forests (regeneration, late successional forests, thin and burn mid successional stages)

The Chattahoochee-Oconee National Forest falls within three Physiographic areas including the Southern Blue Ridge (SBR), Piedmont and Ridge and Valley. Breeding Bird Surveys (BBS) analysis indicates that about 30 percent of the species known to breed in the SBR have declined sharply in the last 30 years, and an additional 18 percent have shown possible declining trends. The number of species showing declines in the SBR exceeds that found in any other physiographic area within the Southeast (James *et al.* 1993, Hunter *et al.* 1993) including resident species, nearctic-temperate migrants, and neartic-neotropical migrants.

The Chattahoochee National Forest has established objectives to maintain and restore mesic deciduous forest, oak and oak/pine forest and high-elevation early-successional forest. Because of the importance of maintaining viability of migratory birds, all alternative have objectives to maintain and restore habitats for these species. Alternatives E and G have a relatively lesser opportunity for maintenance and restoration than they do for alternatives A,B,D and I (see Table 3- 130).

Table 3- 130. Estimated Annual Average Treated Acres By Forest, Objective, and Alternative

Objective By Forest and Vegetation Communities	Alt. A	Alt. B	Alt. D	Alt. E	Alt G	Alt. I
CHATTAHOOCHEE						
Prescribed Burn						
Oak/Oak-Pine	7,210	7,840	8,610	5,950	5,040	7,600
Thinning						
Oak/Oak-Pine	515	560	615	425	360	550
Restoration						
Oak/Oak-Pine	103	112	123	34	17	125
Mtn Longleaf	103	112	123	34	17	110
Canebrakes	5	5	5	5	5	5
Woodlands	1,030	1,120	1,230	340	170	1,000
Canopy Gap						
Mesic Deciduous	1,030	1,120	1,230	850	720	1,030
Riparian	70	50	50	40	20	50
High Elevation						
Early-Successional (maximum)	324	427	433	193	146	327

Many early-successional species at mid- to high elevations have declined due to forest maturation, fire suppression, elimination of grazing, and decline in active forest management on federal lands. The Chattahoochee National Forest has approximately 40,000 acres above 3,000 ft that is not allocated to management prescriptions that would have significant constraints on management activities. The forest has established objectives to restore and maintain between 2,160 and 3,690 acres of high elevation early-successional habitats [Refer to section on High Elevation Early-successional Habitats]

A predominance of forest stands in the 40-80 year age class on national forest lands has resulted in a closed canopy condition with poorly developed understory and subcanopy. There is an overall lack of forest with "old growth" characteristics, including a multi-layered canopy, snags and downed woody debris. The Chattahoochee National Forest has objectives to create canopy gaps and vertical structure on approximately 5,291 to 11,620 acres. (Refer to the section on *Mesic Deciduous Hardwood*.)

PIF Piedmont Plan

Major Issues:

- Mix of mature riparian forest and patches of dense understory (Acadian flycatcher, Swainson's warbler, woodcock, Louisiana waterthrush)
- Forest interior versus early-successional habitat—emphasize early-successional habitat in pine forests
- Native grassland/savanna/woodland restoration; shortleaf pine restoration (red-cockaded woodpecker, quail, Bachman's sparrow)

The two largest challenges facing the conservation of habitat in the Piedmont today are urbanization and intensification of agriculture and forest management. Of these, the former is of much greater concern because its effects are essentially permanent.

Mixed pine-hardwood comprises about 1,914,500 ha, or about 15 percent, of the Southern Piedmont. Oak-hickory forests comprise about 1,539,500 ha, or about 12 percent, of the region. Most of the land in national forests, wildlife management areas, and other public lands are in this cover type. The Chattahoochee-Oconee National Forest has outlined objectives to restore pine and pine/oak stands ranging between approximately 900 to 1,100 acres (decadal) on the Oconee National forest [Refer to the section on *Pine and Pine/Oak Forest*.]

Pasture, hay, and other grasslands comprise about 370,000 ha, or about 3 percent of the region. Row crops cover over 2.6 million ha, or about 20 percent, of the Southern Piedmont. These areas are important because the conservation plan for early-successional species principally calls for enhancement of these habitats. The Oconee National Forest has approximately 1,058 acres of improved pasture which will be maintained in an early-successional condition.

The term riparian refers to streamside areas. Riparian woodlands may also be called greenbelts, stream corridors, streamside management zones, or streamside buffers. Riparian habitat in the Southern Piedmont is often dominated by mixed mesic hardwoods or by tree and shrub species more typical of uplands such as oak-hickory, beech-maple. Upland riparian habitats are often important to both aquatic and terrestrial fauna, especially in areas where there is high topographic relief. In addition to providing direct benefits to birds, riparian zones can also serve as corridors that permit movement between forest patches. Objectives to restore canebrake communities have been identified by the forest to enhance riparian habitats for species occupying those habitats. The Chattahoochee-Oconee National Forest has established objectives to maintain and restore canebrakes, shortleaf pine and woodland savannahs and grasslands. Because of the importance of maintaining

viability of migratory birds, all alternative have objectives to maintain and restore habitats for these species. Ranges between alternatives are indicated in the Table 3-131.

Table 3- 131. Estimated Annual Average Treated Acres By Forest, Objective, and Alternative – Oconee NF

Objective By Forest and Vegetation Communities	Alt. A	Alt. B	Alt. D	Alt. E	Alt G	Alt. I
OCONEE						
Prescribed Burn						
Shortleaf Pine	535	510	530	505	450	500
Loblolly (Outside RCW HMA)	1,070	1,020	1,060	1,010	900	1,100
Loblolly (Inside RCW HMA)	13,375	12,750	13,250	12,625	11,250	13,300
Oak/Oak-Pine	535	510	530	505	450	550
Canebrakes	3	3	3	3	3	3
Thinning						
Shortleaf Pine	214	204	212	202	180	230
Loblolly (Outside RCW HMA)	107	102	106	101	90	3,500
Oak/Oak-Pine	535	510	530	505	450	520
Hardwood Midstory Reduction						
Shortleaf Pine	535	510	530	505	450	500
Loblolly (Outside RCW HMA)	535	510	530	505	450	1,100
Restoration						
Oak/Oak-Pine	54	51	53	51	45	55
Canebrakes	15	15	15	15	15	15
Woodlands	107	102	106	101	90	110
Shortleaf Pine	107	102	106	101	90	110
Pine-Oak	107	102	106	101	90	110
Canopy Gap						
Mesic Deciduous	107	102	106	101	90	110
Riparian	27	26	27	25	23	30

PIF Southern Cumberland Plateau and Ridge and Valley Plan

Major Issues:

- Maintaining minimum area of upland hardwood (worm-eating warbler, wood thrush)
- Restoration of riparian woodlands with dense understories (Swainson's warbler)
- Pine woodland restoration and maintenance (red-cockaded woodpecker, quail, brown-headed nuthatch)
- Providing large-patch early-seral habitat (may be provided by private land and importance may vary across the three relevant NF units)

The greatest conservation issue in the Southern Cumberland Plateau and Ridge and Valley is conversion of hardwood and mixed pine/hardwood forest to monocultures of loblolly pine, urbanization, and agriculture. A large percentage of natural vegetation has been cleared for other uses, and mature forest and the birds dependent on

mature forest are less secure here than in any other physiographic area in the Southern Appalachians. The long-term health of populations of priority birds will probably depend on maintenance and management of remnant forest as well as aggressive restoration efforts. The Chattahoochee-Oconee National Forest has objectives to maintain and restore oak and oak pine stands within this physiographic region. The Forest has also outlined objectives to restore longleaf pine stands on appropriate sites.

The Chattahoochee-Oconee National Forest has established objectives to maintain and restore canebrakes, shortleaf pine and woodland savannahs and grasslands. Because of the importance of maintaining viability of migratory birds, all alternative have objectives to maintain and restore habitats for these species. Ranges between alternatives are indicated in Table 3- 130 and Table 3- 131.

Stable scrub-shrub habitat is greatly depleted, and birds adapted to those conditions persist largely in the early succession phases of actively managed forests. The Ridge and Valley on the Chattahoochee-Oconee National Forest is primarily in options 2 (1 to 4 percent early-successional) or 3 (4 to 10 percent) across all alternatives. This allows the landscape to be managed for early-successional habitats at those percentages.

Because migratory birds cover such large areas, their conservation is dependent on the distribution of suitable habitats across large regions. Currently, national forests provide some of the largest blocks of forested habitat when viewed at a regional scale. As habitat quality and quantity continues to decline on many privately-owned lands due to conversion to urban and suburban land uses, national forest lands will become even more critical to migratory birds in the future. Efforts by the Forest Service to coordinate closely with partners in bird conservation and to incorporate proactive conservation measures into forest plan revisions are designed to ensure national forests continue to support at-risk migratory birds.

SPECIES VIABILITY

Terrestrial Species Viability Evaluation

National Forest Management Act (NFMA) regulations, adopted in 1982, require that habitat be managed to support viable populations of native and desirable non-native vertebrates within the planning area *(36 CFR 219.19)*. USDA regulation 9500-004, adopted in 1983, reinforces the NFMA viability regulation by requiring that habitats on national forests be managed to support viable populations of native and desired non-native plants, fish, and wildlife. These regulations focus on the role of habitat management in providing for species viability. Supporting viable populations involves providing habitat in amounts and distributions that can support interacting populations at levels that result in continued existence of the species well distributed over time.

The Southern Appalachian region supports extremely high levels of biological diversity relative to other regions, viewed both nationally and globally. As a result, large numbers of species are present for which population viability may be of concern. Detailed demographic or habitat capability analysis to evaluate population viability is not feasible for this large number of species. Therefore, our goal for this evaluation is to use a clearly defined, transparent process to identify species for which there are substantive risks to maintenance of viable populations, and to ensure consideration of appropriate habitat management strategies to reduce those risks to acceptable levels where feasible.

For comprehensiveness and consistency, evaluation of species viability was coordinated across several national forests undergoing simultaneous plan revisions. These forests are the Jefferson National Forest, Cherokee National Forest, Sumter National Forest, Chattahoochee and Oconee National Forests, and National Forests in Alabama. These forests encompass portions of the Southern Appalachian, Piedmont, and East Gulf Coastal Plain ecoregions. However, the scale for this assessment is set by NFMA regulations as the "planning area," or the area of the National Forest System covered by a single forest plan. Therefore, separate risk assessment was done for each national forest covered by a separate forest plan. Risk assessment was further split where national forest units under the same forest plan occur in different ecoregions, or are widely separated geographically. For this reason, the Chattahoochee (Southern Appalachian Eco-Region) and Oconee (Piedmont Eco-Region) National Forests were evaluated separately. Although viability evaluation was coordinated across the ecoregions, analysis presented here focuses on information relevant to the Chattahoochee and Oconee National Forests.

Because NFMA regulations require providing habitat for species viability within the planning area, focus of this evaluation is on habitat provided on national forest land. Surrounding private lands may contribute to, or hinder, maintenance of species viability on national forest land, but are not relied upon to meet regulation requirements. For this reason, habitat abundance was assessed based on conditions found on national forest land. Habitat distribution, however, was assessed

considering the condition of intermixed ownerships and conditions, which may affect the interactions of species among suitable habitat patches on national forest land.

Evaluation of migratory birds focused on breeding populations only, unless otherwise indicated. This focus does not mean that wintering and migrating populations were not considered during planning, but that viability evaluation makes most sense when viewed in terms of the relative stability of breeding populations.

Much of the foundational information used in this evaluation was compiled by NatureServe, under a Participating Agreement with the Forest Service. NatureServe is an international non-profit organization, formerly part of The Nature Conservancy. Its mission is to develop, manage, and distribute authoritative information critical to conservation of the world's biological diversity. Partnership with NatureServe was sought as a means to ensure the best available information on species status and habitat relationships used in this evaluation. Under this agreement, NatureServe staff engaged numerous species experts and state heritage programs to develop a relational database that includes relevant information on species' status, habitat relationships, and threats to viability.

Viability Evaluation Process

Risk to maintenance of viability over the next 50 years was assessed for each species in relation to each of its principle habitat relationships by plan revision alternative. Risk assessment was based on three factors: 1) current species abundance, 2) expected habitat abundance in 50 years, and 3) expected habitat distribution in 50 years (Figure 3 - 25). Once risk ratings were developed, we assessed how well management strategies across alternatives provide for species viability.

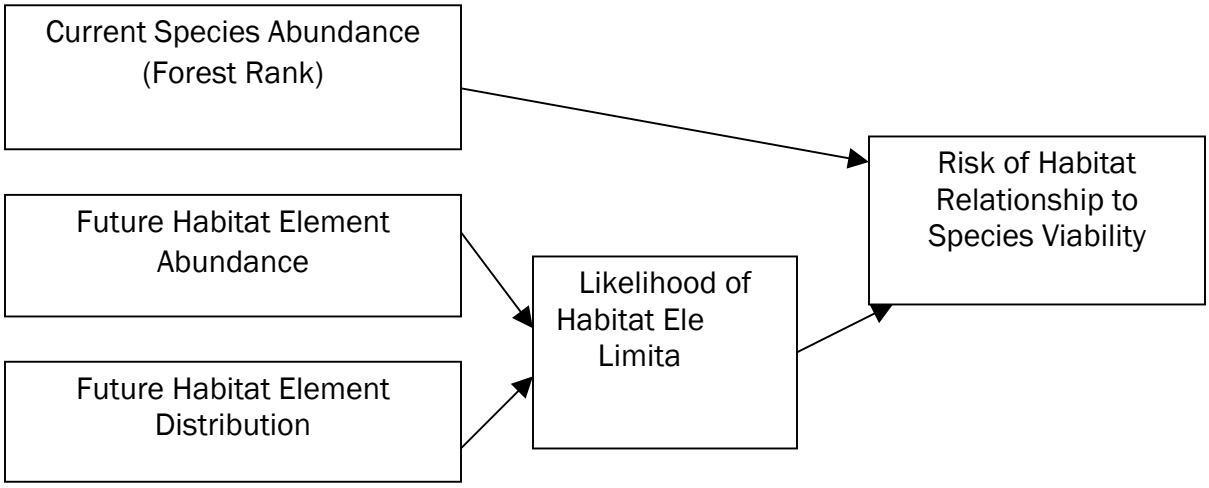

Figure 3 - 25. Relationship Of Variables Used To Rate The Risk To Viability Resulting From A Species' Relationship With A Habitat Element.

A comprehensive list of species with potential viability concern was compiled for the Chattahoochee and Oconee National Forests. The list includes those species found, or potentially found, on these national forests from the following categories:

- Species listed as proposed, threatened, or endangered under the Federal Endangered Species Act,
- Species listed on the Regional Forester's Sensitive Species list,
- Species identified as locally rare on these national forests by Forest Service biologists,
- Birds of conservation concern as identified by the USFWS, and
- Declining species of high public interest.

Species lists from all national forests in the Southern Appalachian and Piedmont Eco-regions were pooled to create comprehensive lists of species of potential viability concern. NatureServe staff and contractors assigned abundance ranks for each species on the comprehensive eco-region list for the Chattahoochee and Oconee National Forests. These Forest Ranks, or F Ranks, follow the conventions used by NatureServe and others in defining State and Global Ranks (Table 3- 132). F Ranks were used in viability risk assessment as a categorical variable representing a species' current abundance. Forest Service biologists reviewed F Ranks developed by NatureServe to identify any inconsistencies between these rankings and Forest Service information. Discrepancies in this abundance variable were resolved through coordination with NatureServe and its contractors. Where conflicting information or opinion on species abundance occurs, the most conservative information (i.e., that indicating lowest abundance) was used.

Only those species that are both confirmed present and rare or of unknown abundance (F1 through F3, and F?) on the Chattahoochee and Oconee National Forests were assessed for viability risk. Species ranked as F? were treated as F1 species to provide a conservative approach to those species for which abundance information is not available. Species that are currently abundant on these forests (F4, F5) are assumed to be at low risk of losing viability within the next 50 years, and, therefore, were not further evaluated for viability risk.

Table 3- 132. Forest Ranks (F Ranks) And Definitions Used To Define Viability Status Of Species On The Chattahoochee And Oconee National Forests, 2002.

F Rank	F Rank Definition
F0	Not present; no known occurrences on the forest unit and forest is outside species' range or habitat not present.
F1	Extremely rare on the forest unit, generally with 1-5 occurrences.
F2	Very rare on the forest unit, generally with 6-20 occurrences.
F3	Rare and uncommon on the forest unit, from 21-100 occurrences.
F4	Widespread, abundant, and apparently secure on the forest unit.
F5	Demonstrably secure on the forest unit.
F?	Present on the forest, but abundance information is insufficient to develop rank.
FP	Possibly could occur on the forest unit, but documented occurrences are not known.
FH	Of documented historical occurrence on the forest unit; may be rediscovered.
FX	Once occurred but has been extirpated from the forest unit; not likely to be

F Rank	F Rank Definition
	rediscovered.

Because viability regulations focus on the role of habitat management in providing for species viability, habitat condition was the primary factor used to drive species viability evaluation. NatureServe staff and contractors identified habitat relationships for all species of potential viability concern, linking each species to vegetation community types, successional stages, and habitat attributes as appropriate. Based on this information, each species was linked by Forest Service biologists to one or more habitat elements. These habitat elements (Table 3- 133) roughly correspond to categories of management direction included in the revised plan, and to sections of effects analysis included in this environmental impact statement. NatureServe staff reviewed and provided adjustments to species' assignment to these habitat element groups.

Table 3- 133. Habitat Elements Used To Plan For, And Assess Risk To, Viability Of Terrestrial Species During Forest Plan Revision, Chattahoochee And Oconee NF

Habitat Element	Element Description
Bogs, Fens, Seeps, Seasonal Ponds	Bogs, fens, seeps, seasonal ponds characterized by saturated soils
Open Wetlands	Open wetlands, marshes, beaver ponds, generally characterized by having some permanent standing water
River Channels	Riverine gravel and sand bars, and river banks subject to flood scour
Glades and Barrens	Glades and barrens characterized by shallow soils, exposed parent material, and sparse or stunted vegetation
Table Mountain Pine Forests	Forests and woodlands dominated by table mountain pine and maintained by periodic fire
Basic Mesic Forests	Basic mesic or "rich cove" forests characterized by calciphilic herbs and usually dominated by maples, basswood, and buckeye.
Rock Outcrops and Cliffs	Rock outcrops and cliffs characterized by exposed rock, shallow soils and sparse vegetation
Spray Cliffs	Rock that remains wet for all or most of the year, associated with waterfalls or seepage
Shrub Balds	Shrub balds
Canebrakes	Canebrakes characterized by dense stands of cane and open canopies, usually within riparian areas
Caves and Mines	Caves and mines with microclimates capable of supporting associated biota
Mature Mesic Hardwood Forests	Mid- and late-successional mesic deciduous forests, including northern hardwood, mixed mesophytic, mesic oak, and bottomland hardwood forests

Habitat Element	Element Description
Mature High-Elevation Mesic Hardwood Forests	Mid- and late-successional mesic hardwood forests at high elevations, primarily northern hardwood forests
Mature Oak Forests	Dry to mesic mid- and late-successional oak and oak-pine forests subject to moderate levels of disturbance sufficient to maintain the oak component
Mature Yellow Pine Forests	Mid- and late-successional southern yellow pine and pine-oak forests maintained in open conditions by frequent fire
Mature Mountain Longleaf Pine Forests	Mid- and late-successional mountain longleaf pine forests maintained in open conditions by frequent fire
Early-Successional Forests	Early-successional forests, typically aged 0-10 years and dominated by woody species
High Elevation Early Succession	Early-successional habitats at high elevations, including early-successional forests, open woodlands, and old fields
Mature Forest Interiors	Mature forest interiors with minimal adverse effects due to forest edge.
Canopy Gaps	Mid- and late-successional mesic deciduous forests with a diverse vertical and horizontal structure as a result of gaps in the canopy
Woodlands and Savannas	Open woodlands and savannas characterized by low canopy cover and rich grass-dominated understories, and maintained in open conditions by periodic fire
Grasslands	Grasslands with little to no overstory, usually occurring as patches within woodland and savanna complexes and maintained by periodic fire
Mixed Landscapes	Landscapes characterized by a broad mix of successional habitats
Late Successional Riparian	Riparian areas dominated by mid- and late-successional deciduous forests
Early-Successional Riparian	Riparian areas with a dense understory or early-successional forest in riparian areas
Snags	Forests containing an abundance of snags
Downed Wood	Forests containing an abundance of downed wood and thick leaf litter
Den Trees	Forests containing an abundance of large hollow trees suitable as den trees
Hard Mast	Forests producing abundant hard mast
Remoteness	Remote habitats away from frequent human disturbance
Lakeshores	Forested shores of lakes and ponds High water quality in streams and lakes

Habitat Element	Element Description
Water Quality	

Effects to these habitat elements are analyzed in this EIS under other sections. Based on these analyses, each habitat element was assigned categorical values by alternative to indicate future abundance (Table 3- 134) and distribution (Table 3- 135), general likelihood that the habitat element would limit viability of associated species (Table 3- 136), and overall effect of national forest management on the habitat element (Table 3- 138).

The future abundance variable (Table 3- 134) is defined as the abundance of the associated habitat element in fifty years if the alternative were selected and implemented over that fifty-year period. This variable indicates the abundance of the habitat element on national forest land only, to provide focus on the role of the national forest planning area in supporting associated species. Its focus on national forest land only reflects recognition that viability is to be provided within the "planning area" (area covered by the forest plan). Definitions of abundance categories are stated in quantifiable terms in order to be objective as possible; however, in many cases quantifiable estimates of future abundance are not available. In these cases, knowledge of Forest Service biologists was used to assign abundance values based on current conditions and the magnitude and direction of effects expected under each alternative.

Table 3- 134. Values Used To Categorize Projected Abundance Of Each Habitat Element After 50 Years Of Implementing Each Forest Plan Revision Alternative.

Habitat Abundance Value	Description
Rare	The habitat element is rare, with generally less than 100 occurrences, or patches of the element generally covering less than 1 percent of the national forest planning area.
Occasional	The habitat element is encountered occasionally, and generally is found on 1 to 10 percent of the national forest planning area.
Common	The habitat element is abundant and frequently encountered, and generally is found on more than 10 percent of the national forest planning area.

Similar to the future abundance variable, the future distribution variable (Table 3- 135) is defined as the distribution of the associated habitat element in fifty years if the alternative were selected and implemented over that fifty-year period. In contrast to the abundance variable, it includes consideration of intermixed ownership patterns and conditions, and their general effects on movements and interactions of individuals among the suitable habitat patches found on national forest land. Because assessing adequacy of habitat distribution for a species requires a level of

knowledge not available for most species, and the number of species being evaluated is very large, we have defined habitat distribution in terms of a historical reference condition - that which was present prior to the major perturbations associated with European settlement of the planning area. This period is generally defined as 1000 to 1700 A.D. This approach relies on the assumption that a habitat distribution similar to that which supported associated species during recent evolutionary history will likely contribute to their maintenance in the future, and that the further a habitat departs from that historical distribution, the greater the risk to viability of associated species. This approach has its own set of difficulties, as evidence of pre-settlement conditions relevant to the planning area is often anecdotal and scarce. In addition, the reference period may have included a wide variety of conditions as a result of growing aboriginal populations and accompanying use of agriculture and fire during the early portion of this period, and their subsequent dramatic decline due to disease epidemics following early European contact. Nevertheless, the precision required to assign the categorical values for this variable is not high, and may be supported by general positions described in mainstream conservation literature (see Wear and Greis 2002). Knowledge of Forest Service biologists was used to assign distribution values, based on interpretations of historical conditions supported by conservation literature, current conditions, and magnitude and direction of effects expected under each alternative.

Differences in scale between the Habitat Abundance and Habitat Distribution variables is intentional in order to bring two different pieces of information into the analysis. Habitat Abundance has been defined in terms of the amount of habitat on national forest land only. This definition reflects the amount of habitat available to support a species on the national forest, in recognition of regulation requirements that viability be provided within the "planning area" (area covered by the forest plan). Habitat Distribution, on the other hand, is defined to include the landscape setting of national forest lands, which includes the intermingled private lands and broken ownership patterns that provides the context for national forest populations and may affect ability of individuals living on national forest lands to interact with each other.

Table 3- 135. Values Used To Categorize Projected Distribution Of Each Habitat Element After 50 Years Of Implementing Each Forest Plan Revision Alternative.

Habitat Distribution Value	Description
Poor	The habitat element is poorly distributed within the planning area and intermixed lands relative to conditions present prior to European settlement. Number and size of habitat patches and/or their evenness in distribution across the landscape is greatly reduced.
Fair	The habitat element is fairly well distributed within the planning area and intermixed lands relative to conditions present prior to European settlement. Number and size of habitat patches and/or their evenness in distribution across the landscape is somewhat reduced.
Good	The habitat element is well distributed within the planning area and intermixed lands relative to conditions present prior to European settlement. Number

and size of habitat patches and/or their evenness in distribution across the landscape is similar to or only slightly reduced relative to reference conditions.

Habitat element abundance and distribution variables were combined to create one variable to indicate the general likelihood that the habitat element would be limiting to populations of associated species (Table 3- 136). In this general context, habitat limitation refers to a habitat factor - quantity, distribution, or quality - that results in risk to continued existence of the species within the planning area. Everything else being equal, quality habitat elements that are rare and poorly distributed are those most likely to cause risk to viability of associated species; those that are common and well distributed are least likely to cause risk to viability of associated species.

Table 3- 136. Likelihood Of Habitat Limitation (High, Moderate, And Low) To Associated Species As Derived From Habitat Abundance And Distribution Values.

Habitat Abundance	Habitat Distribution		
	Poor	Fair	Good
Rare	High	High	Moderate
Occasional	High	Moderate	Low
Common	Moderate	Low	Low

Providing for species viability requires providing abundant and well-distributed habitat in ways that allow existing populations to persist or expand. The ability of existing populations to respond to available habitat depends in part on their current robustness, which is generally a function of population size. In general, for a given habitat condition, small populations will be at more risk than large populations. To reflect this fact, likelihood of habitat limitation variable was combined with a species' F Rank for each species/habitat element interaction to generate viability risk ratings (Table 3- 137). Associations of very rare species with habitat elements that are likely to be most limiting were identified as those most at risk; associations of more common species with habitats less likely to be limiting received lower risk ratings. Ratings include three levels of "high" risk (Table 3- 137) to ensure that results err on the side of caution.

Table 3- 137. Viability Risk Ratings For Species/Habitat Interactions As A Function Of A Species' F Rank And Likelihood Of Habitat Element Limitation Variables.

Likelihood of Habitat Element Limitation	Species F Rank			
	F1 or F?	F2	F3	F4, F5
High	Very High	High	Moderately High	Moderate
Moderate	High	Moderately High	Moderate	Low
Low	Moderately High	Moderate	Low	Low

Once viability risk ratings were developed for each species/habitat relationship, habitat elements most commonly associated with risks to species viability were identified by counting the number of very high, high, and moderately high ratings associated with each. To assess the role of national forest management in minimizing viability risk associated with each habitat element, a management effects variable was assigned to each habitat element by alternative. The management effects value (Table 3- 138) categorizes the goal of management for the habitat element, the expected resulting trend, and any additional opportunity for minimizing viability risk. Numbers of very high, high, and moderately-high risk ratings were summarized by management effects variable by alternative to assess how well alternatives address viability-related habitat needs.

Table 3- 138. Values Used To Categorize The Effect Of National Forest Management In Minimizing Or Contributing To Species Viability Risk Associated With Each Habitat Element By Forest Plan Revision Alternative.

Management Effect Value	Description
1	Abundance and distribution of the habitat element is maintained or improved by providing optimal protection, maintenance, and restoration to all occurrences (with limited exceptions in some cases). Little additional opportunity exists to decrease risk to viability of associated species because management is at or near optimal.
2	Abundance and distribution of the habitat element is improved through purposeful restoration, either through active management or passively by providing for successional progression. Opportunity for decreasing risk to associated species is primarily through increasing rates of restoration, where possible.
3	The habitat element is maintained at approximately current distribution and abundance, though location of elements may shift over time as a result of management action or inaction. Opportunity to reduce risk to viability of associated species is primarily through adopting and implementing objectives to increase abundance and distribution of the habitat element.
4	Regardless of management efforts, the habitat element is expected to decrease in distribution and abundance as a result of factors substantially outside of Forest Service control (e.g., invasive pests, acid deposition). Opportunity to reduce risk to viability of associated species is primarily through cooperative ventures with other agencies and organizations.
5	The habitat element is expected to decrease in distribution and abundance as a result of management action or inaction. Opportunity to reduce risk to viability of associated species is primarily through adopting and implementing objectives to maintain or increase this habitat element.

Distribution of viability risk was also summarized by species status, i.e., federally-listed under the Endangered Species Act, listed as Regional Forester's sensitive species, or identified as locally rare or of other concern. The species status summary highlights the relative role of other provisions included in law and policy that result in additional consideration of at-risk species during planning.

Viability Evaluation Results

Species viability evaluation for the Chattahoochee National Forest included consideration of 1,368 species of the Southern Appalachian ecoregion (Appendix E, Table J1). Of these species, 250 are considered rare and are known to occur on the Chattahoochee National Forest. Species viability evaluation for the Oconee National Forest included consideration of 124 species of the Piedmont ecoregion (Appendix E, Table J2). Of these species 17 are considered rare and are known to occur on the Oconee National Forest.

Outcomes for habitat elements, as described under individual effects analysis sections, are summarized in Appendix E, Tables K1 and K2 for the Chattahoochee and Oconee National Forests, respectively, using the four variables described in Table 3- 134, Table 3- 135, Table 3- 136, and Table 3- 138. These variables indicate expected habitat condition following fifty years of implementing each forest plan revision alternative.

Ratings of risk to viability for each species/habitat relationship by alternative are presented in Appendix E, Tables L1 and L2 for the Chattahoochee and Oconee National Forests, respectively. To facilitate comparison of effects of alternatives on species viability, the number of very-high, high, and moderately high-risk ratings is summarized for each alternative by habitat element (Table 3- 139 and Table 3- 140), management effect (Table 3- 141 and Table 3- 142), and species status (Table 3- 143 and Table 3- 144).

Viability risk rating summaries indicate relatively small differences among alternatives relative to effects on species viability. This similarity results from planning efforts to include in all alternatives provisions to provide for species viability in compliance with NFMA regulations. Examples of such provisions common to all alternatives (except Alternative F, which represents the current forest plan) are the prescriptions for rare communities and riparian corridors. Similarity of viability outcomes among alternatives also results from the influence of external forest health threats, which represent serious risks to forest communities and associated species regardless of alternative. Differences among alternatives are also muted by the small scale of actions contemplated under all alternatives relative the more extensive effects to ecological systems that have occurred to national forest landscapes since European settlement. Broader scale effects will likely continue to have similar important effects to species viability regardless of which alternative is selected.

Despite similarities, some differences in effects of alternatives are apparent. For the Chattahoochee National Forest, Alternatives E and G result in greater risk to more species than other alternatives primarily because of emphasis on minimizing disturbance, which puts species associated with early-successional habitat and woodlands, savannas, and grasslands at very-high risk (Table 3- 139). Alternative F also would result in very limited emphasis on restoration of woodland and grassland communities, and as a result, shows higher numbers of species associated with these habitats at very-high risk. There are very few differences among alternatives for the Oconee National Forest (Table 3- 140). Alternatives E, F, and G would result in very limited emphasis on restoration of woodland and grassland communities as

compared to other alternatives, and as a result, show slightly higher numbers of species associated with these habitats at very-high risk.

Table 3- 139. Number Of Species/Habitat Relationships Rated As Very High, High, And Moderately High Risk to Terrestrial Species Viability for Each Habitat Element by Alternative – Chattahoochee National Forest

Habitat Element	Alternative A	B	D	E	F	G	I
Bogs, Fens, Seeps, Seasonal Ponds							
Very High	23	23	23	23	23	23	23
High	10	10	10	10	10	10	10
Moderately High	11	11	11	11	11	11	11
Total	44	44	44	44	44	44	44
Open Wetlands							
Very High	2	2	2	2	2	2	2
High	1	1	1	1	1	1	1
Moderately High	0	0	0	0	0	0	0
Total	3	3	3	3	3	3	3
River Channels							
Very High	1	1	1	1	1	1	1
High	2	2	2	2	2	2	2
Moderately High	2	2	2	2	2	2	2
Total	5	5	5	5	5	5	5
Glades and Barrens							
Very High	8	8	8	8	8	8	8
High	8	8	8	8	8	8	8
Moderately High	5	5	5	5	5	5	5
Total	21	21	21	21	21	21	21
Table Mountain Pine Forests							
Very High	3	0	0	3	3	3	3
High	0	3	3	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	3	3	3	3	3	3	3
Basic Mesic Forests							
Very High	8	8	8	8	8	8	8
High	1	1	1	1	1	1	1
Moderately High	11	11	11	11	11	11	11
Total	20	20	20	20	20	20	20
Rock Outcrops and Cliffs							
Very High	0	0	0	0	0	0	0
High	31	31	31	31	31	31	31
Moderately High	5	5	5	5	5	5	5
Total	36	36	36	36	36	36	36
Spray Cliffs							
Very High	0	0	0	0	0	0	0
High	2	2	2	2	2	2	2
Moderately High	2	2	2	2	2	2	2
Total	4	4	4	4	4	4	4

Table 3-139 (Chattahoochee), continued	Alternative						
Habitat Element	A	B	D	E	F	G	I
Shrub Balds							
Very High	5	5	5	5	5	5	5
High	1	1	1	1	1	1	1
Moderately High	1	1	1	1	1	1	1
Total	7	7	7	7	7	7	7
Canebrakes							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Caves and Mines							
Very High	0	0	0	0	0	0	0
High	2	2	2	2	2	2	2
Moderately High	1	1	1	1	1	1	1
Total	3	3	3	3	3	3	3
Mature Mesic Hardwood Forests							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	29	29	29	29	29	29	29
Total	29	29	29	29	29	29	29
Mature High-Elevation Mesic Hardwood Forests							
Very High	0	0	0	0	0	0	0
High	17	17	17	17	17	17	17
Moderately High	7	7	7	7	7	7	7
Total	24	24	24	24	24	24	24
Mature Hemlock Forests							
Very High	8	8	8	8	8	8	8
High	3	3	3	3	3	3	3
Moderately High	3	3	3	3	3	3	3
Total	14	14	14	14	14	14	14
Mature Oak Forests							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	12	12	12	12	12	12	12
Total	12	12	12	12	12	12	12
Mature Yellow Pine Forests							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2

Table 3-139 (Chattahoochee) continued	Alternative						
	A	B	D	E	F	G	I
Mountain Longleaf Pine Forests							
Very High	0	0	0	0	0	0	0
High	1	1	1	1	1	1	1
Moderately High	0	0	0	0	0	0	0
Total	1	1	1	1	1	1	1
Early-Successional Forests							
Very High	0	0	0	4	0	4	0
High	0	0	0	2	0	2	0
Moderately High	4	4	4	0	4	0	4
Total	4	4	4	6	4	6	4
High Elevation Early Succession							
Very High	0	0	0	7	7	7	0
High	7	7	7	3	3	3	7
Moderately High	3	3	3	0	0	0	3
Total	10	10	10	10	10	10	10
Mature Forest Interiors							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Canopy Gaps							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	6	6	6	6	6	6	6
Total	6	6	6	6	6	6	6
Woodlands, Savannas, and Grasslands							
Very High	0	0	0	18	18	18	0
High	18	18	18	11	11	11	18
Moderately High	11	11	11	9	9	9	11
Total	29	29	29	38	38	38	29
Mixed Landscapes							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	4	4	4	4	4	4	4
Total	4	4	4	4	4	4	4
Late Successional Riparian							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	24	24	24	24	24	24	24
Total	24	24	24	24	24	24	24

Table 3-139 (Chattahoochee) continued	Alternative						
Habitat Element	A	B	D	E	F	G	I
Early-Successional Riparian							
Very High	2	2	2	2	2	2	2
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	2	2	2	2	2	2	2
Snags							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	1	1	1	1	1	1	1
Total	1	1	1	1	1	1	1
Downed Wood							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
Den Trees							
Very High	0	0	0	0	0	0	0
High	1	1	1	1	1	1	1
Moderately High	0	0	0	0	0	0	0
Total	1	1	1	1	1	1	1
Hard Mast							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Remoteness							
Very High	0	0	0	0	0	0	0
High	1	1	1	1	1	1	1
Moderately High	0	0	0	0	0	0	0
Total	1	1	1	1	1	1	1
Lakeshores							
Very High	0	0	0	0	0	0	0
High	1	1	1	1	1	1	1
Moderately High	0	0	0	0	0	0	0
Total	1	1	1	1	1	1	1
Water Quality							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Table 3-139 (Chattahoochee) continued	Alternative						
Habitat Element	A	B	D	E	F	G	I
All Habitat Elements							
Very High	60	57	57	89	85	89	60
High	107	110	110	98	96	98	107
Moderately High	146	146	146	137	141	137	146
Total	313	313	313	324	322	324	313

Table 3- 140. Number Of Species/Habitat Relationships Rated As Of Very High, High, And Moderately High Risk to Terrestrial Species Viability for Each Habitat Element by Alternative – Oconee National Forest

	Alternative						
Habitat Element	A	B	D	E	F	G	I
Bogs, Fens, Seeps, Seasonal Ponds							
Very High	0	0	0	0	0	0	0
High	2	2	2	2	2	2	2
Moderately High	0	0	0	0	0	0	0
Total	2	2	2	2	2	2	2
Open Wetlands							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
River Channels							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Glades and Barrens							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Rock Outcrops and Cliffs							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Canebrakes							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Caves and Mines							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Mature Mesic Hardwood Forests							
Very High	0	0	0	0	0	0	0
High	2	2	2	2	2	2	2
Moderately High	0	0	0	0	0	0	0
Total	2	2	2	2	2	2	2

Table 3-140 (Oconee) continued	Alternative						
Habitat Element	A	B	D	E	F	G	I
Mature Oak Forests							
Very High	0	0	0	0	0	0	0
High	1	1	1	1	1	1	1
Moderately High	0	0	0	0	0	0	0
Total	1	1	1	1	1	1	1
Mature Yellow Pine Forests							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
Early-Successional Forests							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Mature Forest Interiors							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
Canopy Gaps							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
Woodlands, Savannas, and Grasslands							
Very High	0	0	0	1	1	1	0
High	1	1	1	1	1	1	1
Moderately High	1	1	1	1	1	1	1
Total	2	2	2	3	3	3	2
Mixed Landscapes							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Late Successional Riparian							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	3	3	3	3	3	3	3
Total	3	3	3	3	3	3	3

Table 3-140 (Oconee) continued	Alternative						
Habitat Element	A	B	D	E	F	G	I
Early-Successional Riparian							
Very High	0	0	0	0	0	0	0
High	2	2	2	2	2	2	2
Moderately High	0	0	0	0	0	0	0
Total	2	2	2	2	2	2	2
Snags							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Downed Wood							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	1	1	1	1	1	1	1
Total	1	1	1	1	1	1	1
Den Trees							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Hard Mast							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Remoteness							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Lakeshores							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Water Quality							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Table 3-140 (Oconee) continued	Alternative						
Habitat Element	A	B	D	E	F	G	I
All Habitat Elements							
Very High	0	0	0	1	1	1	0
High	8	8	8	8	8	8	8
Moderately High	11	11	11	11	11	11	11
Total	19	19	19	20	20	20	19

Evaluation results indicate, under all alternatives, high levels of risk to species viability are associated with certain key habitats (Table 3- 139 and Table 3- 140). For the Chattahoochee National Forest, highest risks are associated with 1) bogs, fens, seeps, and seasonal ponds, 2) rock outcrops and cliffs, 3) woodlands, savannas, and grasslands, 4) mature mesic hardwoods, 5) mature high-elevation mesic hardwood forests, 6) late successional riparian forests, 7) glades and barrens, and 8) basic mesic forests.

Bogs, fens, seeps, and seasonal ponds are critical to maintaining species viability due to their natural rarity on the landscape, their decline during European settlement due to beaver control and drainage for agriculture, and the number of rare species associated with them. Provisions of the rare community prescription provide for optimal protection and management of all occurrences of these habitats under all alternatives except Alternative F; therefore, opportunities for further reducing risk to viability of associated species are limited. Under Alternative F such habitats likely would be maintained, but would not receive the focused attention provided by the rare community prescription. Because of the rarity of these habitats, the likelihood of habitat limitation is expected to be high under all alternatives, which results in a high viability risk rating for those species associated with these wetland communities.

Distribution of rock outcrops and cliffs has been and should continue to be relatively stable over time under all alternatives due to the stability of the factors that define them. Provisions of the rare community prescription provide for optimal protection and management of all occurrences of these habitats under all alternatives except Alternative F; therefore, opportunities for further reducing risk to viability of associated species are limited. Under Alternative F such habitats would likely be maintained, but would not receive the focused attention provided by the rare community prescription. Because of the rarity of these habitats, the likelihood of habitat limitation is expected to be moderate under all alternatives, which results in a high viability risk rating for those species associated with rock outcrops and cliffs.

Historically, woodlands, savannas, and grasslands occurred on xeric sites in association with fire. Because of fire suppression, these habitats are much reduced today. Restoration activities will improve their distribution, but not likely to historical levels under any alternative. Emphasis on restoration would be much more limited in Alternatives E, G, and F as compared to the other alternatives. As a result, woodland

habitats would remain rare under these alternatives, increasing the likelihood of a habitat limitation for those species associated with these habitats.

Mature mesic hardwoods likely were widespread historically and will remain so in the future under all alternatives, despite some conversions to other land uses on private lands. Increases in mature forests are expected under all alternatives, with especially large increases under E and G. These habitats will be common and well distributed across all alternatives. The likelihood of habitat limitation of these habitats is expected to be low under all alternatives. However there are a large number of extremely rare species (F1) associated with these habitats. Because of their rarity, these species have a moderately high viability risk rating in spite of improving habitat conditions.

Historically, mature forests likely were the predominate condition of high elevation mesic hardwoods. On the Chattahoochee National Forest this remains the situation today and will likely remain so the future under all alternatives. Early-successional habitat creation and maintenance would not be expected to substantially alter distribution of this habitat as it would still be the predominant matrix condition at high elevations. However, because of the somewhat limited acreage of high elevation habitats and the loss of these habitats on private lands, the likelihood of habitat limitation is expected to be moderate under all alternatives, which results in a high viability risk rating for those species associated with mature high-elevation mesic hardwood forests.

Historically, most riparian areas likely were in mature forest, but Native American uses created some early-successional habitat. Most national forest riparian areas are in mature forest and will remain so into the future under all alternatives. The likelihood of habitat limitation of these habitats is expected to be low under all alternatives. However there are a large number of extremely rare species (F1) associated with these habitats. Because of their rarity, these species have a moderately high viability risk rating in spite of improving habitat conditions.

Glades and barrens occur on sites with thin soils and exposed parent material and usually are found in relatively discrete patches, but may be found within woodland complexes. Some existing sites may be restored through burning, but their distribution is greatly reduced from historic levels due to permanent land use alterations and lack of fire on private lands. Provisions of the rare community prescription provide for optimal protection and management of all occurrences of these habitats under all alternatives except Alternative F; therefore, opportunities for further reducing risk to viability of associated species are limited. Under Alternative F such habitats would likely be maintained, but would not receive the focused attention provided by the rare community prescription. Because of the rarity of these habitats, the likelihood of habitat limitation is expected to be high under all alternatives, which results in a high viability risk rating for those species associated with glades and barrens.

Basic mesic forests occur in rich coves within mixed mesophytic forests. Although many of these sites have been logged in the past, with future protection they are restorable to near historic levels on national forest lands. However, overall distribution is reduced from historic levels due to permanent land use alterations on private lands. Provisions of the rare community prescription provide for optimal protection and management of the best examples of these habitats under all alternatives except Alternative F; therefore, opportunities for further reducing risk to viability of associated species are limited. Under Alternative F many of these communities would likely be maintained, but some of these habitats would be available to timber management, reducing their distribution relative to other alternatives. Because of the rarity of these habitats, the likelihood of habitat limitation is expected to be high under all alternatives, which results in a high viability risk rating for those species associated with basic mesic.

For the Oconee National Forest, highest risks are associated with 1) late successional riparian forests 2) bogs, fens, seeps, and seasonal ponds, 3) mature mesic hardwood forests, 4) mature yellow pine forests, 5) mature forest interiors, 6) canopy gaps, 7) woodlands, savannas, and grasslands, and 8) early-successional riparian (Table 3- 140). Expected trends and management influences for late successional riparian forests, bog, fens, seeps, and seasonal ponds, and woodlands, savannas, and grasslands would be similar for those described for these habitats on the Chattahoochee National Forest.

Historically, mature mesic hardwood forests were likely distributed along drains and low areas not heavily influenced by fire. Although there are some minor differences among alternatives due to differences in management intensity and emphasis, all alternatives would maintain the majority of the mesic hardwood forests in mid and late-successional conditions. However, intermixed ownerships and conversions to other land uses on private lands have reduced distribution overall and this likely would be reduced further in the future. Because of the limited distribution of these habitats, the likelihood of a habitat limitation is expected to be moderate under all alternatives, which results in a high viability risk rating for those species associated with mature mesic hardwood forests.

Mature yellow pine forests were the predominant community on historical landscapes in the Piedmont and still are today. All alternatives will provide for sufficient management opportunities to maintain these forests in desired conditions. Therefore the likelihood of habitat limitation of these habitats is expected to be low under all alternatives. However there are several extremely rare species (F1) associated with mature yellow pine forests. Because of their rarity, these species have a moderately high viability risk rating in spite of improving habitat conditions.

Mature forest interiors were historically limited to hardwood types, which were limited by fire. Trends for this habitat are similar to those for mature mesic hardwood forests. These conditions would be found on national forest lands in moderate amounts under all alternatives but distribution overall would be limited due to losses on private lands. Because of the limited distribution of these habitats, the likelihood

of a habitat limitation is expected to be moderate under all alternatives, which results in a high viability risk rating for those species associated with mature forest interiors.

Canopy gap conditions are relevant to mesic hardwood types, which were limited on the landscape by fire. Historically this habitat likely was distributed along drains and low areas. On national forest land these habitats would continue to be distributed similarly under all alternatives, due in large part to the riparian prescription. However, intermixed ownerships and conversions to other land uses on private lands have reduced distribution of mesic hardwoods and this likely will be reduced further within 50 years. Because of the limited distribution of these habitats, the likelihood of a habitat limitation is expected to be moderate under all alternatives, which results in a high viability risk rating for those species associated with canopy gap conditions.

Quality early-successional riparian forests likely were present historically due to the effects of shifting Native American agriculture and settlement. These conditions would be created at very low levels under all alternatives but the majority of the riparian areas will be maintained in late successional conditions. Some early-successional habitats would be provided on private lands but overall distribution will be reduced from historical conditions, resulting in a high likelihood of habitat limitation for all alternatives and a high viability risk rating for species associated with early-successional riparian forests.

The effects of management of species/habitat risk ratings are shown in Table 3- 141 and Table 3- 142, for the Chattahoochee and Oconee National Forests, respectively. For most alternatives, the majority of species with very high, high and moderately high viability risk are associated with habitats that would be managed to provide optimal protection or would be enhanced through restoration efforts. The ability to reduce risk is limited, and regardless of management efforts these species would remain at risk because of their extremely limited numbers on the Chattahoochee and Oconee National Forests.

Table 3- 141. Number Of Species/Habitat Relationships Rated As Of Very High, High, And Moderately High Risk To Terrestrial Species Viability For Each Category Of Management Effect By Forest Plan Revision Alternative - Chattahoochee National Forest.

	Alternative						
Management Role	A	B	D	E	F	G	I
Provide Optimal Protection and Management for All Habitat Occurrences							
Very High	47	47	47	47	0	47	47
High	59	59	59	59	3	59	59
Moderately High	38	38	38	38	1	38	38
Total	144	144	144	144	4	144	144
Improve Habitat Abundance and Distribution Through Restoration							
Very High	5	2	2	23	2	23	5
High	27	30	30	13	1	13	27
Moderately High	58	70	29	61	44	61	58
Total	90	102	61	97	47	97	90
Maintain Habitat Abundance and Distribution							
Very High	0	0	0	0	72	0	0
High	18	18	1	18	88	18	18
Moderately High	47	35	28	35	93	35	47
Total	65	53	29	53	253	53	65
Reduce Habitat Abundance and Distribution as Result of External Factors							
Very High	8	8	8	8	8	8	8
High	3	3	3	3	3	3	3
Moderately High	3	3	3	3	3	3	3
Total	14	14	14	14	14	14	14
Decline in Habitat Abundance and Distribution as Result of Management							
Very High	0	0	0	11	3	11	0
High	0	0	17	5	1	5	0
Moderately High	0	0	48	0	0	0	0
Total	0	0	65	16	4	16	0
Total for All Management Role Categories							
Very High	60	57	57	89	85	89	60
High	107	110	110	98	96	98	107
Moderately High	146	146	146	137	141	137	146
Total	313	313	313	324	322	324	313

Table 3- 142. Number Of Species/Habitat Relationships Rated As Of Very High, High, And Moderately High Risk To Terrestrial Species Viability For Each Category Of Management Effect By Alternative - Oconee National Forest.

	Alternative						
Management Role	A	B	D	E	F	G	I
Provide Optimal Protection and Management for All Habitat Occurrences							
Very High	0	0	0	0	0	0	0
High	2	2	2	2	0	2	2
Moderately High	0	0	0	0	0	0	0
Total	2	2	2	2	0	2	2
Improve Habitat Abundance and Distribution Through Restoration							
Very High	0	0	0	1	0	1	0
High	6	6	4	6	2	6	6
Moderately High	6	8	2	6	1	8	8
Total	12	14	6	13	3	15	14
Maintain Habitat Abundance and Distribution							
Very High	0	0	0	0	1	0	0
High	0	0	0	0	6	0	0
Moderately High	5	3	3	5	10	3	3
Total	5	3	3	5	17	3	3
Reduce Habitat Abundance and Distribution as Result of External Factors							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Decline in Habitat Abundance and Distribution as Result of Management							
Very High	0	0	0	0	0	0	0
High	0	0	2	0	0	0	0
Moderately High	0	0	6	0	0	0	0
Total	0	0	8	0	0	0	0
Total for All Management Role Categories							
Very High	0	0	0	1	1	1	0
High	8	8	8	8	8	8	8
Moderately High	11	11	11	11	11	11	11
Total	19	19	19	20	20	20	19

Of key interest are habitats elements that are both associated with high risk to species viability, and for which management can reduce risk by improving abundance and distribution. For both the Chattahoochee and Oconee National Forests, only Alternative D would reduce a substantial number of habitat elements with high-risk species relationships as a direct result of management because of its emphasis on

maintaining a regulated age class distribution. These associations involve mature mesic hardwood forests, mature high-elevation mesic forests, mature oak forests, and mature forest interiors on the Chattahoochee National Forest, and mature mesic hardwood forests, mature yellow pine forests, mature forest interiors, and the structural diversity or canopy gaps found in older age-classes of such forests on the Oconee National Forest. For Alternative D the declines in these habitats are expected to be relatively minor and abundance and distribution of these habitat elements will not vary greatly from the other alternatives.

For some alternatives, lack of management emphasis will reduce abundance and distribution of several key habitat elements. Habitat abundance for viability concern species associated with early-successional habitats would decline in Alternatives E and G as a result of limited management actions to create these conditions. All other alternatives have objectives to maintain or increase the availability of this habitat. Similarly, Alternative F would result in a decline in the abundance of rare communities such as canebrakes, mountain longleaf pine and table mountain pine forests due to lack of management emphasis on restoration in this alternative.

Planning for, and evaluation of, species viability for forest plan revision has focused primarily on providing desired abundance and distribution of habitat elements, in compliance with NFMA regulations. Risks to species viability can be much reduced by additional provisions present in existing law and policy. These include specific consideration of effects to federally-listed threatened and endangered species, those proposed for such listing, and Regional Forester's Sensitive Species, in biological assessments and evaluations conducted as part of all national forest management decisions. These assessments and evaluations identify where additional protective measures are warranted to provide for continued existence of the species on national forest land. Projects that may affect federally-listed or proposed species must be coordinated with the U.S. Fish and Wildlife Service. In support of these requirements, these species are also often the focus of inventory and monitoring efforts.

Additional species-based provisions included in all forest plan revision alternatives supplement existing law and policy. All alternatives include general and species-specific provisions for federally-listed species, developed through coordinated planning with the US Fish and Wildlife Service.

The species/habitat risk ratings by species status are shown in Table 3- 143 and Table 3- 144, for the Chattahoochee and Oconee National Forests, respectively. For both forests, all alternatives are similar in the number of federally-listed species with moderately high or higher species/habitat association risk ratings. For listed animals with high-risk ratings such as the red-cockaded woodpecker, additional species-specific standards have been established to provide further protection and enhancement for this species above that provided by the coarse filter habitat elements. For listed plants, specific management objectives have been established for each species to contribute to their recovery.

Table 3- 143. Number of Species/Habitat Relationships Rated as Very High, High, and Moderately High Risk to Terrestrial Species Viability for Each Category of Species Status by Alternative - Chattahoochee National Forest.

Habitat Element	Alternative A	B	D	E	F	G	I
Federally-Listed or Proposed as Threatened or Endangered							
Very High	5	5	5	6	6	6	5
High	6	6	6	6	6	6	6
Moderately High	1	1	1	0	0	0	1
Total	12	12	12	12	12	12	12
Regional Forester's Sensitive Species							
Very High	10	10	10	15	14	15	10
High	23	23	23	21	21	21	23
Moderately High	40	40	40	37	38	37	40
Total	73	73	73	73	73	73	73
Locally Rare and Other Species							
Very High	45	42	42	68	65	68	45
High	78	81	81	71	69	71	78
Moderately High	105	105	105	100	103	100	105
Total	228	228	228	239	237	239	228
Total for All Species Status Categories							
Very High	60	57	57	89	85	89	60
High	107	110	110	98	96	98	107
Moderately High	146	146	146	137	141	137	146
Total	313	313	313	324	322	324	313

Table 3- 144. Number Of Species/Habitat Relationships Rated As Very High, High, And Moderately High Risk To Terrestrial Species Viability For Each Category Of Species Status By Alternative – Oconee National Forest.

	Alternative						
Habitat Element		B		E	F	G	I
Federally-listed or Proposed as Threatened or Endangered							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	1	1	1	1	1	1	1
Total	1	1	1	1	1	1	1
Regional Forester's Sensitive Species							
Very High	0	0	0	0	0	0	0
High	1	1	1	2	2	2	1
Moderately High	1	1	1	0	0	0	1
Total	2	2	2	2	2	2	2
Locally Rare and Other Species							
Very High	0	0	0	1	1	1	0
High	7	7	7	6	6	6	7
Moderately High	9	9	9	10	10	10	9
Total	16	16	16	17	17	17	16
Total for All Species Status Categories							
Very High	0	0	0	1	1	1	0
High	8	8	8	8	8	8	8
Moderately High	11	11	11	11	11	11	11
Total	19	19	19	20	20	20	19

As discussed above, all PETS species will be evaluated during project-level analysis. Where needed to protect species from potential adverse effects of management activities, project-level surveys would be conducted in accordance with procedures outlined in the Region 8 supplement of Forest Service Manual 2672. As needed, additional, site-specific measures will be implemented to ensure the continued persistence of these species on the Chattahoochee and Oconee National Forests.

In conclusion, differences in effects to viability risk among alternatives are relatively small. High-risk species/habitat relationships are primarily a result of historical influences that have reduced distribution and abundance of some habitat elements and species populations and of future impacts from forest health threats. In general, effects of proposed management strategies are small relative to historical impacts and future external threats. In general, risks to species viability are minimized by forest plan revision alternatives that provide a balanced mix of low-disturbance and disturbance-dependent habitat elements. Some elements in this mix are best

provided through passive management and protection, while others require active management for restoration and maintenance.

Slight differences in results presented here from those in the DEIS are primarily the result of updates to species' status information (F Ranks) made during the comment period through review and coordination with NatureServe and their contractors. Additional changes are the result of adding species inadvertently omitted from the DEIS. These adjustments have not resulted in substantial changes to overall patterns of risk, or conclusions relative to overall effects of alternatives. It is important to note that information on the status and ecology of this great diversity of species is constantly changing and will continue to do so as the revised forest plan is implemented. Lists of species of viability concern and related information will be maintained and updated as part of plan implementation; however, this updating will typically be small and incremental, and is not expected to change the overall conclusions of this analysis during this planning period.

Aquatic Species Viability on the Chattahoochee-Oconee National Forest

Background

National forests are required to manage aquatic habitats for the maintenance of viable populations of existing native and desired nonnative plants, fish, and wildlife species in the planning area. For planning purposes (NFMA), a viable population is one that has reproductive individuals well distributed in the planning area. Life history information, including viability is not known for most aquatic species. This is due to the fact that viability of a species can not be determined easily and conclusions about their status may be misleading. The analysis in this document attempts to correlate the well-being of a species with their respective habitat conditions.

Aquatic habitats are those in and adjacent to streams and lakes, and the mobility of aquatic species is usually limited to these habitats. Habitat alteration is likely the major cause of decline of aquatic diversity in the South. Channelization, impoundment, sedimentation, and flow alterations are the most common physical habitat alterations associated with the decline of aquatic species (Walsh et al. 1995; Etnier 1997; Burkhead et al. 1997). Other human-induced impacts to aquatic species include pollution and introduced species (Miller 1989).

Habitat quality within a freshwater ecosystem is determined by activities within the watershed (Abell et al. 2000; Scott and Helfman 2002). Habitat conditions can be estimated at the landscape scale by the level of activities within the watershed. At the forest Plan level, the planning areas for aquatic species were considered at the 5th level hydrologic unit code (HUC) or watershed.

Consideration at the 5th level HUC allowed analysis of entire watersheds with any Forest Service ownership. Watershed condition rankings were determined from land use activities throughout each watershed on public and private lands. The rankings were used to compare those watersheds with any Forest Service ownership to one another. Because Forest Service ownership is low in most watersheds, rankings primarily consisted of comparing land use activities on private lands. The extent and detail required to address all watersheds, including private land, made it necessary to determine values from geographic data. These values are compared among the watersheds and a condition or set of conditions is determined for each watershed. 'Excellent' ranked watersheds are a result of those watersheds with the fewest impacts among watersheds with any Forest Service ownership. This ranking allows Forest Service to evaluate the watersheds and to determine if efforts can be made on public lands to improve their condition.

Assessing the viability risk for each aquatic species documented on the Forest is an impossible task. As a surrogate, the viability of federally-listed threatened or endangered and Forest Service sensitive species are assessed and threat to their viability was determined. To estimate if adequate habitat conditions exist at the watershed level for these species, 5th level watershed condition was assessed using land use activities occurring throughout the watershed on private and public lands.

Viability for these species is dependent on adequate habitat throughout the 5th level watersheds where they occur. Several fish species are imperiled within watersheds that contain National Forest lands. In all cases, for all aquatic PETS species, National Forest lands account for a small fraction of their respective ranges. In watersheds where the Forest Service manages only a small fraction of the watershed, the influence of the agency on survival for of these species is limited.

Methods and Assumptions

Watershed Condition

Watersheds or hydrologic units are defined as areas that drain to a common point. Fifth level watersheds are generally between 40,000 and 250,000 acres. Watershed units were queried against other information layers. These layers include ownership, streams, roads, point sources, dams, and land use from the 1970's and 1990's.

These layers were intersected with the 5th level watersheds and determined as a percent of the watershed or as a density (miles per square mile). The following table demonstrates the layers, their use, data source and unit of measure.

Table 3- 145. Data Sources and Uses.

Layers	Use	Source	Unit
watersheds	planning unit	from NRCS or USFS	5th level HU
ownership	to determine the potential affect of Forest Service ownership on viability of Species of Concern	from individual forests	percent
streams	used to determine riparian areas	RF3 data from EPA Basins III	not applicable
roads	road density and riparian road density	from tiger census data	miles per square mile
Land use	determine watershed and riparian area land use	1970 GIRAS data from EPA Basins III, 1994 NLCD from EPA Region 4	percent
dams	determine altered flow	from EPA Basins III	number per square mile
point sources	CERLIS, RICRIS and NPDES	from EPA Basins III	number per square mile

Source: Clingenpeel, 2003.

This process is modified from the East-wide Assessment Protocol for Forest Plan Amendment, Revision, and Implementation (USDA Forest Service 2000). Instead of a simplified ranking of 1 through n, the individual condition factors were valued or graded (one to five) based on natural breaks using the Jenk's optimization formula within ArcView 3.2a. The values for each layer were averaged to calculate a condition score for each metric:

1.0 – 1.5 = poor
1.51 – 2.5 = below average
2.51 – 3.50 = average
3.51 – 4.5 = above average
4.51 – 5 = excellent

This allows for a determination of condition among the watersheds. However, it does not suggest that a watershed with a score of 4 is twice as good as a watershed of 2, only that the watershed with a value of 4 is above average and the watershed with a value of 2 is below average. A Watershed Condition Rank (WCR) was developed to characterize the condition (excellent, average, and below average) of 5th level watersheds with respect to current sediment load increases and to determine a range of potential effects. These metrics were used to determine watershed condition for particular stressors listed below:

1) Sedimentation (assessed separately by determining the percent increase above the baseline sediment levels by watershed as assessed with the WCR)
2) Point Source Pollutants (density of point sources)
3) Temperature (road density in the riparian area, and percent forest in the riparian area (1970's and 1990's data)
4) Altered stream flow (density of dams, road density in the riparian).

Stressors

PETS species were noted for each 5th level watershed in which they occurred across the forests. Watershed condition ranking was assessed with the occurrence of aquatic PETS species and their associated stressors within this 5th level. This 5th level watershed analysis is a coarse filter of watershed condition from impacts on private and public lands. The coarse filter of watershed condition at the 5th level allows the Forest Service to examine conditions throughout the entire watershed in order to understand the overall status of aquatic PETS species.

Four stressors were identified: sedimentation, point-source pollution, alterations in water temperature, and altered stream flows. Sensitivity to these stressors were assigned for each PETS species, based on the published literature and personal communications (Terwilliger 1991; Etnier and Starnes 1993; Byron Freeman, Wendell Haag, Melvin Warren, Bernard Kuhajda, Stephen Hiner, and Arnold Eversole pers. comm.). Species sensitivity to the four stressors was compared with the condition of their respective watersheds to determine the threats to their persistence in the planning area. Threats to aquatic species viability are not limited to these four variables. The variables chosen are consistently available via Geographical Information System (GIS) information across private and public lands and do not reflect all impacts to the viability of aquatic biota. In addition, the thresholds of PETS species to these four stressors are not known. For forest level planning it is assumed that these four stressors describe any potential land disturbance activities within the planning area.

The recovery of the aquatic biota in the southeast will be through the control of significant threats, primarily those resulting from impacts on private lands, such as point sources from industry and agriculture, power generating dams and uncontrolled development. Efforts by the Forest Service are, in part, to work cooperatively with partners to restore watersheds on private lands, when possible. However, the primary goal of the Forest Service is to maintain or enhance waters within public ownership. These public waters provide refugia for some imperiled species.

Combination of Watershed Condition Rankings and Stressors

To identify watersheds with low rankings, the combined values for each watershed condition value or parameter (sediment, point sources, temperature and altered flows) were multiplied against the presence (value of 1) of species of concern with corresponding stressors. Watershed condition metrics with a score at or above 2.51 (average or above for point sources, temperature and altered flows) and a watershed condition ranking (WCR) of 'Excellent' (for sediment) are assumed to have sufficient aquatic habitat at the watershed scale to maintain species viability.

This coarse filter does not imply that there are no impacts to the aquatic biota within watersheds ranked as excellent or average. These rankings are an assessment for the entire 5th level watershed unit. In other words, impacts are occurring within all watersheds. The viability of the aquatic biota is evaluated at a watershed scale. Those with fewer impacts are thought to be at less risk for viability concerns. This conclusion could be misleading depending on the source of impact. One point source, could for example, have more adverse impacts on the aquatic biota, such as a waste water treatment plant, than numerous more innocuous point sources. Future watershed assessments at the 6th level HUC scale (more detailed than the 5th level HUC) will help identify potential impacts to the aquatic biota.

Two of the watersheds on the forest with a WCR of excellent, Coahulla and the lower Conasauga watersheds are misleading. The most recent land use/cover spatial data was used in this analysis to help determine the degree of current erosion and resulting sedimentation. This model was used to predict erosion for cumulative effects analysis in comparing Plan alternatives. The land use/cover within the lower Conasauga was 70 percent forested cover and the Coahulla Creek watershed was 72 percent. This model did not pull in all impacts to the watershed, major impacts occur to the lower Conasauga watershed from the industrial city of Dalton, immediately upstream of the lower Conasauga watershed. In addition, Coahulla Creek (303d listed for fecal coliform) is degraded prior to the Georgia state line due to impacts from Waterville and Cleveland, Tennessee. Coahulla Creek flows into the Conasauga River in Dalton. Major impacts to Coahulla Creek are from sedimentation and nutrient enrichment (eutrophication).

In addition, Dalton is the leading textile manufacturer in the world, producing 75 percent of the world's carpet. Historical impacts occurred prior to the Clean Water Act (1972), when carpet mills were releasing wastes (dyes, etc.) into the Conasauga River and Coahulla Creek. Mussels in the lower Conasauga and Coahulla Creek watersheds have been reduced dramatically, with only remnant populations presently occurring (Paul Johnson, pers. comm.). None of the PETS mussel species occur within the lower Conasauga watershed.

Aquatic Viability Outcomes

Species of concern were related to the four environmental factors assessed in the watershed analysis (point sources, water temperature, flow and sediment). Separate viability outcomes were determined for each watershed where one or more PETS species occurred, because factors affecting viability can vary considerably from watershed to watershed. All 43 watersheds with some Forest Service ownership had

one or more PETS species. The PETS in this analysis are from the following groups: fish, mussels, crayfish and aquatic macroinvertebrates. PETS species were considered to occur on the forest if they occurred either on Forest Service lands or within one mile of the furthest downstream boundary of Forest Service lands.

In this analysis, mussel species which no longer occur in watersheds where they were once known to occur are ranked as an Outcome 5. This Outcome does not reflect the WCR for that particular watershed. All species of mussels with this Outcome were historically found in the upper Conasauga, middle Conasauga, and/or the Coahulla watershed, all of which had a ranking of Excellent. The Conasauga River and its tributaries have been sampled thoroughly during the past ten years by professional malacologists. In surveys post 1997, there are six species of mussels which no longer are known from a particular watershed. All six species have not been found in one of the following watersheds: upper and/or middle Conasauga and/or Coahulla watersheds. These six species are: Tennessee heelsplitter (Forest Service sensitive), Alabama rainbow (Forest service sensitive), Alabama moccassinshell (endangered), Coosa moccassinshell (endangered), Southern clubshell (endangered) and ovate clubshell (endangered). However, all six of these species have been collected in other watersheds from surveys post 1997, within the Conasauga River and/or its tributaries. There are two additional mussels species that are thought to be extirpated from the Conasauga River and its tributaries. Both of these mussels are federally-listed as endangered, and are thought to be extinct. Reasons for the decline of these mussels are not fully known. However, the three primary reasons (in order of impact) thought to be the causes of their decline are: hydrologic destabilization; sedimentation; and chemicals used in agriculture practices (Dr. Paul Johnson and Steve Ahlstedt, pers. comm. 2003). In addition, the freshwater drum (*Aplodinotus grunniens*) has been progressively moving farther upstream in the Conasauga River. The drum is commonly a large river and reservoir fish, a benthic feeder which feeds in part on mollusks. The freshwater drum moving into the upper headwaters of the Conasauga River could be a detrimental impact to the distribution and numbers of mollusks.

Loss of mussel species on public lands is not thought to be a result of Forest Service activities, but rather habitat degradation downstream of public lands (Dr. Paul Johnson, pers. comm.). Optimum habitat for mussels are medium to large rivers, cool to warm water, limestone geology and low gradients. Forest Service lands in these watersheds of the Coosa are predominately high gradient, cold water and have no limestone deposits. The only section of the main stem of the Conasauga River under public ownership is within the upper Conasauga watershed. In low gradient habitats within the upper Conasauga watershed, mussels occur. River sections of optimum habitat have higher recruitment rates than sections of marginal habitat. Only marginal habitat occurs on public lands, and very little or no mussel recruitment from stream sections where optimum habitat does occur on private lands is occurring onto public lands. Forty-five percent of the mussels known from the Coosa watershed are considered imperiled (Paul Johnson, pers. comm.). Augmentation of the fine-lined pocketbook mussel has been occurring with the partnership of Southeast Aquatic Research Institute and Conservation Fisheries, Incorporated in the Conasauga River on public lands. Georgia is the leading state in the country in the loss of mussel

species. Of the 118 historically known from the state, 36 have been lost within the state, a 30 percent extirpation rate.

It is the goal of the Forest Service for streams flowing out of public ownership to provide clean waters for mussels and other aquatic biota in areas of more optimum habitat. Providing clean waters from public lands will aid in populations immediately downstream of public ownership.

Viability outcomes for each species by watershed were determined by incorporating elements of species distribution, abundance, and sensitivities to environmental factors; watershed condition relative to the species' environmental sensitivities; and the amount of Forest Service ownership in the watershed. Viability outcomes are as follows:

> *Outcome 1. Species occurs within watersheds with no impairment. Likelihood of maintaining viability is high.*
>
> *Outcome 2. Species is potentially at risk in the watershed; however, the Forest Service may influence habitat conditions on public lands, which will keep it well distributed where its associated habitat occurs on Forest Service lands. Therefore, likelihood of maintaining viability is moderate.*
>
> *Outcome 3. Species is potentially at risk within the watershed; however, Forest Service opportunity to affect outcomes for the species in the watershed is limited. PETS species within this outcome are off forest lands. Therefore species viability in the watershed may be at risk*
>
> *Outcome 4. The species is so rare within the watershed (population is at very low density and/or at only a few local sites) that stochastic events (accidents, weather events, etc.) may place persistence of the species within the watershed at risk. The Forest Service may influence conditions in the watershed to keep the species relatively secure. Therefore, likelihood of maintaining viability is moderate to low.*
>
> *Outcome 5. The species is so rare within the watershed (population is at very low density and/or at only a few local sites) that stochastic events (accidents, weather events, etc.) may place persistence of the species within the watershed at risk. Forest Service ability to influence the species is limited. Therefore species viability in the watershed may be at risk*

Aquatic PETS species (aquatic macroinvertebrates, crayfish, mussels and fish) on the Chattahoochee-Oconee National Forests are listed below by the number of watersheds for each of their viability outcomes. (A complete table of viability outcomes is found in Appendix F.) No outcomes changed as a result of impacts from any of the alternatives in the Forest Plan. Total watersheds depict the total number of watersheds in which each PETS species occurs.

Table 3- 146. Viability Outcomes and Number of Watersheds for Aquatic PETS Species

Common Name	Scientific Name	Viability Outcome (1 – 5) No. of Watersheds per Outcome 1	2		4	5	Total Watersheds
Georgia beloneurian stonefly	Beloneuria georgiana	13	8				21
Edmund's snaketail	Ophiogomphus edmundo	13	7				20
Appalachain snaketail	Ophiogomphus incurvatus	21	19				40
Cherokee clubtail	Gomphus consanguis	11	6				17
Mountain river cruiser	Macromia margarita	21	20				41
Crayfish	Cambarus chaugaensis		1				1
A crayfish	Cambarus cymatilis	2		1			3
Chickamauga crayfish	Cambarus extraneus	1					1
Little Tennessee River crayfish	Cambarus georgiae		1				1
Hiwassee Headwaters crayfish	Cambrus parrishi		1				1
A crayfish	Cambrus speciosus						?
Upland combshell	Epioblasma metastriata					3	3
Southern acornshell	Epioblasma othcaloogensis					2	2
Alabama moccasinshell	Medionidus acutissimus					2	2
Coosa moccasinshell	Medionidus parvulus					4	4
Southern clubshell	Pleurobema decisum					3	3
Southern pigtoe	Pleurobema georgianum	2		1		1	4
Georgia pigtoe	Pleurobema hanleyianum	2					2
Ovate clubshell	Pleurobema perovatum					2	2
Triangular kidneyshell	Ptychobranchus greeni	2		1		1	4
Inflated floater	Pyganodon gibbosa	2					2
Ridged mapleleaf	Quadrula rumphiana	1				3	4
Alabama creekmussel	Strophitus connasaugaensis	2		1		2	5
Alabama rainbow	Villosa nebulosa	1		1		3	5
Tennessee heelsplitter	Lasmigona holstonia					5	5
Brook floater	Alasmidonta varicosa		1				1
Finelined pocketbook	Lampsilis altilis	3		1		1	5
Blue shiner	Cyprinella caerulea	2	1	1			4
Amber darter	Etheostoma antesella	3					3
Etowah darter	Etheostoma etowahae	1		1			2
Cherokee darter	Etheostoma scotti	1		1			2
Goldline darter	Percina aurolineata			4			4
Conasauga logperch	Percina jenkinsi	2					2
Ocmulgee shiner	Cyprinella callisema	6	1	4			11
Bluestripe shiner	Cyprinella callitaenia	3		1			4
Altamaha shiner	Cyprinella xaenura	6	1	4			11
Holiday darter	Etheostoma brevirostrum	3	2	1			6
Coldwater darter	Etheostoma ditrema	4					4
Trispot darter	Etheostoma trisella	4		1			5
Wounded darter	Etheostoma vulneratum		1	5			6
Lined chub	Hybopsis lineapunctata	8		2			10
Mountain brook lamprey	Ichthyomyzon greeleyi	1	3	3			7
Robust redhorse	Moxostoma robustum	3					3
Popeye shiner	Notropis ariommus	1					1
Highscale shiner	Notropis hypsilepis	1	1	1			3
freckled darter	Percina lenticula	4					4
Olive darter	Percina squamata		1	5			6
Fatlips minnow	Phenacobius crassilabrum		1				1
Frecklebelly madtom	Noturus munitus	3		1			4

Conclusion

Selection of the 5th level watershed for analysis allows watersheds to be examined at a scale that includes both Forest Service and private lands. Often, much of the habitat at this level is not managed by the Forest Service, limiting the influence the agency has on the restoration of habitats.

PETS species with an Outcome 1 are considered at low or no risk to their viability. For the species that have a viability Outcome 2, the species may be at risk due to one or more stressors within the watershed. All Outcome 2 species are on or are within one mile of the furthest downstream Forest Service boundary. This analysis allows Forest Service to assess any potential impacts from public lands. Improvements on Forest Service lands may have a positive influence upon localized conditions and may, in rare cases influence the entire 5th level watershed. All opportunities to improve watershed condition will be assessed at the Forest Service project level.

Species with an Outcome 3 are impacted from one or more of the stressors. These species are off forest lands at distances greater than one mile and the Forest Service can not measurably improve conditions to influence their habitat conditions. There are no species with an Outcome 4. There are eight mussel species with such rarity as to be ranked Outcome 5. Forest Service ability to influence the species is limited, therefore the viability of the species in the watershed may be at risk. Two federally-listed endangered mussel species, the upland combshell (*Epioblasma metastriata*) and the Southern acornshell (*Epioblasma othcaloogensis*) are considered to be extirpated in the Conasauga River and its tributaries. The other six mussel species are: Tennessee heelsplitter (Forest Service sensitive), Alabama rainbow (Forest Service sensitive), Alabama moccassinshell (endangered), Coosa moccassinshell (endangered), Southern clubshell (endangered) and ovate clubshell (endangered). These six mussel species have an Outcome 5 due to their disappearance in at least one 5th level HUC. In addition, even though these six species are found within the Coosa watershed, their distribution is extremely limited and their numbers are extremely low.

FOREST COVER

Affected Environment

Trees typically grow in the wild as well-defined associations of species with similar physiology. These associations have been identified in a wide variety of naming and coding conventions since about 1900. The Forest Service maintains a forest cover database of approximately 23,000 individual communities mapped through field inventory. Each community is identified with a numeric forest cover type code. In Forest Service inventory, vegetation communities are mapped based on three principal factors; (a) the species that make up the highest layer of canopy, (b) the representative age of those trees, and (c) the condition of those trees. Data collection procedures and conventions, as well as CISC database structure and operation, are described in FSH 2409.26dR, *Silvicultural Examination and Prescription Handbook*.

In forestry, a community of trees sufficiently distinct in composition or structure to be readily identifiable in the field to a trained observer is called a '*stand.' Forest cover* means those trees in a stand that form the canopy of leaves that would be seen when viewed from above. For hardwood trees, this is during the growing season. Another name for this leaf canopy is the '*overstory.*' Tree communities typically develop a vertical stratification with age and have from one to four 'stories' or layers of canopy; ranging from the *understory* of shrubbery such as huckleberry through one or two layers of the *mid-story* of small trees such as dogwood, to the highest layer of *overstory*. In general usage, the finer distinction of 'mid-story' is often dropped and foresters speak simply of overstory and understory. This qualification will become important later in this topic.

Forest cover as a topic is not directly related to any public issue concerning plan revision. But it is indirectly related to many of them as follows: (Issue 1) terrestrial plants and animals and their habitats; (Issue 2) threatened, endangered, Regional-Forester sensitive, and locally rare species; (Issue 3) old growth; (Issue 4) riparian area management; (Issue 5) wood products; (Issue 6) aesthetics and scenery management; (Issue 9) forest health; (Issue 10) special areas and rare communities; and (Issue 14) red-cockaded woodpecker.

Alternatives differ in their active direct effects to forest cover in four primary ways: (1) thinning; (2) regeneration harvest; (3) prescribed burning; and (4) conversion from one vegetation community to another. Alternatives also differ in the amount of land area treated per year and per decade to reach vegetation community objectives. The primary source of this difference is; (a) the amount of land available for active vegetation management, and (b) the early-successional habitat objectives for those lands.

Alternatives differ in their indirect effects primarily by the amount of land not actively managed where forest succession proceeds with little or no direct human intervention.

Rare communities, such as Table Mountain pine or canebrakes, receive the same or very similar emphasis across all alternatives because of the importance of rare communities to federally-listed threatened and endangered species and because rare communities are an important element of overall biological diversity. Major forest communities, such as oak or oak-pine, receive a similar degree of emphasis on lands available for treatment, and alternatives differ by the amount of land that can be actively managed.

Most of the effects of the alternatives to forest cover are dealt with in other topics of the environmental impact statement. The 'forest products' topic analyses harvest methods and amounts. The individual sub-topics of the 'major forest communities' topic analyses prescribed fire use and effects. The 'old growth' topic addresses the amount, distribution, and recruitment of old growth for each alternative. Individual rare community sub-topics focus on the vegetation communities that occupy very little land area on the national forest.

For this 'forest cover' topic, the focus of effects will be on general trends and conditions at the ecological section scale. In particular, conversion from one vegetation community to another will be the focus. Conversion is implied in each alternative by use of similar 'restoration' objectives, since to restore something means to put it back like it was. Restoration also includes the idea of returning historic dynamics, such as re-current fire, grazing, or predation, and in that case does not necessarily mean a conversion of forest cover.

There are two primary original data sources for this report. One is the Forest Service Continuous Inventory of Stand Conditions (CISC) database of tree cover characteristics. The other is Forest Inventory and Analysis (FIA) data collected by the Southern Forest Experiment Station in Asheville, North Carolina. The CISC data was extracted from the 'working' CISC data in 1994 for the Southern Appalachian Assessment. This extracted set was then intensively edited and supplemented. Because forest cover is dynamic, data is not an up-to-the-minute reflection of 2003 conditions. In particular, tree mortality of the 1999 through 2002 southern pine beetle epidemic is not in the data. The FIA data was collected during the 1986 field season. However, the data remains appropriate to inform strategic decisions and to inform and disclose large scale characterizations.

Conditions by Ecological Units

The most meaningful current context for vegetation conditions is the ecological division, province, section, and subsection units of the Forest Service Ecological Classification System (ECS). At this time complete correlations of forest cover on national forests to ecological units below the Land Type Association (LTA) level have not been made, except for the Armuchee RD, where they are in a draft stage. ECS is presented and explained in a separate section in this environmental impact statement and is not repeated here.

A key feature of ECS that is critical to understanding Chattahoochee-Oconee plant and animal occurrence is that it is a primarily a 'nested' system. Individual units fit

within the next-highest level unit. The Chattahoochee-Oconee is in a location at the edge of major ecological units such that domain, division, province, section, subsection, and landtype association lines are coincident on portions of the Chattahoochee. This situation results in bands (called 'ecotones') of ecological transition and a diversity of plants and animals in a relatively small land area. A somewhat dramatic example of this is that at its southwestern corner the Chattahoochee has longleaf pine *(Pinus palustris),* typically associated with the Coastal Plain, and in its northeastern corner occurs Table Mountain pine (*Pinus pungens)*, a southern Appalachian Mountains endemic.

Division

The Oconee NF, the Armuchee RD of the Chattahoochee NF, and the National Forest System lands in Banks and Stephens Counties are in the Humid Subtropic Division. Hot and humid summers and mild winters characterize this division. The remainder of the Chattahoochee NF is in the Hot Continental Division. This division is characterized by hot summers but cool winters. The Hot Continental Division occurs in north Georgia because of the climate modifying effect of elevation in the Blue Ridge Mountains. The common boundary between these divisions is not a "line," but rather a broad band of many miles width with gradual change occurring across it. Within this band small scale variation occurs with microclimate variations such as elevation change on out-lying peaks such as Mount Yonah, or cool, moist gorges such as Panther and Davidson Creeks. The vegetation of the Chattahoochee can perhaps be best understood as a transition between these two divisions.

Province

The Chattahoochee and Oconee NFs are within two provinces. The Chattahoochee, except for the Armuchee RD and a portion of the Chattooga RD, is in the Central Appalachian Broadleaf Forest - Coniferous Forest - Meadow Province. Hardwoods are the prevalent cover. Vegetation is characterized by having vertical zonation; that is, changing with elevation. Across the entire Province, the spruce-fir forests above about 5,000 feet elevation are a significant part of the 'coniferous forest' and mountain balds are the 'meadow' portion, However, in Georgia there are no spruce-fir forests and balds are very few, small, and scattered. Balds are addressed in detail in a separate subtopic of this environmental impact statement.

The Oconee NF, the Armuchee RD of the Chattahoochee NF, and the National Forest System lands in Banks and Stephens Counties on the Chattooga RD are in the Southeastern Mixed Forest Province. At least 50 percent of the stands are made up of loblolly pine (*Pinus taeda*), shortleaf pine (*Pinus echinata*), and other southern yellow pine species occurring as stands with one species dominate or in combinations with several yellow pine species sharing dominance. In northwestern Georgia longleaf pine (*Pinus palustris)* occurs. These combinations are more common near the fringe of a species natural range because of ecological transitions. Common broadleaf hardwood associates include blackgum (*Nyssa sylvatica*), hickory (*Carya* sp.), oaks (*Quercus* sp.), red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*), and winged elm (*Ulmus alata*). Woody understory species include American beautyberry (*Callicarpa americana*), blueberry (*Vaccinium* sp.), dogwood (*Cornus florida)*, viburnums (*Viburnum* sp.), and numerous woody vines such as

Carolina jasmine, muscadine (*Vitis rotundifolia*), poison ivy (*Rhus radicans*), and Virginia creeper (*Parthenosisus quinquefolia*). The main grasses are bluestems (*Andropogon* sp.), longleaf uniola (*Uniola* sp.), and panicums (*Panicum* sp.).

The southern end of the Oconee is just north of the Fall Line, which marks the boundary between the Coastal Plain and the Piedmont. The Coastal Plain is in the Outer Coastal Plain Mixed Forest Province. Individuals of the representative species of this province may be expected to occur infrequently north of the Fall Line, especially in the riparian area along larger streams.

The location of the Chattahoochee on the division and province boundaries is significant to vegetation composition. These boundaries are not a 'line' feature but rather a broad band of ecological transition, called an 'ecotone.' In the ecotone, species of each division or province can be expected to intermingle. For example, in the higher elevations the northern hardwoods mix with mesic site Appalachian hardwoods. Table Mountain pine mingles with other yellow pines and dry site oaks. Longleaf pine occurs as scattered individuals among shortleaf pine, Virginia pine, and dry site oaks.

Sections

There are three ecological sections on the Chattahoochee and Oconee NFs: (1) Blue Ridge Mountains, (2) Southern Ridge and Valley, and (3) Southern Appalachian Piedmont. The Blue Ridge Mountains Section includes the Brasstown, Chattooga, Cohutta, Tallulah, and Toccoa RDs. The Southern Ridge and Valley Section includes only the Armuchee RD. The Southern Appalachian Piedmont includes the Oconee NF and approximately 46,000 acres of National Forest System lands within Banks and Stephens Counties on the Chattooga RD of the Chattahoochee NF.

The Blue Ridge Mountains Section

Between Cherokee removal in 1838 and the late 1800's, white settlers used the forested mountains as a commons area for hunting, fishing, wild plant food gathering, medicinal herb collection, and for the free-ranging of livestock. Annual woods burning in the dormant season was a common practice. Beginning in the 1880's, logging of the highest-quality and value species began using water or wagon transport. As early as 1902 U.S. Secretary of Agriculture James Wilson reported to President Theodore Roosevelt that an estimated 86 percent of the acreage in the Appalachian region had been cut through for the most valuable species, or "culled" at least once (Wilson, 1902). The 'industrial logging' era began about 1900 with narrow gage logging railroads ascending the valleys from saw-milling towns. Steam skidders on flatcars, oxen, or mules brought logs to the railroads. Between 1900 and 1920, about 60 percent of the Southern Appalachian forest was cutover again, much less selectively this time. Sparks from skidders and locomotives started fires in the logging debris. In 1911 Clyde Leavitt, a Forest Service forest inspector, examined a tract for potential Forest Service purchase under the brand new Weeks Act. He reported that on an entire 31,377-acre tract in the headwaters of the Toccoa River, "*Fires have kept the undergrowth down over the greater portion of the tract to an extent which permits of travel almost anywhere on horseback regardless of roads or trails*." He

also predicted that should fire be excluded travel off trails would become impossible in a few years.

On the Chattahoochee NF, woody vegetation structure on acres that historically have not been cleared for cultivation or other purposes is typically two-aged; that is, it has two distinct age classes. The prevalent reason for this is that the last wave of logging between about 1900 and 1930, and generally prior to Forest Service land acquisition, did not remove all stems but was in most cases heavy enough to stimulate the establishment of a new age class. The "culled over" trees ('culled' means they were not cut because of their size, their lack of quality, or the species not being valued by the market), generally appear in current inventories as anywhere from about 13 to 40 percent of the total number of overstory stems. They are usually hollow, crooked, limby, rotten, or otherwise un-merchantable, or of low quality for wood products. Intermingled with them typically are the straight, higher-quality trees that began life during or just after the last logging and the gradual cessation of annual woods burning. In Forest Service forest inventory, only one age is assigned and it is taken for the most-representative stand situation. Age in the data may recognize either one of the age classes but not both.

The Blue Ridge Mountains Section on the Chattahoochee National Forest now has forest cover of approximately 70 percent hardwood and 30 percent pine as follows; 56 percent hardwood, 23 percent pine, 12 percent hardwood-pine, and 9 percent pine-hardwood. Within Georgia, the interior valleys (lower elevations) on major drainages have a mixed oak-pine forest that resembles the Southeastern Mixed Forest Province on the Southern Appalachian Piedmont to the south. Upslope from these valleys is the Appalachian oak forest with dominance shared among a dozen species each in the white oak and red oak groups. Intermingled with the oak forest is white pine (*Pinus strobus*). More northern species—such as fire cherry (*Prunus pennsylvanica*), mountain ash (*Sorbus americana*), sugar maple (*Acer saccharum*), and yellow birch (*Betula lutea*)— generally occur at the highest elevations but are either very localized; for example, on Brasstown Bald, or occur as scattered individuals within other hardwood cover types. Vegetation distribution patterns are complex with mixed mesophytic forests in coves, southern pines extending upward on drier, exposed sites (such as south, southwest, and west slopes), and hemlock (*Tsuga canadensis*) or white pine (*Pinus strobus*) extending downslope in protected ravines where moisture and microclimate resemble that found at higher elevations. The division, province, section, and subsectrion boundaries coincide along the foot of the Blue Ridge Mountains in Georgia.

The Blue Ridge Mountains Section has more plant species than either the Southern Ridge and Valley or the Southern Appalachian Piedmont Sections. In 1993 the Chattooga River Ecosystem Management Demonstration Project found 61 species of trees, 56 species of shrubs, 244 species of herbs, 28 species of grasses, 17 species of sedges, 15 species of vines, 5 species of clubmoss, and 4 species of lichens, or 430 plant taxa within the Chattooga River watershed. In 1995 the Blue Ridge Mountains Section had 39 forest cover types with only 14 of those having one species making up more than 70 percent of the dominant and co-dominant canopy.

The other 25 types had mixtures of species in the dominant and co-dominant canopy classes.

The Southern Ridge and Valley Section

This section has both limestone geology in the valleys and sandstone or chert geology on the ridges. National Forest System lands are almost entirely confined to the dry, rocky, and less fertile ridges and side slopes. This context should be kept in mind in interpreting the accompanying tables.

The Southern Ridge and Valley Section; that is, the Armuchee Ranger District, has forest cover of approximately 52 percent pine and 48 percent hardwood as follows; 29 percent hardwood, 27 percent pine, 25 percent pine-hardwood, and 18 percent hardwood-pine. Lipps (1966) tallied 58 tree species, 32 species of shrubs and vines, and 210 herbs for a total of 300 plant taxa on Horseleg Mountain within the Marshall Forest - a National Natural Landmark - near Rome, Georgia. The geology, landform, and climate are similar; but the Marshall Forest tract borders a large river, a condition not found on the national forest. Among the herbs were 10 species of fern, 23 species of grasses, and 7 species of sedges and rushes. She also noted that some southern species reach the northern limits of their (Georgia) range and that some northern species reach the southern end of their range. Examples of southern species nearing the northern edge of their Georgia range include longleaf pine (*Pinus palustris*), water hickory (*Carya aquatica*), water oak (*Quercus nigra*), and overcup oak (*Q. lyrata*). Examples of northern species at the southern end of their range are buckeye (*Aesculus octandra*), buffalonut (*Pyrularia pubera*), Catawba rhododendron (*Rhododendron catawbaiense*), and hemlock (*Tsuga canadensis*).

The Armuchee Ranger District has 20 forest cover types. By contrast, the Oconee National Forest has only 16, but the Blue Ridge portion of the Chattahoochee National Forest has 38. Mesic site hardwoods occupy only 2 percent of the district due to only small acreages occurring on deep, moist soils; for example, along larger perennial streams.

As early as the deSoto exploration in 1540, the broad valleys of northwest Georgia were sites for Native American towns and fields. The town of Coosa, the seat of a powerful chiefdom, was located just below present-day Carter's Dam on the eastern edge of the Great Appalachian Valley about 15 to 20 air miles from the Armuchee Ranger District. In 1830 prior to white encroachment, the Cherokee population was higher per unit area in the Armuchee area than anywhere else in Cherokee Georgia (Wilms, 1974). Following removal, white settlement was particularly rapid since the area was very well known and extensively traveled by whites before Removal. The 'Old Federal Road', now US 411, was originally a route the Cherokee Nation granted to the fledgling United States. By the Civil War both coal and iron mining were local industries. Numerous small sawmills were providing local construction materials. Unlike the Blue Ridge portion of the Chattahoochee National Forest, the Armuchee Ranger District escaped the industrial logging era. When Forest Service acquisition, began the wooded ridges were being burned, grazed, and hunted for quail.

The Armuchee Ranger District has almost as wide a range of age classes as does the rest of the Chattahoochee National Forest, but the percentage of acreage in older classes is less. Only about 3 percent was greater than 100 years old in 1995. Numerous factors permitted nearly all acres to be logged historically: terrain is gentler, distance to markets was less, distance to travelways was much less, and population per unit area was higher with a resultant greater - and earlier - demand for wood. Two-aged stand structures in hardwood types are expected to have some old-growth attributes even when half or more of the total stocking consists of trees younger than 100 years. An example might be low site quality ridge crests, which were frequently burned before Forest Service acquisition but have since grown a younger age class underneath and alongside older trees.

The Southern Appalachian Piedmont Section

The Southern Appalachian Piedmont Section occurs as two distinct areas. One is the entire Oconee Ranger District in middle Georgia. The other is approximately 46,000 acres generally south of Turnerville, Georgia, and in what is often called the 'upper Piedmont.' Overall, the upper Piedmont area is 60 percent pine and 40 percent hardwood as follows: 46 percent pine, 30 percent hardwood, 14 percent pine-hardwood, and 10 percent hardwood-pine. The Oconee portion of the Piedmont is approximately 70 percent pine and 30 percent hardwood. Within these, more specific composition is as follows; 70 percent pine, 23 percent upland hardwood, 3 percent bottomland hardwood, 2 percent hardwood-pine, and 1 percent pine-hardwood.

The Piedmont portion of Georgia has a land-use and vegetation history quite different from either the Southern Ridge and Valley Section or the Blue Ridge Mountains Section. It was settled much earlier - in the late 1700s and early 1800s - and was extensively cleared and farmed, particularly for cotton. Erosion, soil depletion, and cycles of land abandonment and re-clearing followed. With the New Deal programs of the 1930s, the Oconee NF area was identified as needing special attention. Various New Deal programs and agencies were involved with the land until in 1959 President Dwight D. Eisenhower proclaimed the Oconee National Forest (Alter, 1971).

Table 3- 147 below, shows the listing of applicable CISC forest type codes, the vegetation community name associated with each code, and the ecological section or sections where the type occurs. This information is the 'key' to interpreting subsequent tables for this 'forest cover' topic and as a foundation for other effects topics. More detailed information for each forest type also follows.

Table 3- 147. CISC Forest Types and Occurrence by Ecological Section

Forest Type Code and Name	Occurrence By Ecological Section		
	Ridge	Southern Ridge & Valley	Southern Appalachian Piedmont
Evergreen Conifer			
03 - White Pine	X		X (Chattooga)
04 - White Pine–Hemlock	X		
05 - Hemlock	X		
31 - Loblolly Pine	X	X	X
32 - Shortleaf Pine	X	X	X
33 - Virginia Pine	X	X	X (Chattooga)
38 - Pitch Pine	X	X	X (Chattooga)
39 - Table Mountain Pine	X		X (Chattooga)
Evergreen Conifer-Broadleaf Hardwood			
08 - Hemlock–Hardwood	X		
09 - White Pine–Cove Hardwood	X		X (Chattooga)
10 - White Pine–Upland Hardwood	X		X (Chattooga)
12 - Shortleaf Pine–Oak	X	X	X
13 - Loblolly Pine–Hardwood	X	X	X
15 - Pitch Pine–Oak	X	X	
16 - Virginia Pine–Oak	X	X	X (Chattooga)
20 - Table Mountain Pine–Hardwood	X		
Broadleaf Hardwood-Evergreen Conifer			
41 - Cove Hardwood–White Pine-Hemlock	X		X (Chattooga)
42 - Upland Hardwood White Pine	X		X (Chattooga)
44 - Southern Red Oak–Yellow Pine	X		X
45 -Chestnut Oak–Scarlet Oak–Yellow Pine	X	X	X (Chattooga)
46 - Bottomland Hardwood–Yellow Pine	X	X	X
47 - White Oak–Black Oak–Yellow Pine	X	X	X
48 - Northern Red Oak–Hickory–Yellow Pine	X	X	X
Broadleaf Hardwood			
50 - Yellow Poplar	X	X	X
51 - Post Oak–Black Oak	X	X	
52 - Chestnut Oak	X	X	
53 - White Oak–Northern Red Oak-Hickory	X	X	X
54 - White Oak	X		X
55 - Northern Red Oak	X		
56 - Yellow Poplar–White Oak-Red Oak	X	X	X
58 - Sweet Gum–Yellow Poplar	X	X	X
59 - Scarlet Oak	X	X	
60 - Chestnut Oak–Scarlet Oak	X	X	X (Chattooga)
61 – Swamp chestnut oak-cherrybark oak			X
62 – Sweet gum – Nuttall oak – willow			X
63 – Sugarberry-American elm-green ash			X
64 – Laurel oak – willow oak			X
65 – Overcup oak – water hickory			X
71 - Black Ash–American Elm–Red Maple	X		
72 - River Birch–Sycamore	X		
73 - Cottonwood	X		
82 - Black Walnut	X		X (Chattooga)
99 - Brush Species	X		
Number of communities =	38	20	30

Source: USFS R8 Compartment Prescription Fieldbook (6/1992) and GIS stands data layer 2002

Species Composition

Table 3- 148 below, details the forest cover type composition for the Chattahoochee National Forest. The data includes approximately 46,000 acres of upper Piedmont on the southern end of the Chattooga Ranger District. Individual forest cover type information is being shown as background for other topics of this environmental impact statement that use groupings of forest types; for example the 'old growth' topic, which cross-walks the forest cover types into their applicable old growth community type.

Table 3- 148 contains a wealth of information. It shows that the primary forest cover is Appalachian upland oak forest, but with a significant component of mesic hardwood and white pine. It also shows that, for the forest as a whole, slightly over 50 percent of the forest began life between 1900 and 1930, or in other words, as a result of the early-twentieth century logging. This general pattern holds for most individual cover types also but with the notable exception of fire intolerant species such as white pine, hemlock, and Virginia pine, a majority of which began life after 1930 once fire suppression began protecting their seedlings. The very oldest trees on the Forest appear to be either chestnut oaks (which have a thick, heat-resistant bark) or remnant hemlock that are probably in cool, moist streamside locations typically having high fuel moistures. The table also shows that since Forest Service even-aged timber management officially began in 1964, a total of approximately 15 percent has been regenerated, or 0.375 percent per year or 3.75 percent per decade. In each of the decades of the 1970's and the 1980's, timber management regenerated 5.5 percent each decade or 0.55 percent per year; equivalent to a 182-year rotation on the entire forest or approximately 130 years on the approximately 70 percent of the land base on which harvest is permitted under the 1985 Plan as amended. Regeneration has been focused in white pine, loblolly, and shortleaf types.

Table 3- 148. Forest Cover Type Acres By Decadal Age For All Forested Acres of the Chattahoochee National Forest, Base Year 2000

Forest Type	0 to 10 Years	11 to 20 Years	21 30 Years	31 to 40 Years	41 to 50 Years	51 to 60 Years	61 to 70 Years	71 to 80 Ye s	81 to 90 Ye s	91 100 Years	101. to 110 Years	111 to 120 Years	121 to 130 Years	131 to 140 Years	141 to 150 Years	151 to 160 Years	161 + Years	Total	Percent
3	2430	10489	5881	4564	9081	2007	6883	14208	6295	4060	2346	1141	156	239	0	0	0	69779	9.334
4	23	0	0	30	55	92	44	836	58	245	62	88	0	10	0	0	21	1564	0.209
5	0	0	0	0	0	10	0	68	96	28	26	12	0	0	0	0	22	262	0.035
8	0	0	0	0	53	64	0	385	345	409	113	116	12	0	16	0	0	1512	0.202
9	153	0	124	117	81	239	735	2968	883	1136	498	135	0	27	0	0	50	7144	0.956
10	691	845	707	520	110	1801	2860	3261	2116	1822	583	468	29	0	0	0	0	15812	2.115
12	1685	204	1331	315	74	246	668	1621	5555	7746	3156	1064	399	20	0	0	0	24083	3.221
13	874	891	874	0	12	56	96	59	25	0	0	0	0	0	0	0	0	2885	0.386
15	172	194	62	42	13	68	427	679	1458	1608	1118	837	283	31	0	0	0	6993	0.935
16	157	116	610	172	446	1202	3473	4704	3658	3607	739	218	76	23	0	0	0	19199	2.568
20	0	0	0	0	0	0	0	0	139	40	25	101	0	0	0	0	0	305	0.041
31	3231	10298	4751	932	1437	1282	2093	121	92	0	0	0	0	0	0	0	0	24236	3.242
32	2325	5446	7264	1278	414	1041	1635	2586	6308	7899	4451	1142	280	75	0	0	0	42144	5.637
33	20	311	1682	650	1501	4014	8451	8434	3242	815	587	319	148	24	0	0	0	30198	4.039
38	318	1285	197	0	0	34	164	1455	2113	3384	1053	1305	139	0	22	0	0	11468	1.534
39	53	0	27	0	22	0	29	0	26	105	0	0	43	0	0	0	0	304	0.041
41	38	165	200	39	284	807	3830	4969	3393	1984	1475	944	720	165	30	41	315	19398	2.595
42	184	982	1815	649	177	516	1961	6230	4524	2419	1178	968	228	139	125	37	200	22331	2.987
44	0	0	0	0	49	288	35	1646	543	176	91	163	424	0	0	0	0	3413	0.457
45	206	133	975	257	451	1240	5581	5544	8286	6197	3658	1369	539	76	194	0	0	34707	4.642
46	41	210	27	153	0	172	93	195	218	125	31	53	0	0	0	0	0	1318	0.176
47	145	155	192	134	155	124	1160	961	1802	2648	2329	732	207	62	0	0	0	10805	1.445
48	36	0	135	0	0	53	294	296	952	427	841	901	147	105	27	0	0	4213	0.564
50	134	69	349	167	427	1303	4235	4506	1478	469	141	71	0	22	0	0	0	13371	1.788
51	0	0	0	0	0	0	0	326	194	0	0	0	0	0	0	0	0	520	0.070
52	34	139	29	144	321	1223	1850	1858	4556	4243	3196	1868	1458	732	91	49	351	22141	2.962
53	1825	7817	7284	2635	1277	3969	12280	26353	36379	75474	27052	23435	10756	4017	2394	237	34	243217	32.533
54	19	8	0	0	0	0	80	293	229	837	128	118	14	12	0	0	0	1737	0.232
55	0	0	0	0	0	0	55	0	0	0	0	0	0	0	0	0	0	55	0.007
56	1182	3100	6810	1403	2506	3890	12101	20394	15609	11365	5815	3393	1845	1114	193	16	32	90767	12.141

Table continued next page

Forest Type	0 to 10 Years	11 to 20 Years	21 to 30 Years	31 to 40 Years	41 to 50 Years	51 to 60 Years	61 to 70 Years	71 to 80 Years	81 to 90 Years	91 to 100 Years	101. to 110 Years	111 to 120 Years	121 to 130 Years	131 to 140 Years	141 to 150 Years	151 to 160 Years	161 + Years	Total	Percent
58	12	0	0	16	0	31	58	24	0	77	81	0	0	0	0	0	0	298	0.040
59	0	0	83	0	91	0	330	604	2008	1127	1464	516	312	343	303	0	0	7182	0.961
60	42	103	0	131	0	203	672	2314	3606	2526	2285	969	1152	0	52	48	0	14103	1.886
71	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	17	0.002
72	0	0	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0	60	0.008
73	0	0	0	0	0	0	0	0	0	0	52	0	0	0	0	0	0	52	0.007
82	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0.001
	16027	42967	41406	14344	19035	25971	72172	117959	116201	143001	64572	42443	19368	7237	3445	428	1025	747602	100.000
Percent	2.1	5.5	5.5	1.9	2.5	3.5	9.7	15.8	15.5	19.1	8.6	5.7	2.6	1.0	0.5	0.1	0.1		

Source: Working CISC database 8/2002

Table 3- 149. Forest Cover Type Acres By Decadal Age For All Forested Acres of the Oconee National Forest, Base Year 2000

Forest Type	0 to 10 Years	11 to 20 Years	21 to 30 Years	31 to 40 Years	41 to 50 Years	51 to 60 Years	61 to 70 Years	71 to 80 Years	81 to 90 Years	91 to 100 Years	101 to 110 Years	111 to 120 Years	121 to 130 Years	130+ Years	Total	Percent
12	0	0	0	0	0	0	0	93	0	34	0	0	0	0	127	0.114
13	16	219	130	20	117	45	509	226	69	0	0	0	0	0	1351	1.218
22	0	0	0	0	29	0	0	0	0	0	0	0	0	0	29	0.026
31	5710	15444	11660	3079	3597	3762	12241	13964	3528	1158	408	0	0	0	74551	67.213
32	186	12	0	28	63	191	455	929	233	79	0	0	0	0	2176	1.962
33	0	5	0	0	0	0	0	0	0	0	0	0	0	0	5	0.005
44	0	59	0	0	0	0	0	126	0	0	0	0	0	0	185	0.167
46	0	0	0	0	0	18	204	285	53	0	0	0	0	0	560	0.505
47	0	111	0	0	54	6	74	726	10	49	0	0	0	0	1030	0.929
48	50	0	0	0		33	68	298	19	0	0	0	0	0	468	0.422
53	265	0	77	76	121	784	5203	5009	2154	622	0	92	14	10	14427	13.007
54	0	0	0	0	0	0	0	0	26	0	0	0	0	0	26	0.023
56	112	45	7	0	9	74	1041	1260	658	130	0	0	0	0	3336	3.008
58	31	46	35	0	115	510	1985	4511	848	293	0	0	0	0	8374	7.550
61	0	0	0	7	0	0	0	150	0	0	0	0	0	0	157	0.142
62	0	6	14	25	35	347	1426	1210	185	29	0	0	0	0	3277	2.954
63	0	0	0	0	0	44	466	100	20	0	0	0	0	0	630	0.568
64	0	0	0	0	0	0	0	27	0	0	0	0	0	0	27	0.024
65	0	0	0	0	0	0	0	102	0	0	0	0	0	0	102	0.092
75	0	0	0	0	0	0	0	0	80	0	0	0	0	0	80	0.072
Sum	6370	15947	11923	3235	4140	5814	23672	29016	7883	2394	408	92	14	10	110918	100.000
%	5.7	14.4	10.7	2.9	3.7	5.2	21.3	26.2	7.1	2.2	0.4	0.1	0.0	0.0		

Source: Working ClSC database 8/2002

Table 3- 149 shows that the primary forest cover is loblolly pine, but that riparian area hardwood communities (forest type codes 61 through 65) are a more important group than on the Chattahoochee. Loblolly is a native species that both colonized the eroded cotton fields and was also planted by the Civilian Conservation Corp as a rehabilitation measure in the 1930's. It also shows that, for the forest as a whole, slightly under 50 percent of the forest began life between 1920 and 1940; or in other words as a result of the New Deal programs. This general pattern holds for most individual cover types also. The very oldest trees on the Forest are upland oaks, indicating land that was not cleared for farming, though it likely was burned and grazed. On cleared and farmed lands, grubbing and plowing removed hardwood rootstocks. The table also shows that in the 40-year period since Forest Service even-aged timber management officially began in 1964, a total of approximately 34 percent has been regenerated, or 0.85 percent per year or 8.5 percent per decade. Across the decades of the 1970s and the 1980s, timber management regenerated 12.6 percent each decade or 1.3 percent per year; equivalent to a 77-year rotation on the entire forest or approximately 75 years on the approximately 97 percent of the land base on which harvest is permitted under the 1985 Plan as amended.

Regeneration has been focused on loblolly. This data also includes within it the effects of salvage harvest as a result of numerous southern pine beetle epidemics and tornadoes as well as any acquisitions of land that were in a cut-over condition at they time they were acquired.

Data on small "understory" trees such as dogwood (*Cornus* sp.) or sourwood (*Oxydendron arboreum*), understory shrubs such as rhododendron (*Rhododendron* sp.) or mountain laurel (*Kalmia latifolia*), and herbaceous forest floor plants is not included in the CISC database. This vegetation is not mapped directly as part of forest cover mapping. Indirectly forest cover indicates probabilities of occurrence of both certain woody understory and herbaceous forest floor species because of plant species being associated with certain site characteristics and hence with each other. For example, mountain laurel is most associated with dry, exposed sites and with overstory species such as chestnut oak (*Quercus prinus*), pitch pine (*Pinus rigida*), scarlet oak (*Q. coccinea*), shortleaf pine (*P. echinata*), Virginia pine (*P. virginiana*), and white pine (*P. strobus*). Herbaceous plants are generally most abundant in number of individuals and in number of species on fertile, moist sites such as valley bottoms and sheltered coves. Woody overstory species on these sites in the Blue Ridge are typically basswood (*Tilia americana*), buckeye (*Aesculus octandra*), northern red oak (*Q. rubra*), and yellow poplar (*Liriodendron tulipifera*). Terms applied to this species composition include "cove hardwoods," "mixed mesophytic" and "Appalachian cove forest." An example is Sosebee Cove along State Highway 181 between Suches and Vogel State Park, Georgia.

CISC data also does not include the detail of numbers of stems by diameter class or heights of individual stems. The FIA data does include this level of detail and adds an important dimension to an overall understanding of forest cover.

One of the outputs of the timber growth and yield modeling is a table of the number of stems by diameter class for each set of Forest Inventory and Analysis (FIA) plots. (The general process used is explained in the 'forest products' topic of this environmental impact statement and details are in Appendix B of this EIS.) This number of stems per acre by diameter and species is an average across all of the plots selected to represent each ecological section, old growth community type, and age combination modeled for timber yields. The following table is a compilation of that data (except that the diameter class data has not been compiled) in order to compare and contrast old growth types and ecological sections. The table has a column for each one of the old growth community type and ecological section combinations that were modeled. Old growth types are grouped together in adjacent columns to show variation between ecological sections for the same old growth community type. For each old growth community, data from a representative age (shown in row 4 of the table) was compiled for the number of stems by species from the field-collected FIA data; that is, not model output.

This data was then supplemented with two additional pieces of information. The first of these was a 'shade tolerance' rating on a scale of from 1 through 5 as follows: (1) very tolerant, (2) tolerant, (3) intermediate, (4) intolerant, and (5) very intolerant. Tolerance values were from the *Silvics of North America* (USDA Forest Service,

1990). Shade tolerance is the ability of a tree to establish and persist in shade. The second data item was a fire tolerance rating on a scale of 1 through 4 plus 9 as follows: (1) very low, (2) low, (3) medium, (4) high, and (9) not rated. Fire tolerance is the ability to survive fire. The tolerance ratings shown are for mature trees and will be lower for seedling and sapling size stems; that is, those less than about 5 inches in diameter at the ground line. Fire tolerance ratings are taken from *The Effects of Fire on Flora* (USDA Forest Service, 2000). Once the data had all been compiled, it was sorted on first the shade tolerance, then the fire tolerance rating in ascending order. The value of the sort is to present a side-by-side comparison and reveal the relationship between these two characteristics.

Table 3- 150. Representative Average Number of Stems Per Acre By Species, Old Growth Type or Subtype and Ecological Section For the Chattahoochee-Oconee National Forest

Species	Shade Tolerance	Fire Tolerance	Ecological Section, Old Growth Type, and Age																										
			B02	B05	R05	P05	B13	R13	P13	B21	R21	P21	B22	R22	P22	B24	R24	P24	B25m	R25m	P25m	B25p	R25p	P25p	B25vp	R25vp	P25vp	P27	P28
			Age 46	86	86	86	71	66	66	46	86	86	46	86	76	91	96	66	76	86	66	91	86	86	66	66	76	66	91
Hemlock	1	2	222	1			185			2						15	10		21			21			11				
Sugar maple	1	2		13	157			4			84								55										
Persimmon	1	2										25									23			1	1		13		
American beech	1	2				3			5			12		20									5	2	11				
White ash	1	2			8																								
Ash	1	2		2					21	5		14													7		2	11	21
American hornbeam	1	9						115	32			10												2		6		97	30
American holly	1	9							8	14					37				12					4				20	
Florida maple	2	2							52			5		40										3		21			
Red maple	2	2	49	5	40	36	18	6	65	65	20	21	70	22	51	31	88		178	144		62	45	32	115	48	55	46	51
Green ash	2	2						7																				5	
Blackgum	2	2			9	12		6	16	18		40	27	20		83	73		12	103		80	42	9	41	20	18	46	
Basswood	2	2		2	1				4																	2			
Elm	2	2						3	28			6									3			38	2		4	33	30
Winged elm	2	2			31			23																		22		15	
Southern magnolia	2	3					3					15										20							
Boxelder	2	9						2	16		15																		60
Buckeye	2	9			31																								
Eastern redbud	2	9							10		31													3		3			
Silverbell	2	9		1						9		5																	
Eastern Hophornbeam	2	9		13					17										37										
Mulberry	2	9	12						2																			8	7
Sourwood	2	9	50	27	80	48	40	3	10	40		37	143	160		241	83	68	21	89	33	205	101	17	3	14	43		

Ecological Section, Old Growth Type, and Age																													
Species	Shade Tolerance	Fire Tolerance	B02	B05	R05	P05	B13	R13	P13	B21	R21	P21	B22	R22	P22	B24	R24	P24	B25m	R25m	P25m	B25p	R25p	P25p	B25vp	R25vp	P25vp	P27	P28
			Age 46	86	86	86	71	66	66	46	86	86	46	86	76	91	96	66	76	86	66	91	86	86	66	66	76	66	91
Laurel oak	2	9				1		11																7				8	
Other species	2	9		32			3		3	42	20	5	13			5			4						6	17			
Dogwood	2	9	125	115		108	50	115	37	23	120	178	93	120		8	75	304	20	85	162	20	109	41	39	61	19	20	
Hickory	3	2	10	33	12	43		3	23	32	27	72	13	80	33	7		37	20	15	103	9	21	19	16	48	37	5	10
White oak	3	2	2	11	59	44	50	4	18	38	61	42	83				3		16	11		2	16	7	11	37	30	5	
Southern red oak	3	2						7	3	9			53			1	3			1	12	11	3	15	5	3	12	10	
Black oak	3	2		1	8	5				12	5	26		13		2	15	92	1	17	5	6	2	3	1	7	1		
White pine	3	3	111							56			16			45			27			6			20		8		
Northern red oak	3	3		19	5	20				9	20	2		3					10	3			26	2	1	7			
Hackberry	3	9							13																			17	
Cucumbertree	3	9		2								1													2				
Sycamore	3	9							2																				11
Chestnut oak	3	9	2	9	45					5	35		47	118		23			46	33		5	2		16	19	35		
Red cedar	4	2							5			35					17						18	10	6	3			
Virginia pine	4	2								2	3		10				1		20	16	11		1		159	130	178		
Birch sp.	4	2	52	13		24	12		8		7	10																10	
Black birch	4	2		3																									
Sweetgum	4	2				26	8	97	121			14			163		29		1		30		70	102	6	3	6	89	17
Blackjack oak	4	2																									7		
Post oak	4	2						12		1							19		1	2	90		13	7		7	8		6
Pitch pine	4	3								1						56	2		23			4	1		8				
Yellow poplar	4	3	40	18	35	56	14	41	16	9		8					2		12			21	18	15	8	12	9		
Shortleaf pine	4	4				3			1			15	3			27	85		5	9	12	46	60	67	5	5	27		
Loblolly pine	4	4				4		6	3						42				4	8	94		31	188	6	19	3	4	
Table Mt. pine	4	9																	5						1		8		
Black walnut	4	9	3							1															3				
Black cherry	4	9						2	15			35		20							4		6	13	3	24	8	20	
Chinkapin Oak	4	9									2																		

Ecological Section, Old Growth Type, and Age																													
Species	Shade Toler-ance	Fire Toler-ance	B02	B05	R05	P05	B13	R13	P13	B21	R21	P21	B22	R22	P22	B24	R24	P24	B25m	R25m	P25m	B25p	R25p	P25p	B25vp	R25vp	P25vp	P27	P28
			Age 46	86	86	86	71	66	66	46	86	86	46	86	76	91	96	66	76	86	66	91	86	86	66	66	76	66	91
Swamp Chestnut Oak	4	9						2																				2	
Water Oak	4	9						1	16						55						85			23			3	26	13
Sassafras	4	9	12				7	5					25						12	10				5	3		6		
Scarlet Oak	5	9	7			3		1		10	17	5	59	2		32	5		15	10	10	11	3		11	2	2		
Black Locust	5	9	7								73		4																
Willow	5	9						6																					
			701	324	519	437	390	480	570	403	541	637	659	619	381	574	529	501	579	680	678	528	599	633	528	540	541	495	254

Source: Forest vegetation simulator program output files using Forest Inventory and Ana;ysis 1986 data, 8/2002

These data show a consistent pattern across all old growth types, ecological sections, and also of age of a high stem count of shade tolerant but fire intolerant species. The very tolerant and tolerant species make up 55 percent of the total stem count across all old growth community types and all ecological sections. Among these, hemlock, white pine, dogwood, sourwood and red maple are especially prevalent. Together, dogwood, sourwood, and red maple make up 35 percent of the total stem count across all old growth community types and all ecological sections. These three species are also habitat 'generalists' – as is white pine – and occur across the full range of ecological variability represented by the ecological units and old growth community types as well. Hornbeam and American holly are not rated for fire tolerance but share a thin bark with red maple, beech, and other low fire tolerance species and can also be expected to have a low fire tolerance. One aspect of fire tolerance is that some species cannot regenerate from sprouts if they are top-killed by fire. Significant examples of these are white pine, Virginia pine, eastern red cedar, and eastern hemlock. Nearly all of the hardwoods re-sprout if top-killed but sugar maple at least does so only rarely. Among the southern yellow pines, loblolly, shortleaf, pitch and longleaf re-sprout if top-killed but only while they are young; that is, seedling or sapling size. Oaks and hickories sprout readily but this ability declines with increasing diameter.

Many other relationships are also shown in this table as well. A review of each old growth community column individually shows the overall species composition of that old growth type. It also shows a measure of relative importance for each species by the number of stems. Shifts in composition between ecological sections are also evident. For example, hemlock and white pine rarely appear outside the Blue Ridge. Southern magnolia is restricted to the Piedmont. Winged elm is common to only the Ridge and Valley.

Not shown in this data, but important to an overall understanding of forest cover is the distribution of woody species by size within each old growth community type. In the table below, a representative sample of the number of stems by species and diameter is shown for the dry and dry-mesic oak-pine old growth community type in the Blue Ridge ecological section. It is important to understand that this data is an average across several plots and therefore does not represent a single stand somewhere on the landscape. Rather it represents the average situation for the entire community and this exact mix of species by diameter distribution probably does not occur anywhere on the landscape. In the original selection of FIA plots, variations in the ability of different soils to support growth (site quality) was not used as a selection criteria. Site quality has a rather wide range of variability and across this range shows variability of species composition while the predominant community remains the same. Because of this variation, Table 3- 151 is likely to include species that do not occur together in nature on a single site quality.

Table 3- 151. Representative Species Composition by Diameter Class for Late-Successional Dry and Dry-mesic Oak-pine (OGTY 24) in the Blue Ridge Ecological Section

Diameter Class	Total Stems	
2	272	40% red maple, 20% sugar maple, 7% white pine, 7% hemlock, 4% dogwood, 4% hickory, 4% holly, 4% blackgum, 4% sassafras, 4% chestnut oak
4	116	32% red maple, 32% eastern hophornbeam, 15% sourwood, 10% pitch pine, 10% white oak
6	53	36% chestnut oak, 32% red maple, 13% yellow poplar, 11% pitch pine, 8% scarlet oak
8	49	14% red maple, 10% scarlet oak, 10% chestnut oak, 8% northern red oak, 8% yellow poplar, 8% Table Mt. pine, 8% other species, 6% pitch pine, 4% w. pine, 4% loblolly pine, 4% Virginia pine, 4% hickory, 4% dogwood, 4% white oak,
10	50	30% Virginia pine, 14% red maple, 10% hickory, 10% dogwood, 8% chestnut oak, 6% n. red oak, 6% white pine, 6% sourwood, 4% hemlock, 2% yellow poplar, 2% white oak
12	20	15% scarlet oak, 15% white pine, 10% shortleaf 10% pitch pine, 10% Virginia pine, 10% red maple, 5% loblolly, 5% hickory, 5% dogwood, 5% sweetgum, 5% chestnut oak, 5% n. red oak
14	5	40% chestnut oak, 20% shortleaf, 20% Table Mt., 20% n. red oak, 20% white oak
16	6	17% shortleaf, 17% loblolly, 16% hickory, 17% white oak, 16% scarlet oak, 17% chestnut oak
18	4	50% chestnut oak, 25% post oak, 25% black oak
20	2	50% Virginia pine, 50% scarlet oak
22	1	100% chestnut oak
24	1	100% chestnut oak
Total	579	

Source: FIA plot data collected in the 1986 field season.

When one reads from top to bottom of Table 3- 151, several trends are evident. The 2-inch, 4-inch, and 6-inch diameter classes contain 76 percent of all stems. In these classes, there is a dominance of shade tolerant but fire intolerant species. Virginia pine, a fire intolerant that cannot re-sprout if top-killed and a shade intolerant that needs strong light, is a significant portion of overall composition in the 10-, 12-, and 14-inch diameter classes but absent from the 2- through 6-inch classes and is only a small fraction of the 8-inch class. Red maple, a shade tolerant but fire intolerant species, occurs in all diameter classes through the 12-inch class. Above 12 inches, the composition is dominated by shade intolerant species that are mostly of medium to high fire tolerance. The exception is of one Virginia pine and one hickory.

Considered as a whole, Table 3- 151 recaps southern Appalachian forest history. The largest trees were almost certainly present before the turn of the century and escaped the logging era but they occurred as a low stem density in a landscape burned annually. With National Forest acquisition and fire suppression, the Virginia pine and other shade and fire intolerant species began life and became the forest cover we recognize most readily today. In the table, these are in the 10- through 14-

inch diameter classes. Once this new cover closed its canopy and the forest floor began to open up as natural mortality thinned out the first wave of colonizers, a second wave of shade tolerant species began to establish and form the present dense mid and understory.

The buildup of a tolerant mid and understory puts at risk the establishment and maintenance of regeneration that could replace the existing overstory should anything; such as oak decline, gypsy moth, southern pine beetle, or tornadoes remove it. In the example shown in Table 3- 151, the yellow pine species are at risk to southern pine beetle mortality. But there is no regeneration present of the southern yellow pine species that have small seed and whose seedlings are not competitive in the dense understory shade environment historic management has created. The probability of stump sprouts from the oaks or hickories establishing a new stand declines with increasing diameter, so those hardwood trees above about 14 inches cannot all be counted on to replace themselves by sprouting (and not all of those below that diameter). If oaks are killed by oak decline, there is no re-sprouting regardless of diameter. If oaks are killed by repeated gypsy moth defoliations, there is time and opportunity for tolerant understory, such as white pine, to respond to the increased light during the growing season and more completely take up the growth resources. In the Table 3- 151 example, the most optimistic estimate (assuming 100 percent of existing stems sprout) of total potential regeneration of oak and hickory from the 2-inch through 12-inch diameter classes from sprouts is 83 stems per acre. This is an inadequate number of stems for a future oak and hickory stand, though it could become oak woodland. If an oak-pine stand is desired, supplemental stocking of the yellow pines is needed. There are only two options; (1) stand by for forest succession to shift composition away from oak and yellow pine, or (2) actively intervene to change vegetative composition. For example, either plant supplemental southern yellow pine or provide a seedbed condition through prescribed burning for natural regeneration from existing pine before it is killed by southern pine beetle, blow down, wildfire, or gradually fades out as individual trees die.

A prime example of this dilemma going on now is the 1999 through 2003 southern pine beetle mortality. The trees being killed will not usually be replaced by the same species because no advance regeneration of those species capable of response to increased light exists and seedbed conditions do not allow for natural regeneration to establish and compete against firmly established tolerant species. The change in forest structure is not to early-successional because the existing understory ranges in diameter from 2 to about 10 inches and in height from about 10 to 40 feet. Barring a wildfire of sufficient intensity to kill this understory, a species composition shift is taking place.

The high number of understory stems also fills habitat niches that could be available to herbaceous species or smaller woody species as well. Not even included in this data is the thicket-forming species such as rhododendron, mountain laurel, and especially Japanese privet that seal off sunlight from the forest floor. These species are evergreen or semi-evergreen and when they occur in combination with a species such as hemlock that is also evergreen, two layers of canopy cast their shade over the forest floor and very little light for photosynthesis ever reaches it. In the case of

the death of American chestnut, one of the responses on some sites was for the mountain laurel or rhododendron understory to preclude the establishment of replacement trees.

In the mid-1990's, the Chattooga River watershed of the Chattahoochee National Forest was intensely studied in an Ecosystem Management Pilot Project. One of the reports from that project concluded that, with current disturbance regimes, especially lack of fire,

> *...we should continue to see a shift from fire-adapted oak and pine communities towards communities typical of regions with long term dominance of small scale gap dynamics. Within the old growth stands surveyed increases in red maple and black gum appear particularly prominent. Furthermore, in the understory we should expect to see increases in the dominance of Rhododendron and other relatively fire intolerant understories. Species including Table Mountain pine that are fire obligate may be expected to show decreases as current individuals age and fail to reproduce. . . . Even excluding the coming role of gypsy moth, we must expect that oak dominance of the overstory . . . perhaps for much of the southern Appalachians is unlikely to continue under current management* [Meier and Bratton, 1996].

Direct and Indirect Effects

The Forest Plan includes a rather comprehensive set of forest cover management objectives by individual forest communities or groups of communities. Alternatives are compared by how much they are estimated to contribute toward a specific objective. These estimates show the acres likely to be affected by management in each alternative, a general idea of types of activities, and the communities in which they would occur.

The estimates shown should be interpreted more by comparing alternatives relative to each other than as an assurance that a specific acreage will be an outcome of an alternative. There are a number of reasons for this. The acreages shown cannot be added together because some overlap completely or partially. The acreages shown for restoration (which would normally imply early-successional habitat creation) are not intended to exactly match the quantitative objectives for early-successional habitat creation because some of those objectives may be met in other communities.

The objectives are related to the use of timber harvest but timber harvest will not always be used to meet them. Of the objectives displayed, the thinning and restoration ones are expected to be – with minor exception - a subset of timber harvest acres as shown in the 'forest products' topic. That is, timber harvest will be the tool to achieve thinning, restoration, and early-successional habitat. Some objectives may initially be met by a timber harvest but continue to be met thereafter on the same acreage by repeat treatments. The high-elevation early-successional habitat creation will likely involve some timber harvest, at least initially, but not in every case. For example, the Songbird Management Area on Grassy Mountain on the

Cohutta Ranger District has been maintained in a seedling/sapling condition since the 1970's but had only an initial harvest. An estimated 20 to 30 percent of canopy gap creation will involve a timber harvest with the remainder being non-commercial simply because the volume and value involved will make it economically infeasible to sell. Hardwood midstory removal is expected to always be non-commercial because of small stem sizes, low volume, and low value and therefore not involve a timber sale, though minor exceptions may occur here as well. Finally, individual project level mitigations may introduce further constraints that make timber harvest economically infeasible.

Where natural events have partially created desired conditions, supplemental treatments will often not include a timber harvest because of low volume and low value. For example, southern pine beetle mortality in a mixed pine-oak stand may create a sparse oak canopy with a moderately dense understory. Chainsaw felling of understory and midstory stems followed by growing season burning could quickly begin to create oak woodland conditions. Given the overall forest age, species, composition, forest health threats, and natural dynamics, some portion of objective accomplishment will routinely result from response to natural events.

Plan vegetation objectives are not necessarily separate from each other; that is, they are not always mutually exclusive, creating an 'either/or' choice. They were structured with the thought that two or more objectives could apply to the same acreage as sequential treatments. For example, prescribed burning will partially accomplish a mid-story reduction by top killing stems up to about 2 to 3 inches at groundline. Burning might be followed by mechanical treatment of stems not top killed on the prescribed burned acres as the most efficient way to achieve a complete mid-story reduction.

Some objectives are mutually exclusive and the choice is an 'either/or' one. At a strategic plan level this is desirable to some degree. Individual projects implementing the plan need flexibility to choose among specific objectives depending on site-specific factors not considered at the strategic planning level.

In evaluating the effects of alternatives to the various communities, the first consideration is how much of the entire community is available to be treated. Availability depends upon the nature of the treatment, as some acres are available for some activities but not others. The basis for the land area considered available by treatment is shown in Table 3- 152, below.

Table 3- 152. Availability of Land for Vegetation Treatments

Type of Treatment	
Rx burn	Early-successional options 2, 3, & 4
Thinning	Mgmt Rxs modeled for timber yields
Hardwood Mid-story Reduction	Early-successional options 2, 3, & 4
Restoration	Mgmt Rxs modeled for timber yields
Canopy Gap	Early-successional options 2, 3, & 4
High Elevation early-successional	Early-successional options 2, 3, & 4

For relative comparison, restoration and treatments that would result in early-successional conditions were not rigorously matched to the individual component forest cover types and the minimum or maximum quantities permissible by each early-successional habitat objective of each management prescription. Nor were they structured to equal annual forestwide early-successional habitat amounts, since some of this will occur where the forest cover type is maintained at what it was before. Also 'available acres' were not reduced for slope. There are two primary reasons the very rigorous match was not made; (1) the degree of detail is not needed for a strategic decision, and (2) there was usually more opportunity than could reasonably be met.

High elevation early-successional was analyzed in more depth than other objectives. Reasons for doing so included the relationship with; (a) a neo-tropical migratory bird species with potential for listing under Endangered Species Act, (b) inventoried roadless, and (c) major trail corridors, especially the Appalachian Trail. The numbers shown as annual objectives by alternative are the maximum permissible within the early-successional habitat objectives of management prescriptions. Several points are worth noting. The high elevation areas typically include a significant proportion of steep slope (greater than 45%) and therefore the potential exists to push objective satisfaction onto gentler terrain. Doing so may cause difficulty in meeting the objective within constraints on opening size and opening interspersion. Also, depending on how widely elevation varies within an allocated block that contains lands higher than 3,000 feet in elevation; the potential exists for the high elevation early-successional habitat objective to take precedence over other objectives that might otherwise could have been met at lower elevations

The sum of estimated treated acres for activities creating early-successional habitat was checked to be sure it was well within the permissible early-successional habitat creation range at Forestwide scale. As part of this effort, they were also checked against SPECTRUM estimated harvest acreages to see if they were generally consistent, although we did not force an exact match, since SPECTRUM was not driving treatments. As a result of this check, both Alternatives E and G were found to have had restoration objective acres in the DEIS that were in excess of early-successional habitat objectives. They were reduced for the FEIS to be within the range. Quantities in objectives are a combination of a large degree of analysis and a small degree of reasoned judgment to produce a balanced and feasible program. Because some judgment was used, there may be small discrepancies between numbers shown here and within other topics of this EIS.

The restriction of only considering thinning or restoration on suitable acres is also a conservative estimate by equating them to a sustained yield timber harvest program. Each of these activities can, and likely will, occur within those prescriptions with an early-successional option of zero to four percent that were not modeled for timber yields; that is, the 'not appropriate' classification. However, they are not likely to contribute a significant amount and it will also be irregular in timing.

All of the various management prescriptions that had no early-successional habitat option were considered unavailable for active vegetation management, including

prescribed burning. These prescriptions are primarily National designations such as Wilderness or Wild and Scenic River. But they also include the 9.F. Rare Communities prescription that specifically provides for treatments to maintain the community. They are not completely off-limits to all activities in all cases but are so nearly so that it is reasonable not to count on them for an annual or even decadal contribution toward meeting objectives. In the case of prescribed fire, it can be used in Wilderness but is judged unlikely to be in the short to medium term of five to ten years. Events that happen inside these areas that provide effective early-successional habitat may affect whether and/or how much treatment is proposed in the surrounding area in the implementation of the plan.

Given these background assumptions, alternatives were evaluated for their relative ability to achieve the over-arching objective of maintaining diversity. We assumed communities were affected in direct proportion to the land area in each early-successional habitat option in each alternative. This assumption may not hold true if the acres of each community were to be calculated for each early-successional option within each alternative, but it is reasonable to expect that it would allow a true relative comparison of alternatives and a projection of trends.

Table 3- 153. Estimated Annual Average Treated Acres By Forest, Objective, and Alternative

Objective By Forest and Vegetation Communities	Alt. A	Alt. B	Alt. D	Alt. E	Alt. G	Alt. I
CHATTAHOOCHEE						
Prescribed Burn						
Shortleaf pine-Pitch pine-Table Mountain pine	3,090	3,360	3,690	2,550	2,160	3,750
Table Mountain pine	103	112	123	85	72	200
Oak/Oak-Pine	7,210	7,840	8,610	5,950	5,040	7,600
Thinning						
Shortleaf pine-Pitch pine-Table Mountain pine	206	224	246	170	144	500
Oak/Oak-Pine	515	560	615	425	360	550
Hardwood Midstory Reduction						
Shortleaf pine-Pitch pine-Table Mountain pine	6,180	6,720	7,380	5,100	4,320	7,500
Table Mountain pine	103	112	123	85	72	100
Restoration						
Shortleaf pine-Pitch pine-Table Mountain pine	103	112	123	34	17	210
Table Mountain pine	52	56	62	17	8	100
Oak/Oak-Pine	103	112	123	34	17	125
Mtn Longleaf	103	112	123	34	17	110
Canebrakes	5	5	5	5	5	5
Woodlands	1,030	1,120	1,230	340	170	1,000
Canopy Gap						
Mesic Deciduous	1,030	1,120	1,230	850	720	1,030
Riparian	70	50	50	40	20	50
High Elevation						
Early-Successional (maximum)	324	427	433	193	146	327
OCONEE						
Prescribed Burn						
Shortleaf Pine	535	510	530	505	450	500
Loblolly (Outside RCW HMA)	1,070	1,020	1,060	1,010	900	1,100
Loblolly (Inside RCW HMA)	13,375	12,750	13,250	12,625	11,250	16,000
Oak/Oak-Pine	535	510	530	505	450	550
Canebrakes	3	3	3	3	3	3
Thinning						
Shortleaf Pine	214	204	212	202	180	230
Loblolly (Outside RCW HMA)	107	102	106	101	90	3,500
Oak/Oak-Pine	535	510	530	505	450	520
Hardwood Midstory Reduction						
Shortleaf Pine	535	510	530	505	450	500
Loblolly (Outside RCW HMA)	535	510	530	505	450	1,100
Restoration						
Oak/Oak-Pine	54	51	53	51	45	55
Canebrakes	15	15	15	15	15	15
Woodlands	107	102	106	101	90	110
Shortleaf Pine	107	102	106	101	90	110
Pine-Oak	107	102	106	101	90	110
Canopy Gap						
Mesic Deciduous	107	102	106	101	90	110
Riparian	27	26	27	25	23	30

Alternatives were also compared in terms of how much of each group of forest cover types was available (under the 'rules' already discussed) to meet the objectives. The value of this comparison is to see what proportion is not contributing. From this, an inference can be drawn about the relative ability of alternatives to maintain or restore the various communities. This information should be interpreted in the light of the understory species information already presented in the 'Forest Cover' topic and also with consideration of forest health risks presented in the 'Forest Health' topic. The portion of communities without planned and scheduled vegetation treatments is at greater risk to be replaced by another community type through forest succession following natural events that remove the overstory.

Table 3- 154. Percent of Total Vegetation Community Available By Treatment By Alternative

Forest and Vegetation Communities	Alt. A	Alt. B	Alt. D	Alt. E	Alt G	Alt. I
CHATTAHOOCHEE						
Prescribed Burn						
Shortleaf pine-Pitch pine-Table Mountain pine	78	77	76	70	48	77
Table Mountain pine	100	100	100	100	100	100
Oak/Oak-Pine	78	77	76	70	48	77
Thinning						
Shortleaf pine-Pitch pine-Table Mountain pine	52	65	65	17	20	49
Oak/Oak-Pine	52	65	65	17	20	49
Hardwood Midstory Reduction						
Shortleaf pine-Pitch pine-Table Mountain pine	78	77	76	70	48	77
Table Mountain pine	100	100	100	100	100	100
Canopy Gap						
Mesic Deciduous	78	77	76	70	48	77
Riparian	78	77	76	70	48	77
High Elevation						
Early-Successional	55	51	47	41	33	53
OCONEE						
Prescribed Burn						
Shortleaf Pine	94	95	89	94	87	92
Loblolly (Outside RCW HMA)	94	95	89	94	87	92
Loblolly (Inside RCW HMA)	100	100	100	100	100	100
Oak/Oak-Pine	94	95	89	94	87	92
Canebrakes	100	100	100	100	100	100
Thinning						
Shortleaf Pine	79	78	80	70	66	81
Loblolly (Outside RCW HMA)	79	78	80	70	66	81
Oak/Oak-Pine	79	78	80	70	66	81
Hardwood Midstory Reduction						
Shortleaf Pine	94	95	89	94	87	92
Loblolly (Outside RCW HMA)	94	95	89	94	87	92
Canopy Gap						
Mesic Deciduous	94	95	89	94	87	92
Riparian	94	95	89	94	87	92

Source: GIS Analysis

On the Chattahoochee, all alternatives can be expected to result in net loss of southern yellow pine, yellow pine-oak, oak-yellow pine, and oak in the medium term of twenty or more years, except for Table Mountain pine. All alternatives have at least 22 percent of the land area without any efforts to maintain these communities through prescribed burning. Alternative G has prescribed burning on only 48 percent of the land area. All alternatives also have a relatively low proportion of the southern yellow pine types available to be regularly thinned, thus exposing aging trees to increasing southern pine beetle mortality risk. Alternatives E and G in particular have an extremely low level of acreage available for thinning. Restoration objectives for these communities are expected to fall short of their rate of loss in all alternatives, resulting in a net long-term decrease in their acreage. The most probable replacement types are white pine or white pine-oak without burning. With burning, the most probable replacement would be xeric oak, primarily scarlet and chestnut oaks, unless they are killed by oak decline. Both Alternatives E and G provide for a very low level of high elevation early-successional.

On the Oconee, a range of approximately 90 to 100 percent is available to be burned or have midstory reduction. Regular thinning can occur on approximately 80 percent of the pine, mixed, and oak types except for Alternatives E and G where it is 70 and 66 percent respectively. Given the history of southern pine beetle epidemics on a seven to eight year cycle, all alternatives can be expected to result in higher southern pine beetle risk compared to present but the differences among alternatives A, B, D, and I are small.

In addition to the land area available, the time it takes to meet the desired condition objective on that land area is an important indicator in comparing alternatives. For example, prescribed burning is needed to control the tolerant understory but it is not a one-time treatment. Thinning and canopy gap treatments are similar in that the desired response declines over time. A cycle is needed; first to create desirable conditions and then to maintain them thereafter. The time needed to cycle through all available acres once is an indicator of the relativity intensity and effectiveness of the alternatives. The table below compares the alternatives in this regard.

Table 3- 155. Years Needed to Treat All Available Acres By Vegetation Community By Alternative

Forest and Vegetation Communities	Alt. B	Alt. D	Alt. E	Alt G	Alt. I
CHATTAHOOCHEE NF					
Prescribed Burn					
Shortleaf pine-Pitch pine-Table Mountain pine	22	19	18	23	19	18
Table Mountain pine	6	5	5	7	8	3
Oak/Oak-Pine	37	33	30	40	33	35
Thinning						
Shortleaf pine-Pitch pine-Table Mountain pine	214	249	224	85	116	84
Oak/Oak-Pine	344	399	359	136	186	305
Hardwood Midstory Reduction						
Shortleaf pine-Pitch pine-Table Mountain pine	11	10	9	12	10	9
Table Mountain pine	6	5	5	7	8	3
Canopy Gap						
Mesic Deciduous	28	26	23	31	25	28
Riparian	667	833	909	909	1429	833
High Elevation						
Early-Successional	184	130	118	229	250	175
OCONEE NF						
Prescribed Burn						
Shortleaf Pine	4	4	4	4	4	4
Loblolly (Outside RCW HMA)	25	26	24	28	27	24
Loblolly (Inside RCW HMA)	3	3	3	3	4	3
Oak/Oak-Pine	28	30	27	30	31	27
Canebrakes	33	33	33	33	33	33
Thinning						
Shortleaf Pine	9	9	9	8	8	8
Loblolly (Outside RCW HMA)	209	217	214	197	208	7
Oak/Oak-Pine	24	25	24	22	24	29
Hardwood Midstory Reduction						
Shortleaf Pine	4	4	4	4	4	4
Loblolly (Outside RCW HMA)	50	53	48	53	55	24
Canopy Gap						
Mesic Deciduous	15	15	14	15	16	14
Riparian	301	320	290	320	332	264

The general trend across all alternatives is for treatments to be too conservative for greatest effectiveness. Except for the yellow pine types, prescribed burning cycles are generally too long and will allow re-sprouting and new colonization of understory to re-grow to conditions similar to before the first burn. For example, the prescribed burning cycle in the yellow pine types on the Chattahoochee ranges from 18 to 23 years. To create and maintain optimum conditions, the interval should be less than ten years. The large acreages in the major community types and the slow pace of

thinning means that 'preventive maintenance' to condition stands to replace themselves or to withstand insect or disease attack prior to the need will not be occurring rapidly enough. Hardwood midstory reduction on the Oconee outside the RCW HMA is far too slow, essentially amounting to a doubling of the current stand age before all acres are treated even once. This pace falls far behind the rate of loss to southern pine beetle and may soon be lagging far behind littleleaf disease.

There are notable exceptions to the general trend. All alternatives effectively create and maintain desired conditions in Table Mountain pine communities with both prescribed burning and mid story reduction occurring on all acres within ten years. Except as previously noted, hardwood midstory reduction rates will reach desired conditions in the southern yellow pine, pine-oak, oak-pine, and oak types within twelve years. Canopy gap creation rates will ensure a continual supply of this habitat, assuming about 10 years for the canopy to close again after each treatment.

The final major effect of the alternatives is the human-caused shifts in forest cover types due to active management. Each alternative has restoration objectives for several communities. Each acre restored involves a conversion from the existing forest cover because by implication if something is being 'put back'; it is not there now. The communities to be restored have been chosen to create a more diverse forest cover and also to improve wildlife habitats. Communities targeted for species conversion are primarily those where human land use has resulted in their opportunistic invasion onto sites where they are often temporary. In forest ecology, these are called 'pioneer species.' They have also been likened to 'band aids' in that they can quickly cover an area in trees and, in historic context, stop soil erosion. Examples are Virginia pine and loblolly pine. Other conversions are not of species but of forest structure, such as from forest to woodland or savanna. On the Oconee this structural conversion will not be dramatic or especially noticeable. Management for red-cockaded woodpecker on National Forest and burning, grazing, and other land uses off National Forest have created similar open stand conditions for many years. The major difference will be a less dense overstory canopy. On the Chattahoochee woodland conditions will initially be dramatically different. At first this may be the reduction in the typically dense understory and midstory, following by opening up the canopy with more sunlight penetration. Later, the shift will be toward an herbaceous ground cover. The combination of open, 'park-like' conditions and herbaceous ground cover is currently rare.

In the table below the maximum restoration value by community from any alternative is used to indicate the likelihood that restoration objectives could result in eliminating specific forest cover types. (Woodland creation will not convert species, but rather structure.) It also indicates approximate amounts of conversion of forest types; those gaining and those losing area.

Table 3- 156. Estimated Forest Cover Types Affected by Restoration on the Chattahoochee National Forest

Community	Max. Restoration (acres/decade)	Forest Cover Types Most Likely Converted and The Total Acres of Each
Shortleaf pine-Pitch pine-Table Mountain pine	12,300	Frty 3 = 69,779 ac.; Frty 9 = 7,144 ac.: Frty 33 = 30,198 ac.
Table Mountain pine	2,100	Frty 9 = 7,144 ac.; Frty 45 = 34,707 ac.; Frty 60 = 14,103 ac.;
Oak/Oak-Pine	12,500	Frty 16 = 19,199 ac.; Frty 33 = 30,198
Mtn Longleaf	1,230	Frty 16 = 7,009 ac.; Frty 33 = 5,658 ac. (Armuchee RD)
Canebrakes	10	Frty 46 = 1,318 ac.; Frty 58 = 298 ac.; Frty 71 = 17 ac.; Frty 72 = 60 ac.; Frty 73 = 52 ac.
Woodlands	12,500	Frty 45 = 34,707 ac.; Frty 59 = 7,182 ac.; Frty 60 = 14,103 ac.

Source: Plan revision GIS data layer November 2002.

In most cases, the restoration objective is so small and the affected forest types cover so much area that effects are insignificant to the affected types. Only in the case of canebrakes and woodland restoration is there apparent potential to totally replace an existing native forest cover type from an ecologically appropriate site. In the case of canebrakes however, restored communities are expected to be only a few acres in size and the objective can be met by numerous small patches embedded within the appropriate riparian forest cover communities as an additional element of diversity without replacing them entirely. Achieving the woodlands objective has potential for significant changes in the structure of xeric oak and oak-pine communities since the objective is greater than the total acres in the scarlet oak type (forest type 59) and almost as large as the total acres in the scarlet oak-chestnut oak type. In addition, the Table Mountain pine restoration objective is expected to be partially met from forest type 60. In the entire group of associated forest cover types however, there is abundant opportunity to create the woodland condition and restore Table Mountain pine without eliminating a forest type.

Table 3- 157. Estimated Forest Cover Types Affected by Restoration on the Oconee National Forest

Oconee	Max. Restoration (acres/decade)	Forest Cover Types Most Likely Converted
Oak/Oak-Pine	550	Frty 31 = 74,551 acres
Canebrakes	200	Frty 58 = 8,374 ac.; Frty 61 = 157 ac.; Frty 62 = 3,277 ac.; Frty 63 = 630 ac.; Frty 64 = 27 ac.; Frty 65 = 102 ac.; Frty 75 = 80 ac.
Woodlands	1,100	Frty 31 = 74,551 acres
Shortleaf Pine	1,100	Frty 31 = 74,551 acres
Pine-Oak	1,100	Frty 31 = 74,551 acres

Source: Plan revision GIS data layer November 2002.

Provided that no existing mixed types - that is, pine-oak or oak-pine - are converted on the Oconee; restoration will generally have minimal effect to current forest cover type diversity. The maximum decadal amount is approximately 4,000 acres or 3.5-percent of the total Oconee. Of this amount, 3,800 acres derives from the loblolly pine cover type – the single most abundant community – converting 5-percent of it. Canebrake establishment has potential to significantly reduce the acreage of – or even totally replace - forest cover types 61, 64, 65, and 75. Their total acreage is only 83-percent more than the restoration objective and each of the four types have less acres individual than the objective. However abundant opportunity remains in forest types 58, 62, and 63. Also it is expected that canebrakes will typically be inclusions of an acre or a few acres within a larger riparian area hardwood stand. At least initially, restoration will be focused on areas that already have river cane that can respond to treatments designed to enhance it.

Cumulative Effects

All alternatives are conservative in their response to the forest health and successional problems identified. It is reasonable to expect that regardless of which of these alternatives were to be chosen, significant shifts in forest cover composition will occur on both national forests in the long term but especially on the Chattahoochee. Management efforts to create and maintain healthy forests are not aggressive enough to keep pace with the aging forest and the increasing vulnerability to native and introduced pests except in localized sub-areas of the forest. The xeric oak and the xeric pine and pine-oak communities in particular on the Chattahoochee includes species already at physiological maturity such as Virginia pine and scarlet oak and vulnerable to southern pine beetle and oak decline. The recent discovery of the hemlock wooly adelgid in Georgia likely means that understory hemlock will be removed as a potential component of the 'third forest' on the Chattahoochee, favoring white pine as the most likely species to increase on the landscape. Where southern pine beetle removes overstory pine, a sparse oak and hickory cover is likely to become the new forest type until such time as either white pine grows up from below, gypsy moth defoliates them, or oak decline kills them.

Because of the overall conservatism, 'conditioning' treatments will be more important. These are treatments designed to reduce stem density, decrease shade on the forest floor, reduce the litter depth, and suppress non-native species. Prescribed fire will be a major tool to simultaneously accomplish each of these to some degree. Alternative or supplemental treatments such as chainsaw felling, mulching chipper, or small stem product sales will also be needed. Herbicide treatment of non-native invasive species will be needed as part of restoration efforts to re-open historic habitat niches for plants and animals.

All alternatives differ from past management in giving stronger emphasis to the restoration and maintenance of native vegetation communities. Carrying it out will require more activity than the 1985 plan in changing vegetative structure rather than in changing species composition. Restoration activities will change species but they will remain native species and will further diversify communities. There is a greater ecological basis than in the 1985 plan for selecting species to restore, structure to create and maintain, locations for activities, and distribution patterns of

communities. Vegetation management programs are being directed by wildlife habitat needs and community conservation rather than wood production amounts or dollar returns.

Natural events will be used as opportunities to achieve or partially achieve objectives. Conversion of some previously created pine plantings to other communities will occur. Some of this will be in response to southern pine beetle mortality. Some will be in recognition of opportunities to meet plan objectives. Planting of pine species, except as needed in restoration, will typically be less than occurred in the 1985-1995 period and mixed pine-oak and oak-pine communities will be more emphasized. Planting will often be supplemental, just enough to achieve a mixed type. Regeneration efforts will be more often natural.

FOREST HEALTH

Background

In an ecological sense, all of the issues concerning the physical and biological resources of the national forests are about the health of the forest. All of the parts of the ecosystems are inter-related. The holistic concept of forest health; that is, inclusive of all aspects, is too broad to be addressed as a single topic. In this environmental impact statement, that level of information is obtained by reading all of the topics.

As a separate subtopic, however, this forest health discussion is focused on the smaller piece of ecological dynamics, especially on the probable trends of insect and disease organisms and non-native invasive plants. Traditionally, poor forest health has been identified with the death of trees due to a single insect or disease organism (called – in this context – a "pest"), or some interaction of two or more of them. The 'unhealthy' condition stemmed from the negative effects to human values, such as loss of wood product volume and value, a decrease in scenic quality, or an increase in fuel loading for wildfires. A less human-centered view recognizes that tree death through competition, insect attack, disease attack, wildfire, or weather-related events are all part of ecosystem dynamics. Our approach is that each of these are true and neither is the exclusive truth. We seek a balance of them. To the degree that we value intact, functioning ecosystems, the human-centered view and the purely ecological one overlap.

For this analysis, forest health is about the risk of tree death and a resultant elimination from, or reduction in, landscape representation of a species or vegetation community. Landscape representation reflects the resiliency of a community to recover from insect or disease attack and regenerate itself on sites to which it is well adapted. The focus of risk evaluation is on the most common tree species groups; the southern yellow pines and the oaks. This analysis also focuses on the most common and important pests; oak decline, gypsy moth, southern pine beetle, hemlock woolly adelgid, beech bark disease, non-native invasive plants, dogwood anthracnose, butternut canker, and littleleaf disease. The changes as a result of tree death are not considered in detail here. Rather, the effects to other resources are considered in those resource topics. For example, see the 'Forest Cover' topic for an analysis of forest succession trends.

<u>Common issue</u>
Forest health was identified as an issue common to each of the five Southern Appalachian Forests in revision.

There are three primary groups of strategies used to manage the health of forests:

- Prevention – Taking the initiative to reduce the risk of forest pest problem occurrence in a host vegetation community *before* the pest becomes a problem. Reduced risk is a result of improved resistance. Improved

resistance, in turn, comes from improving the growth conditions. Reducing plant competition usually creates improved growth conditions. Reducing the number of stems per unit area (density) reduces competition and thereby increases the growth resources available to remaining plants. Management tools to reduce stem density include silvicultural treatments such as thinning, fuels reduction treatments, and prescribed fire. Both the intensity of the treatments within treated areas and the amount of acreage treated will affect the effectiveness of this strategy. If too little is done, resistance is not increased. When minor acreages are treated, most of the host remains susceptible and epidemic pest outbreaks can originate from untreated land. Once an epidemic is underway, risk is increased for even treated communities.

- Conversion – Management strategy in which high risk stands are replaced with stands having lower risk of adverse pest activity. In the short term, conversion (like prevention) replaces a highly susceptible vegetative condition, such as an advanced age and low vigor host type, with a younger, more vigorously growing and less-susceptible condition. In the long term, conversion replaces the tree species most at risk with other species that are either not a host at all or not a preferred host for a specific pest. This approach may be a good choice were past land use history has resulted in a large increase of a host community type, especially if it is also vulnerable by growing in locations were it is stressed in some way.
- Sanitation/risk reduction – Management strategies developed to reduce the risk to pests of a stand that will be retained, not replaced, from an ongoing pest attack. The most commonly used techniques in this strategy are; (1) selective removal of individual trees at high risk or already disease infected or insect attacked, and (2) stem density reduction through a commercial thinning.

Of these three, prevention is the most powerful and most economically efficient strategy for pest management. Preventive actions take place in a non-crisis environment, allowing more time to make the best decisions. Preventive actions typically affect much less of stems present that an insect or disease attack would and are therefore less impacting to scenery. Where tree removal by commercial timber harvest is one of the tools, product values remain high, unlike the low salvage values of dead or dying trees.

There are three items that vary by alternative that relate to forest health. First is the acreage with a management direction that allows active management such that the risk can be reduced before a problem develops (prevention) or can be used to minimize it afterwards (suppression). Active management includes biological controls, chemical pesticides, timber harvest, silviculture treatments, fuels treatments, and prescribed fire. Second is the rate (acres per decade) at which stands with a very high or high risk are replaced by stands with a lower risk by management action; that is, the early-successional habitat objective for each management prescription. Third is the rate (acres per decade) at which the risk rating is reduced by management activities such as thinning. Of these, the ability to reduce the likelihood of a problem developing before it occurs is both the most powerful and

the most efficient economically and biologically. As Ben Franklin said, '*An ounce of prevention is worth a pound of cure.'*

Measure(s) of Response

Alternatives are compared for their ability to effectively meet the threat of the major pests: gypsy moth, oak decline, southern pine beetle, and hemlock woolly adelgid. Comparison data is sensitive both to the specific forest cover types that are host for a specific pest and to how these host types are distributed among management prescriptions. Comparisons show the proportions of existing host type within each of three forest health activity categories; (1) little or no forest health activity, (2) forest health activities generally limited to suppression after pests problems have begun, or (3) forest health activities include both a regular preventive treatment program to manage the risk and active suppression once a pest problem emerges. The category of little or no forest health management includes those lands without an early-successional wildlife habitat objective; that is, no push for active management of vegetation conditions. The 'suppression' category includes those acres with a zero to five percent early-successional habitat objective that are not considered for a sustained yield timber management program. The category of 'prevention and suppression' includes those acres with a sustained yield timber regime modeled, that is, a regular vegetation management program conducive to prevention activities.

These categories are not absolutes. For example, insect or disease suppression is possible even within Wilderness areas. However, the gulf between permitted and practiced is so wide that; especially for relative comparison purposes, an assumption that little or no activity will take place within the next ten to fifteen years is not unreasonable. Similarly, the 'suppression' category includes a limited opportunity for preventive actions but the acreage affected is expected to be minor overall. Finally, in the 'prevention and suppression' category there is variation among management prescriptions in the amount of preventive activity but the overall characterization is an appropriate one.

Each comparison table also includes an 'acre-weighted activity level' column. The values shown here are weighted averages of the forest health categories with acreage in each category being the weight. Each category was assigned a value as follows:

Little or no activity = 1
Suppression activity = 2
Prevention and suppression = 3

The ranking for each alternative was then calculated by multiplying the acres in each category times the category value, then summing the three results, and finally dividing by the total host type acreage. Within this approach, the highest possible value (and the alternative with the greatest ability to manage a pest problem) would be a "3" in the case where all acres of host type were in category three. The lowest possible value (and the alternative with the least ability to manage a pest problem) would be a "1" when all acres of host type were in category one. Arranged in ascending order from lowest to highest, these numbers thus rank alternatives in relation to the estimated ability to effectively deal with a forest health issue.

Note that this method of comparison does not say that category "3" means prevention and suppression activities will be 100 percent effective, only that it is more effective than doing less. Because of the high proportion of each Forest at or nearing physiological maturity, management activities are not likely to keep pace with an increasing vulnerability due to declining tree vigor.

Other forest health concerns are addressed in narrative form. In general, the ability to respond to major pests compares well with the ability to handle other pests as well.

Affected Environment

The Southern Appalachian Assessment identified particular forest health concerns for the entire 32 million acre assessment area. These were categorized as; tree declines, non-native diseases, insect pests, and non-native plants. The tree decline of significance and concern to the Chattahoochee NF was oak decline. Non-native diseases of significance were: dogwood anthracnose *(Discula destructiva* [causal fungus]*)*, beech bark disease *(Plethodon fourchensis* [scale insect] *Nectria coccinea* var. *faginata* and *Nectria galligena* [causal fungi]), butternut canker *(Sirococcus clavigignenti-juglandacearam* [causal fungus]*)*, Dutch elm disease *(Ophistoma ulmi* [causal fungus]*)*, and chestnut blight *(Cryphonectria parasitica* [causal fungus]*)*. Insect pests of concern to the Chattahoochee are southern pine beetle *(Dendroctonus frontalis),* hemlock woolly adelgid (*Adelges tsugae*), European gypsy moth *(Lymantria dispar)*, Asian gypsy moth (*Lymantria dipar),* and the Asian oak weevil (*Cyrtepistomus castaneus*). The southern pine beetle, a native insect, has been a recurrent challenge on an approximate seven to eight year cycle on the Chattahoochee but on a three to five year cycle on the Oconee. The European gypsy moth has begun to appear here in advance of its leading edge of spread. The hemlock woolly adelgid was discovered in 2002. There are numerous non-native plants of concern and the number of species and their populations within the forest are increasing.

Blue Ridge Mountains

Gypsy Moth (Gm)

There are two known varieties of gypsy moth; the European and Asian gypsy moth. However, only the European gypsy moth has become established in portions of the eastern United States and it poses the greatest threat to the Chattahoochee-Oconee National Forests. Its preferred host type is oak and the oaks as a group are the most common species on the Chattahoochee. On the Oconee, while not the most common species overall, the oaks are the most common hardwood species group. Both varieties are similar in appearance; however, the female of the Asian variety can fly whereas the female moth of the European variety is flightless. There have been accidental introductions of the Asian variety at several US ports. The Animal Plant Health Inspection Service (APHIS) eradication program in coordination with the state and other Federal agencies has been successful in eliminating these introductions. It is highly unlikely that the Asian variety would become established on the Chattahoochee-Oconee National Forest during the current planning period.

European Gypsy Moth

The European gypsy moth is a major defoliator of deciduous hardwood forests. It was first introduced from Europe into Massachusetts in 1869, and because the favored host, oak, is widespread in the eastern deciduous forests, it thrived and continues to expand its range west and south each year. By the 1980s, the gypsy moth was established throughout the Northeast (SAMAB, 1996). The generally infested, or quarantine area, extends from New England, south into Virginia, west to Ohio, and includes all of Michigan.

In response to concerns that the U.S. Department of Agriculture (USDA) was not adequately addressing the apparent increase in spread rates of the European gypsy moth over the past three decades (Liebhold and others 1992), the USDA Forest Service (FS) in cooperation with Animal and Plant Health Inspection Service (APHIS); the states of Michigan, West Virginia, Virginia, and North Carolina; and the National Park Service, embarked on a pilot project called "Slow the Spread" (STS). The STS goal is to determine the feasibility of reducing the rate at which gypsy moth is currently spreading, by comprehensively implementing integrated pest management strategies over large geographic areas in the transition zone. The transition zone is located between the infested and un-infested areas and currently includes portions of North Carolina and Virginia. As of this writing, evaluation of the STS project indicates that estimated spread rates significantly declined from an average of 26.5 km/yr prior to 1990 to 8.6 km/yr after 1990 (Sharov and Liebhold, 1998). STS has been integrated into USDA's national management strategy for gypsy moth.

As the infested area of gypsy moth expands, the frequency of accidental introductions of gypsy moth on the Southern Appalachian Area national forests will increase. Increasing recreational use of national forest lands may increase the number of accidental introductions of gypsy moth on Chattahoochee-Oconee NF. Accidental introductions of gypsy moth may lead to the use of insecticides to eliminate (or eradicate) and prevent the gypsy moth from becoming established on the Chattahoochee-Oconee National Forests. Although STS will delay permanent establishment, it will not stop spread and the Chattahoochee-Oconee National Forest will eventually become infested by gypsy moth and will be subjected to occasional outbreaks of this insect as populations increase regionally. Projections indicate that the Chattahoochee-Oconee National Forests will likely be entirely infested by 2020 (SAMAB, 1996). This projection is based on the historical unrestricted spread rate of 26.5km/yr and will be used for the purpose of this analysis. However, continued implementation of eradication actions to eliminate newly detected infestations and continuation of the STS project to slow the rate of spread from areas where it is established may delay occurrence of gypsy moth on the Chattahoochee-Oconee Forests. Based on a change from 26.5 km/yr to 8.6 km/yr, the Chattahoochee could escape until 2060. Defoliation may be extensive and severe when gypsy moth outbreaks do occur.

There have already been four accidental gypsy moth infestations on the Chattahoochee. The first was discovered near Helen in 1991 and treated in 1992 and 1993. The second was near Blue Ridge in Fannin County, discovered in 1994 and initially treated in 1995 then part of the area re-treated in 1996. The third was

near Blairsville in Union County in 1996. The fourth was along the North Carolina state line south of Highlands, NC on the Tallulah Ranger District. Eradication actions were successful in eliminating these "isolated infestations." Most likely these "isolated infestations" resulted from the movement of gypsy moth egg masses on campers, vehicles, building stone, furniture, or other items of inter-state commerce.

As part of the gypsy moth detection program, the Georgia Forestry Commission places a grid of gypsy moth traps across the state each year. Forest Service personnel are responsible for trap placement on National Forest lands. These traps contain a synthetic female gypsy moth sex pheromone that acts as an attractant to the male moths. If a trap contains one or more male gypsy moths, the trap grid is intensified the following year to delimit the area, estimate the population density, and plan the most appropriate treatment. It was this monitoring that detected the four previous infestations.

Southern Pine Beetle

Southern pine beetle (SPB) is a native insect pest of the Southern Appalachians (SA). It is also the most economically damaging forest insect pest in the Eastern United States. Losses due to SPB during an epidemic can total in the millions of dollars within a particular state or national forest. Southern pine beetle can utilize all pine species found within the SA as host material. However, five yellow pine types (shortleaf, loblolly, Virginia, pitch, and Table Mountain) and five mixed pine-hardwood types (shortleaf-oak, loblolly-hardwood, Virginia pine-oak, pitch pine-oak, and Table Mountain pine-hardwoods) are most susceptible to SPB. Historically eastern white pine was not considered a host type but during the most recent epidemic of 1999 through 2003 it also has been killed in significant numbers. The ten yellow pine or yellow pine-hardwood forest cover types make up approximately 22 percent of the total forested acres of the Chattahoochee. On the Oconee, 71 percent of the total forested acreage is in pine types. If white pine and white pine-hardwood communities are also included, the potentially affected land area of the Chattahoochee rises to approximately 32 percent of total forested acres. Attacks on the Table Mountain pine rare community (which is only 0.08 percent of all forested acres) are of particular concern both for the direct loss of the community and the loss of the needed seed source to restore it. Loss of nesting and foraging habitat for the endangered red cockaded woodpecker on the Oconee is another cause for concern. Periodic SPB outbreaks are common across the South and can range in severity depending on many environmental and stand conditions.

Southern pine beetle populations can rapidly expand to epidemic levels (one active SPB infestation per one thousand acres of host type) when the prevalent host type condition is stressed trees. Stresses can be environmental or man caused. The most common stressors are: (1) crowded, overstocked stands, (2) drought, (3) biological maturity (older stands), and (4) root disease such as littleleaf disease in shortleaf and loblolly pine or annosum root disease in thinned white pine stands in the mountains. Stresses due to crowding and over-stocking are not limited to trees of the same or even similar species. Overstocking and declining tree vigor can be managed to reduce the risk of catastrophic loss due to SPB. Managing stand density by thinning and prescribed burning can greatly reduce SPB hazard and subsequent

losses. This along with replacing the yellow pine host trees, such as by timber harvest, before they become very susceptible due to declining vigor with age can keep SPB losses to a minimum. As the age of southern pine trees increases, the threat of SPB attack also normally increases. Other environmental stressors such as drought, or storm damage are beyond our control but they are measurable and can be used as indicators to predict potential surges in SPB populations. Control measures when implemented quickly can curtail losses due to SPB, limiting impact in both the mountains and piedmont-costal plain forests.

There have been three SPB epidemics on the Chattahoochee NF since 1985. The first from 1986 through 1988 coincided with the last three years of a five-year drought. The second was in 1996 through 1997. There is currently a third that began in 1999 and continues today in 2003. Risk into the future continues to increase because of the large proportion of southern yellow pine cover in the 70 to 100 year age range present on the Forest that is continuing to age. On the Chattahoochee in 2000, approximately 53 percent of the SPB yellow pine host type was older than 70 years. On the Oconee, the 70-year old and older stands are approximately 20 percent of the susceptible types. Combinations of drought and mild winters worsen the situation; by stressing older trees and by allowing SPB populations to survive the winter in higher than normal numbers. Until recently, the white pine cover types had not been considered a southern pine beetle host type. In part this was because the primary tree defense is to produce a large quantity of resin that suffocates attacking beetles. White pine does produce abundant resin if injured, but recent experience has demonstrated that, once SPB are in epidemic status, white pine becomes a susceptible host type as well.

Southern pine beetle populations are monitored annually with traps in the spring for projections of current season activity or in late fall for estimate of the potential in the following year. In addition, a south-wide database is available for reporting SPB activity, planning control, and tracking control accomplishment.

Data on SPB host type is presented in the following tables. Unlike the ‘forest cover’ report, host type data are shown by ecological section rather than totaled for the forest. This is to highlight that potential effects are not uniform across the forest landscape, but rather some areas would be especially hard hit. Even within the ecological sections shown, there is considerable variation. For example, the west side of the Cohutta Mountains within the Blue Ridge ecological section has a greater proportion of yellow pine cover than does the Blue Ridge Mountain interior.

Table 3- 158. Southern Pine Beetle Susceptible Host Types On All Forested Acres of the Chattahoochee NF Exclusive of the Armuchee Ranger District.

Forest Cover Type Code and Name		Acres	Percent of NF in Section
White pine types			
03 – White pine		52,937	7.7
04 – White pine-hemlock		2,324	0.3
09 – White pine-cove hardwood		7,378	1.1
10 – White pine-upland hardwood		17,518	2.6
	Subtotal	80,157	11.7
Pine types			
31 - Loblolly		14,882	2.2
32 - Shortleaf		38,192	5.6
33 - Virginia		28,750	4.2
38 -Pitch		11,929	1.7
39 - Table Mountain pine		334	0.1
	Subtotal	94,087	13.8
Pine-oak			
12 - Shortleaf-oak		20,663	3
13 - Loblolly-hardwood		559	0.1
16 - Virginia pine-oak		12,966	1.9
15 - Pitch pine-oak		7,210	1.1
20 - Table Mountain pine-hardwood		280	<0.1
	Subtotal	41,678	6.1
	TOTAL	215,992	31.6

Source: CISC data in unfrozen database, September 21, 1995 as reported in the July 1996 Analysis of the Management Situation (AMS).

Table 3- 159. Area of Southern Pine Beetle Susceptible Host Type of the Armuchee Ranger District of the Chattahoochee NF Within the Southern Ridge and Valley Ecological Section.

Forest Cover Type Code and Name		Acres	of NF in Section
Pine types			
31 - Loblolly		10,247	17
32 - Shortleaf		2,420	4
33 - Virginia		5,658	9
38 - Pitch		24	<0.1
	Subtotal	18,349	30
Pine-oak types			
12 - Shortleaf pine-oak		5,824	10
13 - Loblolly-hardwood		1,855	3
15 - Pitch pine-oak		242	0.4
16 - Virginia pine-oak		7,009	11
	Subtotal	14,930	24.4
	TOTAL	33,279	54.4

Source: unfrozen CISC data, September 1995 as reported in the July 1996 Analysis of the Management Situation (AMS).

Table 3- 160. Area of Southern Pine Beetle Susceptible Host Types on the Oconee NF Within the Southern Appalachian Piedmont Ecological Section.

Forest Cover Types Code and Name		Acres	of NF in
Pine types			
22 - Slash		23	<0.1
31 - Loblolly		75,594	69
32 - Shortleaf		2,109	2
33 - Virginia		10	<0.1
	Subtotal	77,734	71
Pine-hardwood types			
12 - Shortleaf pine-oak		135	0.1
13 - Loblolly pine-hardwood		1,230	1
	Subtotal	1,365	1
	TOTAL	79,099	72

Source: unfrozen CISC data September, 1995 as reported in the July 1996 Analysis of the Management Situation (AMS).

Table 3- 161. Area of Southern Pine Beetle Susceptible Host Types on the Chattahoochee NF Within the Southern Appalachian Piedmont Ecological Section Portion of the Chattooga Ranger District.

Forest Cover Types Code and Name		Acres	Percent of NF in
Pine types			
31 - Loblolly		8,719	18.9
32 - Shortleaf		11,136	24.2
33 - Virginia		724	1.6
38 – Pitch pine		203	4.4
39 – Table Mountain pine		70	0.2
	Subtotal	20,852	49.3
Pine-hardwood types			
12 - Shortleaf pine-oak		5,656	12.3
13 - Loblolly pine-hardwood		254	0.6
16 – Virginia pine-oak		39	<0.1
	Subtotal	5,949	12.9
	TOTAL	26,801	62.2

Source: unfrozen CISC data September, 1995 as reported in the July 1996 Analysis of the Management Situation (AMS).

Yellow pine tree mortality in the 1999-to-present epidemic has been severe. Very little control activity has taken place. As described in Appendix B, between the DEIS and FEIS we derived an estimate of pine mortality as being 10 percent in all locations except the Piedmont portion of the Chattooga RD where it was 50 percent. Most of the beetle-killed stands will be unable to regenerate themselves with new southern yellow pine seedlings for the reasons detailed in the 'forest cover' report. Rather they will shift toward hardwood or hardwood-pine types unless management actions

intervene to regenerate the pine through silviculture treatments including site preparation, planting, and release from competition.

Hemlock Woolly Adelgid (HWA)

The hemlock woolly adelgid (HWA) was introduced into the eastern United States from Asia in the early 1950's near Richmond, VA. The adelgid was present on some non-native tree species that a private collector planted in his arboretum. The distribution of the HWA remained localized until the 1960's. The population has since spread throughout the Shenandoah Valley into the Blue Ridge Mountains of Virginia into North Carolina and north onto the Northeastern United States. Currently much of the hemlock resource within the George Washington/Jefferson National Forest is infested by HWA. Significant mortality is occurring and will continue. In 2002, the adelgid was confirmed on the South Carolina side of the Chattooga River, then on the Georgia side as well. The HWA has now almost spread to the southern limits of the hemlock range that generally coincides with the ecological Domain, Division, Province, and Section boundary at the foot of the Blue Ridge Mountains. .

In Georgia, hemlock is primarily a Blue Ridge Mountains species where it is widespread in distribution and frequent in occurrence, but rarely the dominant species. It generally makes up less than 30 percent of the canopy cover within the communities where it occurs. The oldest and largest trees are strongly associated with riparian areas, probably due mostly to historic burning because it is easily killed by fire in the seedling, sapling, and even pole timber size classes. It increases in frequency with elevation. In the past sixty years with fire suppression, it has begun moving upslope from the streams, and now occurs as an understory or midstory tree in upland stands. It also does extend out into the Piedmont, along with white pine, in sheltered gorges along streams such as the Tallulah River and Panther Creek.

The impacts to the host species of eastern hemlock (*Tsuga Canadensis)* and Carolina hemlock (*Tsuga caroliniana*,) are severe. Once infested, tree mortality usually occurs in less than 7 years. Mortality is not restricted to one life stage of the hemlock; all life stages are vulnerable. This insect pest not only threatens the hemlock resource but also threatens the unique ecosystem it helps comprise.

Eastern hemlock is an ecologically important tree species and in many cases irreplaceable. A number of wildlife species benefit from the environment that exists in hemlock stands including birds, fish, invertebrates, amphibians, reptiles and mammals. Although most wildlife species are not completely limited to hemlock for their habitat requirements, many wildlife species will select hemlock trees and forests for food, shelter or breeding purposes. The dense year-round shade underneath the evergreen hemlocks also helps maintain cooler water temperatures in many streams allowing some aquatic species to exist there that would not otherwise. Aesthetically hemlock is a beautiful tree in form, foliage texture, color, and even smell. In fall its color contrast with the vivid yellows, reds, and oranges of hardwoods emphasizes their brilliance. And a snow-covered hemlock has no counterpart for winter beauty. Hemlock is strongly associated with the most desirable recreation setting in the Blue Ridge, the riparian area along mountain streams. Favored recreation activities include trout fishing, hiking, and camping.

The adelgid is spread in numerous ways but mostly by wind and birds. Biological control is the most promising prospect for control of HWA. Research to date has not located any native predators capable of limiting HWA impact. Currently, a 'ladybird' beetle from the native range of HWA is being grown and released as a potential predator of the adelgid. This work looks promising, but it is too soon to tell if it will be a complete answer. In previous attempts the beetle apparently died out before the HWA was eradicated. As of 2002, there is a proposal for rearing ladybird beetles at Clemson University in South Carolina for release in Georgia and South Carolina. Cooperative efforts will continue among the three branches of the Forest Service and with State agencies, universities, non-governmental organizations, and volunteers to monitor HWA status and trends, develop effective control efforts, and – in the worst case – plan for genetic conservation of the species for future restoration.

Control of the HWA on individual trees in the urban landscape can be accomplished using a number of insecticides including horticultural oils and insecticidal soaps, providing there is access to the trees for spraying equipment needed to saturate the entire crown. This option might be possible for selected high-use areas on the National Forest but is not a viable choice for general forest. At present, there are no insecticide treatment options available for controlling HWA in the forest environment.

Table 3- 162. Hemlock Woolly Adelgid Host Acreage on All Forested Acres and All Forested Acres of the Blue Ridge Mountains of the Chattahoochee National Forest.

Forest Cover Type Code and Name	Acres	Chatt.	Percent of Blue Ridge
04 - White pine-hemlock	1,564	0.2	0.2
05 - Hemlock	262	0.03	0.04
08 - Hemlock-hardwood	1,512	0.2	0.2
09 - Cove hardwood-white pine-hemlock	19,398	2.6	3.0
TOTAL	22,736	3.03	3.4

Source: Report from GIS stands data layer October 2002.

Oak Decline

Oak decline is a natural ecological dynamic of oak communities that has been reported since the mid-1800's. In forest pathology terms, it is a complex that involves the interaction of environmental stresses such as drought, root disease, insect pests of opportunity, and physiologically mature trees. Symptoms are slow, progressive dieback of overstory trees from the top downward and from the outside inward. It results from disturbance to carbohydrate physiology and water relations; that is, the movement of water within the roots, bole, and crown. Susceptible trees die within a few years from the time when dieback exceeds one-third of the crown volume. Species in the red oak group are most susceptible, particularly black and scarlet oaks. Hickories are the only non-oak species commonly observed with symptoms in decline areas. (SAMAB, 1996; Rpt 5 of 5, p. 104.)

Oak decline is a serious forest health concern on upland hardwood forests in Southern Appalachian national forests. The seriousness of the threat is not uniform everywhere. There is lower concern on Piedmont and Coastal Plain locations. Factors that contribute to lower concern on piedmont and coastal ranger districts of the

Sumter, Oconee, and National Forest's in Alabama are an emphasis on pine management on less productive sites, younger age class distribution of all forest types due to more recent disturbance history, and overall higher site quality of stands supporting manageable hardwood stands.

Stand and site factors that determine oak decline risk in the Southern Appalachians include forest type (primarily oak density), site productivity (site index), age, and stress factors such as spring defoliation, drought, or combinations of these stresses. The highest risk scenario includes stands with a large oak component (especially red oak) of advanced age, growing on sites of average or lower productivity, having suffered recent stress such as defoliation(s) or prolonged growing season drought. The Chattahoochee in particular has substantial acreage meeting all of these risk factors. Black oak, scarlet oak, and southern red oak – each in the red oak group – are common species. More than 50 percent of the forested acres had tree cover more than 80 years old in 2000. Almost two-thirds (65 percent) of the existing forest cover acreage in 2000 was growing on sites of low productivity for those species and another 20 percent of acreage was on average productivity sites. Moderate droughts spanning several growing seasons occur about every ten years and severe droughts occur approximately every twenty to thirty years. And a moderate drought year at landscape scale is actually a severe drought on drought-prone sites. Risk may be reduced by reducing stand age by regeneration, altering species composition through thinning focused on reducing or eliminating the red oak component, or preventing controllable stress factors (treating spring defoliating insects with insecticides is the only feasible option but is often not economically justifiable).

Of particular concern with oak decline is that oaks killed by it do not re-sprout. Sprout regeneration is normally the primary and most reliable means of regenerating the oaks. The loss of this regeneration source and a simultaneous loss of acorn production for new seedlings are serious challenges to perpetuating red oak or mixed red and white oak communities. Hard mast supplies for wildlife food are affected because white oak acorns mature in one year and red oak acorns in two years. This variation helps to buffer against mast failures in any one season.

The SAA identified as ‘host type’ any stand with a plurality of oak stocking and as ‘vulnerable’ those stands of host type which had reached pole or sawtimber size with at least 30 square feet of oak basal area per acre. Table 3- 163 below identifies forest cover types (from the ‘Forest Cover’ report of the AMS), which would be expected to meet the ‘host type’ criteria based on the definition of that forest cover type in the June, 1992 Forest Service Region 8 Silvicultural Examination and Prescription Field Book.

Table 3- 163. Forest Cover Types Estimated To Be Oak Decline Host Type On All Forested Lands Of The Chattahoochee National Forest Exclusive Of The Armuchee Ranger District.

Forest Cover Type Code & Name	Acres	Percent of NF
42 - Upland hardwood-white pine	24,519	3.6
44 - Southern red oak-yellow pine*	4,813	0.7
45 - Chestnut oak-scarlet oak-yellow pine*	24,361	3.6
47 - White oak-black oak-yellow pine*	10,995	1.6
48 – Northern red oak-hickory-yellow pine	4,111	0.6
51 - Post oak-black oak*	322	0.05
52 – Chestnut Oak*	15,976	2.3
53 - White oak-northern red oak-hickory	226,072	33.0
54 – White oak	1,750	0.3
55 - Northern red oak	65	0.01
59 - Scarlet oak*	7,749	1.1
60 - Chestnut oak-scarlet oak*	15,902	2.3
Totals	336,635	49.16

Source: CISC data as reported in the 'Forest Cover' report of the 7/96 Draft AMS

Of the estimated host types, those communities identified with an asterisk (*) in Table 3- 163 are expected to be at very high risk because of being on low productivity, dry sites susceptible to drought and having a major red oak component. Together, these communities amount to about 12 percent of the Forest's forested area. In addition, an estimated 20 percent of type 53 would also be on droughty, low-fertility sites; adding another 7 percent of high risk for a total of about 19 percent. Forest cover types occurring on the driest sites, for example scarlet oak, and chestnut oak-scarlet oak are in old growth community type 22. A relatively high proportion of those stands are at or near the minimum old growth age; that is, they have another risk factor in effect. *(See the 'Old Growth' topic of this EIS for details.)* Throughout the host types identified, oak decline risk is estimated to be at least moderate. Oak decline on the driest sites could be used as an opportunity because these areas are most appropriate for oak woodland restoration efforts.

When the data presented in Table 3- 163 is further refined to remove seedling and sapling acreages, about 46 percent of all forested acres of the Chattahoochee within the Blue Ridge Mountains are estimated to be vulnerable to oak decline. Within the entire SAA area, 53 percent of National Forest was rated as vulnerable (SAMAB,1996). In the Blue Ridge portion of the Chattahoochee at least 8 percent of forested land area is expected to be highly vulnerable due to the combination of adverse site and proportion of the more-susceptible red oak. The SAA identified that about 19 percent of National Forest in the assessment area is already damaged by oak decline and a nearly identical percentage is not damaged, but is vulnerable. (SAMAB, 1996). FHP Staff has since identified that 22.9 percent of total forested acres on the Chattahoochee is damaged by decline.

Table 3- 164. Acres of Oak Decline Host Type On the Armuchee Ranger District of the Chattahoochee NF within the Southern Ridge and Valley Ecological Section

Forest Cover Type Code and Name	Acres	Percent of NF in Section
45 - Chestnut oak-scarlet oak-yellow pine*	7,969	13
47 - White oak-black oak-yellow pine*	821	1
48 - Northern red oak-hickory-yellow pine*	680	1
51 - Post oak-black oak*	59	0.1
53 - White oak-northern red oak-hickory*	10,284	17
59 - Scarlet oak*	98	0.2
60 - Chestnut oak-scarlet oak*	219	0.4
TOTALS	20,130	32.7

Source: unfrozen CISC data, September, 1995 as reported in the 7/96 Draft AMS.

Due to ecological differences, all of the oak forest types in the Southern Ridge and Valley are at moderate or higher risk to oak decline. All oak types include a significant red oak component and soils are typically infertile and drought-prone. In addition, the average annual rainfall is at its lowest on the entire Chattahoochee here, being about 55 inches. Approximately 25 percent of the total forested acreage is expected to be particularly at risk because of being on drought-prone sites and having a major red oak component. The potential exists for the complete loss of communities at high risk that also occur on few acres; such as post oak–black oak, scarlet oak, and chestnut oak-scarlet oak.

Table 3- 165. Acres of Oak Decline Host Type On the Oconee NF within the Southern Appalachian Piedmont Ecological Section

Forest Cover Type Code and Name	Acres	Percent of NF in Section
44 - Southern red oak-yellow pine*	174	<1
47 - White oak-black oak-yellow pine*	899	1
48 - Northern red oak-hickory-yellow pine	482	<1
53 - White oak-northern red oak-hickory	14,009	13
55 - White oak	31	<1
56 – Yellow poplar-white oak-N. red oak	3,078	3
TOTALS	18,673	16

Source: unfrozen CISC data, September, 1995 as reported in the 7/96 Draft AMS.

Oak decline had not been inventoried on the Oconee on FIA plots as of 1989. This is probably because of the generally higher soil productivity and younger ages. For example, there is less acreage of very dry site conditions such as occur on the Armuchee Ranger District. Those types with an asterisk (*) in Table 3- 165 are those expected to be are drought-prone soils and also a lower productivity. They are only about 1 percent of the Oconee. However, the overall lower proportion of oak cover and the very low acreage of some oak and mixed oak-pine types increases the potential for future adverse effects. Because oak decline killed trees do not re-sprout, maintaining these types is more difficult.

Beech Bark Disease

Beech bark disease is a complex of the beech scale, a non-native insect, and at least two different fungal pathogens of the inner bark. One of these pathogens is native and the other is non-native. Together, these can kill American beech. Without the scale insect to provide entrance wounds through the bark, the fungal pathogens do not cause disease. There is a slight amount of resistance in the population of American beech to the scale insect, but it is not known how or whether this resistance can be practically exploited. Therefore, wherever American beech grows in the Southern Appalachians and upper Piedmont, it should be considered susceptible to mortality from beech bark disease. However, disease impact will vary substantially depending on the density of beech in forest landscapes.

On the Chattahoochee and Oconee, beech occurs as scattered individual trees. Although generally considered a 'northern hardwood,' beech is rather common in the Piedmont as well. Fire-intolerant because of its thin bark, large beech trees occur (like hemlock) generally in close association with streams; in locations where fire intensities have been lowest. On the Chattahoochee, it is likely to occur as scattered individuals within the hemlock-hardwood, white pine-cove hardwood, and cove hardwood-white pine-hemlock cover types. Together, these types occur on 27,733 acres or 4 percent of all forested acres. Neither the Chattahoochee nor the Oconee has any forest cover types mapped that include beech as a significant enough component in terms of percent of canopy cover to include it as a diagnostic species.

Littleleaf Disease

Littleleaf disease is a root disease of shortleaf and loblolly pines. It occurs mainly in the Piedmont when these species are growing on eroded clay soils with poor internal drainage. These soils promote the development and spread of a fungal pathogen of feeder roots. Shortleaf pine on high hazard sites begins to show symptoms around age 20 to 30 years, while symptoms on loblolly develop about 10 years later. Hardwoods in the current forest are not affected.

Littleleaf disease is closely tied to past land use. Agricultural use followed by land abandonment and subsequent erosion during the 19th and early 20th century resulted in concentrations of littleleaf disease in the southeastern Piedmont of Virginia, North Carolina, South Carolina, Georgia, and Alabama, with smaller areas of scattered disease in southeastern Tennessee and Kentucky. In Georgia, geographic areas of concern, in estimated order of acres affected, are: (1) the Oconee National Forest, (2) the Piedmont portion of the Chattooga Ranger District, and (3) the Armuchee Ranger District. In particular Jones County, on the southern end of the Oconee, is a high risk location for littleleaf. Both the Piedmont Wildlife Refuge of the US Fish and Wildlife Service and the Hitchiti Experimental Forest of the Forest Service are in Jones County. These two areas are also where existing populations of the federally-listed endangered species the red-cockaded woodpecker occur. Pine trees on the Hitchiti are of an older average age than elsewhere on the Oconee, and southern pine beetle attacks are common there as well.

Non-Native Invasive Plant Species (NIS)

There are a large number of NIS plants affecting forest health, primarily by replacing native species and reducing native plant biodiversity with ancillary effects on wildlife habitat. The Regional Forester maintains a list of these species. The complete 2001 list is reproduced below for Georgia. Inclusion of a species on the list is not a certification that it is known to occur in the State or on National Forest lands. Rather, one of its functions is to alert Forest Service personnel to stay informed about, and to be on the lookout for, these species as being likely to be introduced.

These 'weed' species are divided into two categories; numbered "1" and "2" in Table 3- 166 and Table 3- 167. The explanation of these two categories follows.

Category 1 Species

These are non-native plant species that are known to be invasive and persistent throughout all or most of their range within the Southern Region. They can spread into and persist in native plant communities and displace native plant species and therefore pose a demonstrable threat to the integrity of the natural plant communities in the Region. The use of Category 1 Species for the purposes of re-vegetating or rehabilitating sites is prohibited on National Forest System Lands. Cooperators and Partners may not establish or encourage Category 1 Species for any reason in projects that receive Forest Service funding except in the furtherance of projects, Memorandums Of Understanding (MOU), and Memorandums Of Agreement (MOA) that were already in effect on the date of issuance of the Regional Exotic Invasive Plant Species List, or as required for scientific studies designed to further knowledge about invasive species. Efforts to control Category 1 Species are encouraged where practicable. Proposals for non-native invasive plant species control will receive the highest funding priority when they include Category 1 Species, particularly where native plant communities are threatened.

Category 2 Species

These are non-native plant species that are suspected to be invasive or are known to be invasive in limited areas of the Southern Region. Category 2 Species will typically persist in the environment for long periods once established, and may become invasive under favorable conditions. Plant species in Category 2 pose a significant risk to the integrity of natural plant communities throughout the Region or in parts of the Region. The establishment or encouragement of Category 2 Species is prohibited in areas where ecological conditions would favor invasiveness and is discouraged elsewhere. Projects that use Category 2 Species should document why no other (non-invasive non-native or native) species will serve the purpose and need. Cooperators and Partners are also discouraged from using Category 2 Species. The Forest botanist, plant ecologist, or Forest noxious weed coordinator (or Regional specialists) should be consulted for alternative native or non-invasive non-native species that would serve the purpose and need of the project. Control efforts for Category 2 Species may or may not be necessary to achieve the management objectives of the planning area.

Table 3- 166. Category 1 Nonnative Invasive Plants Of Georgia As Of 2001

Scientific Name	Common Name
Ailanthus altissima	Tree of heaven
Albizia julibrissin	Silktree
Alliaria petiolata	Garlic mustard
Berberis thunbergii	Japanese barberry
Cinnamomum camphora	Camphortree
Dioscorea batatas (=D. oppositifolia)	Air potatoe
Eichhornia crassipes	Common water hyacinth
Elaeagnus umbellata	Autumn olive
Hydrilla verticillata	Waterthyme
Imperata cylindrica (including I. brasiliensis)	Cogongrass
Lespedeza cuneata	Sericea lespedeza
Ligustrum japonicum	Japanese privet
Ligustrum lucidum	Glossy privet
Ligustrum sinense	Chinese privet
Ligustrum vulgare	European privet
Lolium arundinaceum (=Festuca elatior var. arundinacea)	Tall fescue
Lonicera fragrantissima	Sweet breath of spring
Lonicera japonica	Japanese honeysuckle
Lonicera maackii	Amur honeysuckle
Lygodium japonicum	Japanese climbing fern
Lythrum salicaria	Purple loosestrife
Microstegium vimineum	Japanese stiltgrass
Panicum repens	Torpedo grass
Polygonum cuspidatum	Japanese knotweed
Pueraria montana	Kudzu
Rosa multiflora	Multiflora rose
Salvinia molesta	Kariba-weed
Sapium sebiferum	Tallowtree
Solanum viarum	Tropical soda apple
Sorghum halepense	Johnsongrass
Verbena brasiliensis	Brazilian vervain

Table 3- 167. Category 2 Nonnative Invasive Plants Of Georgia As Of 2001

Scientific Name	Common Name
Allium vineale	Wild garlic
Alternanthera philoxeroides	Alligatorweed
Ampelopsis brevipedunculata	Amur peppervine
Arthraxon hispidus	Small carpgrass
Bromus inermis	Smooth brome
Carduus nutans	Nodding plumeless thistle
Cirsium arvense	Canadian thistle
Cirsium vulgare	Bull thistle
Coronilla varia	Purple crownvetch
Egeria densa	Brazilian waterweed
Elaeagnus pungens	Thorny olive
Eragrostis curvula	Weeping lovegrass
Hedera helix	English ivy
Kummerowia striata (=Lespedeza striata)	Japanese clover
Macfadyena unguis-cati	Catclaw vine
Melia azedarach	Chinaberry tree
Miscanthus sinensis	Plume grass
Myriophyllum spicatum	Spike watermilfoil
Nandina domestica	Sacred bamboo
Pistia stratiotes	Water lettuce
Polygonum caespitosum	Asiatic smartweed
Spiraea japonica	Japansese meadowsweet
Wisteria floribunda	Japanese wisteria
Wisteria sinensis	Chinese wisteria

Primary Sources include PLANTS (*www.plants.usgs.gov*), Plant Conservation Alliance, and USGS BRD.

Storm Damage

Storm damage to trees; whether from tornadoes, hurricanes, straight-line winds, microbursts, or snow or ice loading with or without wind, is similar. Two or more of these events occurring together result in greater damage. For example, the 'storm of the century' in March of 1993 combined unusually heavy snow loads with high winds. Torrential rains accompanying hurricanes, when coupled with strong winds, can uproot trees because trees are more susceptible to wind-throw when soils are saturated. Hurricane Opal caused significant damage, especially to hardwoods on portions of the Chattahoochee. The storm occurred in early October 1995, and the fully-leafed hardwoods were vulnerable to the combination of saturated soil and high wind. Storm stresses cause hardwoods and pines to break off, split, be root sprung, bend and suffer branch and foliage losses in much the same manner within each of these two groups because the stresses appear to be much the same regardless of storm type. Tree crown configuration; age (old, large trees suffer greater damage); size and limberness of stems; branching habit; lean of bole; anchorage based on rooting characteristics and soil; and the presence of root and stem diseases have as much or more to do with tree damage as the intensity of the storm itself.

Damaging storms produce other challenges in their wake. Roads and streams are clogged with debris. Visitor use areas may become unsafe and/or unsightly. Buildings may be damaged or destroyed. The amount of fuel available to future fires is greatly increased. Damaged trees are often a breeding ground for subsequent insect or disease problems. However, they are also a natural ecosystem dynamic that can

result in forest community regeneration and diversity of both terrestrial and aquatic wildlife habitat.

Elevation can be important in the case of ice and snow damage. Frequently, a variation of 1 or 2 degrees in air temperature can result in bands of varying damage on the same hillside at different elevations, depending on the temperatures there at the time of precipitation.

Damage-producing storms appear to have increased in frequency; or, perhaps more probable, forests are becoming more susceptible to damage-producing storms with age. Major damage has occurred about every four years on the Daniel Boone National Forest of Kentucky and on Appalachian Mountain Forests since the 1980s. Areas affected ranged in size from 100 to 17,000 acres. For example; there was a 2,000-acre blow-down on the Oconee NF in November 1992, a different blow-down on the former Chestatee RD also in November 1992, a blizzard throughout north Georgia in March 1993 that took down both stands and trees within stands, and another blow-down in March 1994. Lipps (1966) on the Marshall Forest near Rome, Georgia documented severe ice storms in 1902, 1908, 1932, 1935, and 1960; also blow-downs in 1908, 1913, 1921, 1932, 1948, and 1955. She indicated a 30-year periodicity for severe ice storms. The March 1993 blizzard was 33 years after her last recorded one. Yet another ice storm occurred in 1998 with the Armuchee RD particularly hard hit and within the Armuchee, loblolly pine forest cover most severely affected.

It is probable that the frequency and severity of ice storms is related to the position of the Chattahoochee along the climate division boundary. Warm, moist Gulf air masses rise approximately 1600 feet off the ocean to the base of the Blue Ridge, then are confronted with an abrupt 1000 foot or more rise. As air rises it cools and , if it reaches the dew point, moisture condenses. Rain falling on surfaces already at or below freezing produces the ice of ice storms.

On the Chattahoochee at the northern edge of their ranges, both loblolly and longleaf pines are especially susceptible to ice and snow damage. Residual longleaf pine throughout the Armuchee Ranger District typically shows evidence of crown breakage, most likely the result of ice storms. Longleaf is especially vulnerable to ice damage because its very long needles can hold large amounts of freezing rain. Virginia pine is also prone to wind-throw if stand density is reduced so much that adjacent trees do not support each other. Ice pruning of hardwood crowns also occurs in localized areas at the higher elevations.

Dogwood Anthracnose

Dogwood anthracnose is a fungus-caused disease. It is believed to be an Asian species. Infection begins as leaf spots that may spread to kill the entire leaf. It also causes stem and trunk cankers. Stem cankers are capable of killing trees but larger ones may be killed by repeated defoliation after 2 or 3 years. Dogwood anthracnose was first confirmed in Georgia in 1987 in the Cohutta Mountains and since then has spread throughout the National Forests. So far, native populations of dogwood seem to be universally susceptible to infection, but there appears to be a degree of natural resistance by individual trees. Because of the biology of the pathogen, conditions in

the environment are major factors in the spread of the disease. Dampness on the leaves is a major factor increasing infection frequency and severity. Good air circulation and strong sunlight, each of which speed drying, help to reduce infection. For this reason, dogwood on sunny south or west-facing slopes or growing underneath trees that do not cast a dense shade, such as pines, are more likely to escape infection, or even survive if infected.

Dogwood is a 'generalist' species that occurs on almost all sites in association with most forest cover types. It is most frequent in the Blue Ridge and Southern Ridge and Valley within the dry-mesic oak forest cover type group on moderately productive sites. It also occurs with less frequency on all other sites. *(See the 'Forest Cover' topic of this EIS for details of dogwood occurrence.)* On drier sites, it is associated with the yellow pines and oak species such as scarlet oak and chestnut oak. In these locations, conditions are not as conducive to the disease. On the more moist sites, dogwood is associated with yellow poplar, northern red oak, buckeye, and other 'mixed mesophytic' species. In these situations, it is most susceptible to anthracnose because of the cool, moist conditions. In the Piedmont, dogwood is a common understory species in both upland hardwood and loblolly pine stands. Here light and temperature regimes are higher than on the sheltered slopes of the mountains, but not sufficiently so to completely protect dogwoods.

While anthracnose is unsightly and somewhat destructive to dogwoods growing at lower elevations, it is commonly fatal to those infected trees growing on north facing slopes above 3,000 ft elevation. Since the disease has been in Georgia fifteen years already, it is probable that the most susceptible trees within the most susceptible sites have already been affected and killed. Weather conditions may result in seasonally higher levels of activity in the future. No control for dogwood anthracnose exists for forest environments. Maintaining an open canopy by thinning in stands with dogwood would help.

Butternut Canker

This disease, caused by a fungus, was also probably introduced as early as the mid-1960s. There may be some resistance to the disease in some individuals. This is still being tested. But most are susceptible. The butternut population is currently very sparse due in part to the disease, but also to its own natural distribution prior to the introduction of this disease. No environmental conditions appear to protect from the disease or to slow its progress.

All known butternut on and near National Forest in Georgia has been mapped and cataloged as part of the research effort to save the species. It occurs most frequently in riparian areas, usually within sixty feet or less from a stream, on deep alluvial soils, especially those containing some sand. So far, seedlings have not become available from Forest Service seed collections to begin out-planting for restoration. Commercial nurseries sell butternuts both as a fruit tree and as an ornamental. There is currently very limited potential to use butternut in recreation or wildlife projects to increase its numbers and improve its distribution on the Forests. If resistant seedlings were available, it would be a valuable species in mixture with others in restoration of riparian area hardwood communities.

Direct And Indirect Effects

Gypsy Moth

As the area infested by gypsy moth expands, the frequency of accidental introductions of gypsy moth on the Chattahoochee National Forest will increase. Activities that increase travel between the infested area and the Chattahoochee, such as commerce or tourism, can be expected to increase the number of accidental introductions of gypsy moth onto National Forest. Accidental introductions of gypsy moth may lead to the use of insecticides to locally eradicate the gypsy moth and prevent it from becoming established on the Forest. Used this way, eradication is a delaying tactic; part of an overall 'slow the spread' (STS) strategy, for not allowing accidental introductions of gypsy moth to become established on the Forest ahead of natural expansion of the range. However, over time, the Chattahoochee will become infested by gypsy moth and will be subjected to occasional outbreaks of this insect as populations increase regionally. Defoliation may be extensive and severe when gypsy moth outbreaks do occur. In Table 3- 168, the distribution of gypsy moth host type acreage by each of the three forest health activity categories and for each alternative is shown for each of the Chattahoochee and Oconee National Forests.

Gypsy moth outbreaks are not likely to be aggressively suppressed Forestwide unless there is strong public support for suppression activities to manage defoliating populations. The economic cost and concern for environmental impacts of widespread use of current treatment tactics, primarily the aerial application of insecticides, would probably result in only a very small amount of the Forest receiving such management actions. Generally, gypsy moth outbreaks on most National Forest will not be managed actively and population outbreaks may be brought to an end through the action of natural control agents (primarily by disease epidemics caused by fungal and viral pathogens). However, where high value resources, such as developed recreation areas, are threatened with defoliation and damage, treatment with insecticides may be considered to manage gypsy moth populations and limit damage. The impacts associated with such treatments are well documented in the *Final Environmental Impact Statement (FEIS) for Gypsy Moth Management in the United States: A cooperative Approach*. This document and the associated Record of Decision (ROD) analyzes the impacts of various aerially applied insecticides on control of the gypsy moth, impacts to non-target organisms, as well as impacts to human health.

The FEIS and ROD indicate that the use of eradication, slow the spread, and suppression treatments fully meet the USDA goal of reducing the adverse effects of the gypsy moth, addresses the major issues associated with gypsy moth and their treatment, and provides the greatest amount of flexibility in managing ecosystems affected by the gypsy moth. Means to avoid or minimize adverse non-target impacts due to gypsy moth treatment are discussed in Chapter 2 of the FEIS and have been adopted. The findings from this FEIS are hereby incorporated by reference. It should be noted that suppression treatments targeted at the pest organism itself do not lessen the risk associated with a vegetative condition; that is, they are not preventive. They merely control the pest during a single epidemic cycle. Risk conditions remain the same or worsen before another outbreak. As has been learned

with wildfires, the cumulative risk continues to rise and the probability of greater impacts also rises.

Table 3- 168. Distribution of Gypsy Moth Host Type Among Estimated Forest Health Activity Levels by Alternative and Forest

Forest	Alt.	Measure	Estimated Forest Health Activity Level			Total Host Type	Acres-weighted activity level
			1 Little/no	2 suppress	3 prevent & suppress		
Chatt.	A	acres	128,143	134,016	259,074	521,233	2.25
		percent	25	26	50		
	B	acres	137,619	57,757	325,857	521,233	2.36
		percent	26	11	63		
	D	acres	143,180	55,770	322,283	521,233	2.34
		percent	27	11	62		
	E	acres	190,074	246,750	84,409	521,233	1.80
		percent	36	47	16		
	F	acres	118,813	48,246	354,173	521,233	2.45
		percent	23	9	68		
	G	acres	274,923	155,097	91,213	521,233	1.65
		percent	53	30	17		
	I	acres	143,652	144,599	232,073	520,324	2.17
		percent	28	28	44		
Oconee	A	acres	2,317	2,594	18,461	23,372	2.69
		percent	10	11	79		
	B	acres	1,934	3,538	17,900	23,372	2.68
		percent	8	15	77		
	D	acres	3,317	1,684	18,371	23,372	2.64
		percent	14	7	79		
	E	acres	2,428	4,152	16,792	23,372	2.61
		percent	10	18	72		
	F	acres	2,331	1,646	19,395	23,372	2.73
		percent	10	7	83		
	G	acres	3,506	3,108	16,758	23,372	2.57
		percent	15	13	72		
	I	acres	3,747	3,143	16,470	23,360	2.54
		percent	16	13	70		

Source: GIS stands data layer November 2002 for Alts. A thru G and August 2003 for Alt I.

Gypsy moth impacts will be most significant for stands in the oak and mixed oak-pine forest types (oaks are a favored host species and a primary indicator of the susceptibility of a stand to gypsy moth defoliation). Gypsy moth outbreaks may tend to be more frequent and the damage more severe in oak stands already affected by oak decline or on parts of the Forest where average rainfall is lowest. The lowest average annual rainfall on the Chattahoochee occurs on the Armuchee Ranger District near Dalton, Georgia and on the northwestern 'corner' of the Cohutta Ranger District, near Tennga, Georgia. In these locations average annual rainfall is approximately 55 inches compared to up to 70 inches for the maximum. Gypsy moth outbreaks associated with severe spring droughts may lead to relatively high levels of mortality in affected oak stands (more than 15 percent mortality following a single year of severe drought and defoliation; more than 30 percent mortality following 2-3 years of severe drought and defoliation). Long-term losses following gypsy moth

outbreaks will be more conspicuous in scarlet and black oak stands on excessively drained soils. Outbreaks that cause defoliation for two to three years in a row will lead to more severe levels of damage to affected stands, as will outbreaks that recur in the same stand after very short intervening time intervals. Mast production can be expected to either may decline or fail in affected oak stands during gypsy moth outbreaks.

Following the direct effect of tree mortality, there will be other indirect effects. Mast production will be reduced from pre-epidemic levels because of widespread mortality of former mast producers. Shifts in species composition toward species gypsy moth avoids may continue the reduction indefinitely. Large areas of defoliation will be unsightly and caterpillar droppings, dead trees, and strong sunlight will greatly reduce the aesthetic character of defoliated areas. Susceptibility to other problems, especially oak decline will be increased.

Oak Decline

Low or no disturbance prescriptions result in increased age of oak stands with a connected increase in oak decline risk and an increasing disease trend. Alternatives that make substantial use of such prescriptions create the potential for a widespread trend of increased risk and disease. The post-decline oak component is reduced on oak decline affected sites as disturbance is not sufficient to allow competitive oak regeneration to replace dying overstory oaks and oak decline-killed trees do not re-sprout. The slow dieback of the oak canopy is actually conducive to the height growth and site capture of established understory tolerant species, acting as a 'release' treatment that gradually frees them to grow without providing conditions for the establishment of effective competition. This would result in a long-term shift in species composition towards a lower diversity of oak species due to higher relative susceptibility of the red oak group compared to the white oak group and an increase in tolerant midstory non-oak tree species. In contrast, alternatives and prescriptions with disturbances that regenerate high-risk upland hardwood stands would result in a trend of decreasing disease occurrence. The next two tables show the relative responsiveness of each alternative to oak decline.

Table 3- 169. Distribution of Oak Decline Host Type on the Chattahoochee NF by Alternative and Estimated Forest Health Activity

		Estimated Forest Health Activity Level				
	Measure	1 little/no	2 suppress	3 prevent & suppress	Total Host	Acre-weighted Activity Level
A	acres	96,430	92,479	175,516	364,425	2.22
	percent	26	25	48		
B	acres	103,826	38,637	221,962	364,425	2.32
	percent	28	11	61		
D	acres	107,805	36,818	219,802	364,425	2.31
	percent	30	10	60		
E	acres	140,858	167,133	56,435	364,426	1.77
	percent	39	46	15		
F	acres	90,597	32,816	241,011	364,425	2.41
	percent	25	9	66		
G	acres	199,009	104,572	60,845	364,426	1.62
	percent	55	29	17		
I	acres	107,437	100,243	156,154	363,830	2.13
	percent	29	28	43		

Source: GIS stands data layer November 2002 for Alts. A thru G and August 2003 for Alt I.

Table 3- 170. Distribution of Oak Decline Host Type on the Oconee National Forest by Alternative and Estimated Forest Health Activity Level.

		Estimated Forest Health Activity Level				
Alt.	Measure	1 little/no	2 suppress	3 prevent	Total Host	Acre-weighted Activity Level
A	acres	1,493	1,450	13,505	16,448	2.73
	percent	9	9	82		
B	acres	1,345	2,159	12,944	16,448	2.71
	percent	8	13	79		
D	acres	2,060	883	13,505	16,448	2.70
	percent	13	5	82		
E	acres	1,529	`2,503	12,416	16,448	2.66
	percent	9	15	75		
F	acres	1,289	883	14,276	16,448	2.79
	percent	8	5	87		
G	acres	2,139	1,898	12,411	16,448	2.62
	percent	13	12	75		
I	acres	2,384	1,779	12,276	16,439	2.60
	percent	14	11	75		

Source: GIS stands data layer November 2002 for Alts. A thru G and August 2003 for Alt I.

Oak decline is so pervasive in the Southern Appalachians that no reasonable alternative can adequately address the risk at the landscape scale. Management

actions can lower risk locally, and sustained effort over the long-term can gradually lower risk on more areas. Actions include regenerating the most susceptible stands to younger, more resistant oak; reducing vegetative competition in susceptible stands; and matching tree species to the growth capability of sites. Because of current stand age structure, only within individual management prescriptions with an early-successional habitat objective of 10 percent or more will management be highly responsive to oak decline risk.

Southern Pine Beetle

Areas within the Piedmont and foothills of the Blue Ridge where there is an abundance of host material can experience catastrophic losses due to SPB. Areas within the mountain interior with a much more limited southern pine host type may lose far fewer trees. But the effect on a landscape can be equally detrimental in all cases. Loss of the limited pine host within the mountains, while not as economically important in total, could have a major impact on any species relying on this pioneer forest type for existence. Losses on a larger scale in the Piedmont could have similar ecological impacts as well as much greater total economic impacts. Either of these situations have the potential to affect neighboring landowners as well. The table below shows the distribution of southern pine beetle host type among general forest health management activity levels for each Forest.

Table 3- 171. Distribution of Southern Pine Beetle Host Type by Forest, Alternative, And Estimated Forest Health Activity Level.

Forest	Alt.	Measure	Acres By SPB Forest Health Management Flexibility Estimated Forest Health Activity Level 1 little/no	2 suppress	3 prevent & suppress	Total Host Acres	Acre-weighted Activity Level
Chatt.	A	acres	25,448	23,317	113,049	161,815	2.54
		percent	16	14	70		
	B	acres	22,782	6,124	132,908	161,815	2.68
		percent	14	4	82		
	D	acres	19,740	5,846	136,229	161,815	2.72
		percent	12	4	84		
	E	acres	30,424	88,399	42,992	161,815	2.08
		percent	19	55	27		
	F	acres	30,424	88,399	42,992	161,815	2.08
		percent	19	55	27		
	G	acres	61,343	28,905	71,567	161,815	2.06
		percent	38	18	44		
	I	acres	28,621	23,162	109,662	161,445	2.50
		percent	18	14	68		

Forest	Alt.	Measure	Acres By SPB Forest Health Management Flexibility Estimated Forest Health Activity Level 1 little/no	2 suppress	3 prevent & suppress	Total Host Acres	Acre-weighted Activity Level
Oconee	A	acres	3,951	11,838	62,421	78,210	2.75
		percent	5	15	80		
	B	acres	3,450	12,760	62,000	78,210	2.75
		percent	4	16	79		
	D	acres	6,752	8,604	62,854	78,210	2.72
		percent	9	11	80		
	E	acres	4,496	17,660	56,054	78,210	2.66
		percent	6	23	72		
	F	acres	3,994	7,817	66,399	78,210	2.80
		percent	5	10	85		
	G	acres	9,635	17,779	50,796	78,210	2.53
		percent	12	23	65		
	I	acres	2,346	10,090	65,790	78,226	2.81
		percent	3	13	84		

Source: GIS stands data layer November 2002 for Alts. A thru G and August 2003 for Alt I.

Within the Piedmont, alternatives with low or no disturbance and no active control of insect or pest problems can expect *catastrophic* losses due to SPB. The alternatives that allocate land to more old growth and old-growth compatible management prescriptions or lengthen the earliest regeneration age to a point beyond physiologic maturity can be expected to also suffer greater losses due to SPB. This same scenario within the mountains will cause significant impact on a smaller scale, and the long- term prospect includes the potential loss of the southern pine ecosystems in local areas. The losses due to SPB within the Piedmont will be minimized when alternatives focus on prevention, especially managing stand density. In the mountains, however, approximately one-fifth of the host type is on what is now land with a management direction that precludes preventive actions and greatly constrains suppression actions. An example is units of the national wilderness preservation system. In these situations, losses would in most cases still occur. This loss within the mountains again threatens the pine ecosystem in localized areas. These mountain pine forests may be maintained to some extent under restoration alternatives.

Of particular concern is the age structure of the SPB host type. In the Blue Ridge Mountains approximately 20 percent of old growth type 24 (which includes all SPB host types except loblolly pine) would reach minimum old growth age within ten years if simply allowed to grow. By 2020, that amount rises to approximately 60 percent without action. In the Southern Ridge and Valley approximately 20 percent of old growth type 24 will be at or beyond minimum old growth age by 2020. A significant portion of these amounts is Virginia pine with a physiologically mature age even younger than the minimum old growth age. (*See the 'Old Growth' topic of this EIS for details.)*

Most alternatives maintain a predominance of SPB host type available for preventive actions. However the dynamics of recurrent outbreak, increasing vulnerability, budgets, personnel, and public acceptance of the need for action make it probable that preventive action will continue to lag behind the need. Overstory stem densities need reduced to near what would traditionally have been considered 'understocked' conditions and maintained there over extensive acreages of host. The forecast for all alternatives is that SPB risk will continue to rise. Without aggressive suppression in future outbreaks, increasing mortality can be expected.

Hemlock Wooly Adelgid

In the table below, the distribution of hemlock wooly adelgid host type relative to estimated intensity of management response is displayed. Unlike gypsy moth, oak decline, and southern pine beetle; vegetative treatments will not serve as a preventative. Rather the categories are indicators of probable biological control.

Table 3- 172. Distribution of Hemlock Wooly Adelgid (HWA) Host Type on the Chattahoochee NF by Alternative and Estimated Forest Health Activity Level.

Alt.	Measure	Estimated Forest Health Activity Level			Total Host Acres	Acre-weighted Activity Level
		1 little/no	2 suppress	3 prevent & suppress		
A	acres	5,447	6,111	11,165	22,723	2.25
	percent	24	27	49		
B	acres	6,417	1,803	14,503	22,723	2.36
	percent	28	8	64		
D	acres	7,701	1,937	13,085	22,723	2.24
	percent	34	9	58		
E	acres	9,475	7,879	5,369	22,723	1.82
	percent	42	35	24		
F	acres	4,733	1,827	16,163	22,723	2.50
	percent	21	8	71		
G	acres	11,914	6,131	4,678	22,723	1.68
	percent	52	27	21		
I	acres	5,631	5,429	11,659	22,719	2.26
	percent	25	24	51		

Source: GIS stands data layer November 2002 for Alts. A thru G and August 2003 for Alt I.

None of the alternatives would have a significant effect on HWA movement, spread, or impact. Because of the limited amount of hemlock communities, management direction that would not allow active suppression puts these communities at high risk. Untreated areas could become breeding grounds for population buildups that could render treatment on other acres ineffective. Because of the association of hemlock with streams, and also favored recreation settings along those streams, acceptance of insecticide application by the public – should an insecticide become available in the future – can be expected to be low or very low. Conversely, public concern over loss of hemlocks, when it begins to occur, can be expected to be high.

Beech Bark Scale

At the present time there are no management actions that can be taken to reduce or eliminate the beech scale or beech bark disease. Therefore, the disease trend of worsening damage is expected to continue in all alternatives.

The occurrence of beech in riparian areas with hemlock is cause for elevated concern. Both species are at risk. And no effective control technique exists to protect either. Riparian areas within the Blue Ridge become areas of very high concern for a wide variety of reasons.

Littleleaf Disease

The potential effects of each alternative for littleleaf disease were assessed. Littleleaf hazard soils were correlated through GIS with the presence of loblolly pine or shortleaf pine host type; that is, forest cover type codes 31 and 32. Forest Health Protection staff had previously classed Piedmont soils as low, medium, or high hazard. The soils data layer in GIS was attributed with this hazard rating, then GIS was used to match the soils with the host types. Finally, the allocations of management prescriptions within each alternative were added to categorize littleleaf hazard into an indicated forest health activity level for each alternative.

Data is shown for the Oconee and the Chattahoochee separately. The Oconee is generally considered to be of higher concern for a number of reasons. It has a much greater proportion of all forested acres in littleleaf host type. It has much more acreage of littleleaf hazard soils. More of the littleleaf hazard soils are of high or moderate hazard. And the Oconee has had more littleleaf problems in the past. Historically, a 'littleleaf belt' was recognized across the southern end of the Oconee. The Chattahoochee is on the edge of historic littleleaf occurrence. In the data shown here, only the Armuchee Ranger District in the Southern Ridge and Valley ecological section and the upper Piedmont portion of the Chattooga Ranger District were considered. Littleleaf has been diagnosed outside these areas but rarely. Littleleaf is primarily a Piedmont problem with localized occurrence into the edge of the Blue Ridge Mountains.

The 'acre weighted activity level' is a dimensionless variable that ranks alternatives by their relative ability to be pro-active in dealing with littleleaf. (In this case, pro-active management is prevention of the problem or by conversion of host type to non-host types.) It was derived by multiplying the acres of each forest health activity class times the numeric value assigned to each class (Low = 1, Medium = 2, etc), summing the results across each of the three classes, then dividing by the 'total host acres'. The lowest value indicates the least management flexibility to be pro-active. The highest value indicates the most management flexibility to be pro-active.

Table 3- 173. Distribution of Littleleaf Host Type by Forest Health Activity Level, Soil Hazard Class, and Alternative for the Chattahoochee NF.

Alt.	Acres By Soil Hazard Class Within Forest Health Activity Level									Total Host Acres	Acre-weighted Activity Level
	1 little or no activity			2 suppression			3 prevent & suppress				
	low	med.	high	low	med.	high	low	med.	high		
A	4,040	231	12	804	5	0	22,046	3,280	496	30,914	2.70
B	1,786	49	71	738	5	0	24,366	3,463	437	30,914	2.85
D	721	0	0	35	5	0	26,134	3,511	508	30,914	2.95
E	2,928	234	40	17,510	3,210	451	6,453	73	17	30,914	2.11
F	48	26	0	69	0	0	26,773	3,491	507	30,914	2.99
G	4,095	345	52	2,175	5	0	20,620	3,167	456	30,914	2.64
I	3,115	278	41	2,928	218	64	20,847	3,020	403	30,914	2.64

Source: GIS stands and soils layers September 2003

Littleleaf hazard soils and littleleaf host coincide on approximately 28 percent of the total National Forest land area of the Armuchee RD and the Piedmont portion of the Chattooga Rd. The Piedmont portion of the Chattooga has 19,659 acres of shortleaf and loblolly host. The Armuchee Rd has 12,667 acres of shortleaf and loblolly host. . Within the shortleaf and loblolly host types, 96 percent of their land area has some degree of littleleaf hazard Within all hazard soils occupied with host type, 87 percent of the area has low hazard, 11 percent has medium hazard, and the remaining 2 percent is high hazard.

Several patterns emerge from the Chattahoochee NF littleleaf table. Most alternatives are similar in allocating a high proportion of host type to prescriptions allowing both prevention and suppression; that is, pro-active management. Except for Alt E, the range among alternatives is from 100 percent to 76 percent in this regard. The order from greatest to least is: F (99.5%), D (97.6%), B (91.4%), A (83.5%), G (78.4%), I (76.5%), and E (21.2%). Alternative E also differs greatly from the others by having a high proportion (68.5%) in suppression-oriented prescriptions. Except for Alt E, the range among alternatives of suppression-oriented prescriptions is from 11.3-percent to 0.1-percent. The ordering from least to greatest amount allocated is as follows: D (0.1%), F (0.2%), B (2.4%), A (2.6%), G (7.0%), and I (11.3%). Alternatives, including Alt. E. are generally similar in allocating a low proportion of host acreage to very constrained prescriptions, especially of medium or high hazard soils. The range across alternatives is from a low of 0.3-percent to a high of 14.5-percent as follows: F (0.3%), D (2.3%), B (6.2%), E (10.4%), I (12.1%), A (13.8%), and G (14.5%). The interaction among the classes is instructive in that overall Alternatives G and I have the same acre-weighted activity rank but differ significantly in the proportion of host allocated to a suppression-oriented strategy.

The very low acreage in Alt. F in very constrained prescriptions (activity level = 1) or moderately constrained (activity level = 2) shows that littleleaf hazard soils are almost absent from previous allocation decisions either above the authority of the Regional Forester or retained as 'special' designations such as Regional Forester Scenic Areas. The relatively narrow range of acre-weighted values shows that

alternative formulation both; (a) generally avoided allocating high and moderate risk stands to constrained prescriptions, and (b) avoided 'skewing' allocations strongly to either extreme. Alternative E stands out as an exception in the allocation of more than 17,000 acres of host to reacting once a problem has become evident. Even here, however, these acres are of low hazard soils.

The table below shows the littleleaf situation for the Oconee by alternative. The different host acreage for Alternative F is because it does not include all of the land acquisitions. This was deliberate in that Alternative F was held to reflect what had actually been allocated in the 1985 plan and its amendments. All other alternatives allocated acquired but previously unallocated land.

Table 3- 174. Distribution of Littleleaf Host Type by Forest Health Activity Level, Soil Hazard Class, and Alternative for the Oconee NF.

Alt.	Acres By Soil Hazard Class Within Forest Health Activity Level									Total Host Acres	Acre-weighted Activity Level
	1 little or no activity			2 suppression			3 prevent & suppress				
	low	med.	high	low	med.	high	low	med.	high		
A	661	1,711	67	445	6,556	4,152	11,997	31,101	13,786	70,475	2.77
B	310	1,394	60	808	6,881	3,933	11,985	31,093	14,012	70,475	2.78
D	614	2,962	1,001	305	5,302	3,027	12,183	31,104	13,977	70,475	2.75
E	411	1,983	912	952	8,427	7,105	11,739	28,958	9,988	70,475	2.67
F	76	300	4	178	4,478	2,950	12,720	34,300	14,991	69,998	2.88
G	903	4,311	2,372	969	8,950	7,115	11,230	26,106	8,519	70,475	2.54
I	430	1,041	29	472	5,655	3,336	12,165	32,672	14,641	70,440	2.82

Source: GIS stands and soils layers September 2003.

Littleleaf hazard soils and littleleaf host coincide on 61 percent of the Oconee. Within the shortleaf and loblolly host types, 91 percent of their land area has some degree of littleleaf hazard. Within all hazard soils occupied with host type, 19 percent of the area has low hazard, 56 percent has medium hazard, and the remaining 25 percent is high hazard. High hazard soils are associated with the southern end of the Oconee and are therefore related to red-cockaded woodpecker habitat.

Most alternatives are similar in allocating a high proportion of host type to prescriptions allowing both prevention and suppression; that is, pro-active management. The range among alternatives is from 89 percent to 65 percent in this regard. The order from greatest to least is: F (88.6%), I (84.5%), D (81.2%), B (81%), A (80.7%), E (72%), and G (65%). The range among alternatives of suppression-oriented prescriptions is from 24.2 percent to 10.9 percent. The ordering from least to greatest amount allocated is as follows: F (10.9%), D (12.2%), I (13.4%), A (15.8%), B (16.5%), E (23.5%), and G (24.2%). Alternatives are generally similar in allocating a low proportion of host acreage to very constrained prescriptions, especially of medium or high hazard soils. The range across alternatives is from a low of 0.5 percent to a high of 10 percent as follows: F (0.5%), I (2.1%), B (2.5%), A (3.4%), E (4.7%), D (6.5%), and G (10%).

In each alternative on both the Chattahoochee and Oconee, loss of shortleaf and loblolly cover types to littleleaf can be expected to occur. Of greatest concern is high and medium hazard with little or no management. On the Chattahoochee, none of the alternatives have significant acreage in this combination. The primary concern there is Alternative E having a large portion of host in suppression-oriented prescription and including a significant part of the high and medium hazard acres. Considering only the high hazard soils and category 1, Chattahoochee losses in the next ten years could be approximately 1 percent of the total host type in Alternative G. On the Oconee for the high and medium hazard conditions and the little or no activity category, potential risk of loss ranges from lowest to highest as follows: F (0.4%), I (1.5%), B (2.1%), A (2.5%), E (4.1%), D (5.6%), and G (9.5%). Alternative G on the Chattahoochee and the Oconee provide the least capability to be pro-active toward littleleaf. Alternative I is intermediate on the Chattahoochee but near the top on the Oconee in the flexibility to be pro-active.

Non-native Invasive Species

No single set of environmental conditions could adequately predict trends in such a large group of plants. There are two key variables; (1) the probability of introduction, and (2) the probability of establishment once a plant is introduced. Introduction may be natural or human-caused. Human introduction may be accidental or semi-deliberate; that is, no intention to establish but an inadvertent consequence such as might occur with the disposal of yard waste. Increases in the number of people visiting the National Forest and increases in the number of residences in close proximity to the National Forest each also increase the chance of invasive species introductions. However, the probability of establishment for most of the currently recognized species is increased when introduction coincides with disturbance that provides receptive conditions, such as bare soil and strong sunlight. Non-native invasive species would, therefore, be generally favored with any increase in ground disturbance within alternatives. Two examples of exceptions are Japanese stiltgrass, and privet These species can become established and persist beneath a closed canopy, unlike many NIS plants. Even so, they can respond when exposed to increased light.

As with gypsy moth, it is assumed that non-native plant introductions will be occurring in the future regardless of alternative. Low disturbance alternatives and prescriptions are presumed to result in slower rates of establishment and spread for nonnative invasive plants, with high disturbance resulting in more frequent establishment and more rapid spread.

Storm Damage

Longleaf and loblolly as saplings are susceptible to ice. And Virginia pine at all ages is susceptible to windthrow. Timber harvest and reforestation efforts will create a degree of risk with these species in particular. However, there are equal or greater risk from other insect or disease problems with no action. Younger trees past the sapling stage are generally damaged less severely and in many cases survive, grow, and mature after storm events. On balance, alternatives with harvesting that provides for younger stands will result in less overall storm damage. Conversely,

alternatives that allow large areas to reach advanced age can be expected to result in more severe storm effects in the future.

Dogwood Anthracnose

Disturbances that open forest stands to more drying by wind and sunlight help slow infections. In stands where there is a full crown cover causing shade with resultant high humidity and poor foliage drying, the disease is worse. Consequently, the likelihood of maintaining dogwood is highest for those alternatives that do the most to allow sunlight penetration into stands through a combination of regeneration harvest or thinning. Prescribed burning would help to reduce canopy density and improve light intensity, but would wound dogwoods not top-killed and provide a disease entry point. For top-killed dogwood, however, re-sprouted stems would be disease-free until re-infected.

Butternut Canker

No natural control mechanism is at work and so far no resistance has been found in the butternut population. This disease will continue to get worse regardless of management practices; that is, regardless of alternative, until resistant strains of butternut are found and propagated, or effective prevention or control strategies are developed. The greatest risk of a negative effect of forest plan decisions would be to preclude future restoration. This would happen by allocating so much of the appropriate sites to prescriptions that would preclude restoration activities such as site preparation, planting, and release treatments that, should resistant trees become available, restoration of the species would be impractical or be precluded by restriction on land-use. Because of the association of butternut with riparian areas, the risk is not minor. For example, The Alaculsy Valley of the Conasauga River currently has extensive areas of beetle-killed loblolly pine on sites suitable for butternut. But in Alternative I, this area is being recommended for National Wild and Scenic River designation. The designation would not by itself preclude site preparation and planting, but does create the potential to require more intensive, time-consuming, and expensive environmental analysis. It also has potential to create a public expectation that such activities will not, or ought not, occur; thus making any proposal less acceptable.

Summary

In the tables below, a summary comparison of alternatives is given. The comparison uses three different elements. The first of these is the acre-weighted average activity level values for specific pests by alternative. The second – used for non-native invasives and for storm damage – is an acre-weighted average early-successional wildlife habitat objective value. The third is a ranking for each alternative for each forest health concern. A ranking was used because of two factors; (a) the scale of values for activity levels for specific pests ranged from 1 through 3, but for non-native invasive plants and for storm damage, the scale was the early-successional wildlife options one of 1 through 4; and (b) for non-native invasive species, the relationship between the concern and management actions was inverse; that is, more activity results in greater concern about invasive species rather than less. Rankings overcame these problems and allowed calculation of a ranking order with

alternatives arranged on a continuum from least capable of dealing with forest health overall to most capable. The intent is to show an overview of how successful, or not, a specific alternative is expected to be with multiple forest pests considered. In the rankings, the lowest number is the greatest ability to be pro-active or the least effect, and the highest number is the least ability to be pro-active or the greatest effect.

Table 3- 175. Summary of Forest Health Activity Levels with Ranking of Alternatives for the Chattahoochee NF

Forest Health Concern	Forest Health Activity Levels and Alternative Ranks						
	A	B		E	F	G	I
Gypsy moth	2.25	2.36	2.34	1.80	2.45	1.65	2.17
Rank	4	2	3	6	1	7	5
Southern pine beetle	2.54	2.68	2.72	2.08	2.08	2.06	2.50
Rank	3	2	1	5	5	6	4
Hemlock Woolly Adelgid	2.25	2.36	2.24	1.82	2.50	1.68	2.26
Rank	4	2	5	6	1	7	3
Oak Decline	2.22	2.32	2.31	1.77	2.41	1.62	2.13
Rank	4	2	3	6	1	7	5
Littleleaf Disease	2.70	2.85	2.95	2.11	2.99	2.64	2.64
Rank	4	3	2	6	1	5	5
Non-native invasive plants	2.13	2.31	2.54	1.82	3.17	1.52	2.14
Rank	3	4	5	2	6	1	3
Storm damage	2.13	2.31	2.54	1.82	3.17	1.52	2.14
Rank	4	3	2	5	1	6	4
Sum of Ranks	26	18	21	36	16	39	29
Avg. Rank	3.71	2.57	3.00	5.14	2.29	5.57	4.14
Order	4	2	3	6	1	7	5

Table 3- 176. Summary of Forest Health Activity Levels with Ranking of Alternatives for the Oconee NF

Forest Health Concern	Forest Health Activity Levels and Alternative Ranks						
	A	B	D	E	F	G	I
Gypsy moth	2.69	2.68	2.64	2.61	2.73	2.57	2.54
Rank	2	3	4	5	1	6	7
Southern pine beetle	2.75	2.75	2.72	2.66	2.80	2.53	2.81
Rank	3	3	4	5	2	6	1
Oak Decline	2.73	2.71	2.70	2.66	2.79	2.62	2.60
Rank	2	3	4	5	1	6	7
Littleleaf Disease	2.77	2.78	2.75	2.67	2.88	2.54	2.82
Rank	4	3	5	6	1	7	2
Non-native invasive plants	2.95	2.81	2.93	2.83	3.53	2.54	2.80
Rank	6	3	5	4	7	1	2
Storm damage	2.95	2.81	2.93	2.83	3.53	2.54	2.80
Rank	2	5	3	4	1	7	6
Sum of Ranks	19	20	25	29	13	33	25
Avg. Rank	3.17	3.33	4.17	4.83	2.66	5.50	4.17
Order	2	3	4	5	1	6	4

Compared to the existing allocations of Alternative F, all alternatives on both Forests can be expected to be too conservative to fully meet known forest health problems. On each Forest, Alternative F emerges as having the greater capability to deal with forest health. When one remembers that in this analysis many complex forest health factors, such as tree age and site quality are not being explicitly considered and also that management under the 1985 plan has not prevented recurrent losses to insect, disease, and natural catastrophe; it is clear than future mortality can be expected regardless of the alternative chosen. Tree mortality will generally directly and immediately have a negative effect on scenic quality by changes in the visual elements of form, line, color and texture, especially if it results in large areas of 'brownout' or super-abundant snags which dominate the scene. Death of individual 'accent trees' however adds an element of visual diversity and snags can be attractive features in their own right. Dead trees will immediately provide abundant snags for foraging by insect-eating birds and a later site for excavation of cavities by cavity-nesting birds. Defoliations, declines in tree vigor, and tree mortality will negatively affect fruit production of affected trees and lower wildlife food supplies. For example, oak decline and gypsy moth, singly or in combination, will lower total acorn production. Because of variations in the time acorns take to mature between the red oak and white oak groups and the greater vulnerability of red oak to oak decline, greater year-to-year variation of acorn production can also be expected compared to pre-oak decline conditions. Standing dead trees will create a safety hazard in fire control, recreation areas, and on roads and trails.

In the years following initial tree mortality, other effects will occur. Mammals and other birds that do not excavate their own cavities will in turn use cavities excavated by woodpeckers. Standing snags may become lightening-ignition wildfire sources in moderate and severe drought years. As they fall, dead trees will require removal from trails, roads, power line rights-of-way, wildlife openings, and other similar areas. After they fall, dead trees will also provide large down woody debris as feeding substrate for fungi and insects, as well as cover or dens for reptiles, amphibians, and mammals; especially small mammals. In particular, both beech bark scale and hemlock woolly adelgid are likely to result in the fall of large woody debris into streams. Stream flows may be altered, changing in-stream habitat conditions or causing streams to cut new channels with accelerated erosion until any new channels are cut to stable substrate. Dead and down trees will create high volumes of fuels that will result in higher heat release in fires with greater mortality of any living trees present and consumption of greater amounts of the litter and duff layer thus exposing more mineral soil than would have been the case before the tree mortality. In these cases, fire will have greater resistance to control, requiring extra efforts to ensure they do not escape control lines. Off-trail foot travel will be physically limited by down logs and tops, sprouts, vines, and herbaceous plants such as blackberry for many years after initial mortality.

Alternatives A, B, D, and I have enough activity to allow prevention and suppression for a selected subset of all host acres for each pest, but still at levels less than needed to maintain a low or no more than moderate risk at forestwide scale. The focus of specific objectives; for example oak woodland restoration, presents an opportunity to target its creation to the highest risk situations for oak decline and/or

gypsy moth within those acres where this intensity of management is permitted. Alternatives E and G are low-intensity alternatives that would largely preclude or greatly constrain preventive actions and reduce protection actions to the selection of specific highly-valued locations, such as recreation areas, to receive protection, except for possibly the release of biological control agents if available.

The range of change from current management is less on the Oconee, because about two-thirds of the forest is in the red-cockaded woodpecker habitat management area and must meet the USFWS recovery plan. In particular, SPB risk must be managed to avoid loss of RCW habitat. This management will include prescribed burning to control hardwood midstory and thinnings to reduce SPB risk. Because of the requirement of using 'irregular shelterwood' as the regeneration harvest method in the red-cockaded woodpecker habitat management area and of retaining the shelter trees for potential nesting; those trees will be at increasing SPB risk as they age. Regarding gypsy moth risk, the alternatives either do nothing, or allow stands to become more vulnerable, or, especially in Alt. I, actively increase risk through oak restoration. Oak decline is expected to be reduced in some alternatives by identifying high-risk areas and creating oak woodlands, savannas, or other communities either not vulnerable at all or at less risk. The same is true of littleleaf hazard, especially in Alternative I.

Cumulative Effects

All alternatives are too conservative to deal effectively with the known forest health threats at a forestwide scale with existing technologies and probable budgets. Stated another way, each alternative will require working with a subset of host type for each pest. Having large blocks of host type without prevention or suppression treatment will create conditions favoring outbreaks and make protection of other areas more difficult. For some pests and risk conditions, prevention and suppression will be effective locally; for example, Alternatives A, D, B and I can be effective, but only within localized areas of the Forests. Alternatives E and G are effective only in selected high interest areas and then only with intensive treatments.

Some forest health problems will reinforce each other. Littleleaf affected trees are more vulnerable to both windthrow and southern pine beetle attack. Oak decline affected trees are more likely to be killed by gypsy moth defoliations or gypsy moth defoliations will make trees more susceptible to oak decline. In mixed pine-oak or oak-pine stands, oak decline and southern pine beetle are likely to each be a problem at different times. Tree mortality has the potential to decrease the resistance of survivors to windthrow because of exposure or because wind flow is altered by changes in forest cover. High fuel loadings and intense fires have the potential to 'reset' the clock of forest succession back to pioneer species such as the yellow pines.

Regardless of alternative, significant shifts in forest species composition can be expected; especially on the Chattahoochee NF, probably becoming pronounced within twenty to thirty years. As trees die or are killed and the affected species are unable to regenerate on the site, the forest composition will tend to shift toward the more tolerant species, particularly white pine. Until hemlock wooly adelgid reached

Georgia, hemlocks could have been expected to increase. Similarly, beech seedlings and saplings would have responded to mortality of overstory, but now beech bark scale may preclude this in the future. (*Details of understory species have been presented in the 'Forest Cover' topic of this environmental impact statement Appendix F of the Plan also identifies the ability of species to form a high canopy.).* Of the alternatives considered, even those with the highest levels of activity would not prevent this phenomenon, but only reduce its magnitude. The single most effective tool to prevent this result - prescribed fire - is likely to become more and more constrained by Clean Air Act compliance requirements such that the acres that can effectively be treated do not keep pace with the rate of change. In addition, budget, weather, and administrative requirements may constrain the use of fire to levels that are too conservative to; for example, provide conditions that would allow the existing forest cover to regenerate.

The number of invasive plant species and introduced forest pests can be expected to increase due to natural spread and inadvertent introduction by transport of goods and/or persons. The ability of invasive species to aggressively occupy a habitat must come at the expense of other species currently growing there. In some instances, this will further complicate our ability to maintain native vegetation communities. Pesticides of all kinds, whether herbicides, insecticides, fungicides, etc may be expected to have increasing public resistance, until values being lost generally exceed the level of perceived risk.

Not all changes will be negative, however. The heightened risk for southern pine beetle, oak decline, and gypsy moth on the drier sites with oak and pine will actually be favorable to the establishment of oak or pine woodland or savanna communities. If these changes coincide with a prescribed burning regime, more diverse wildlife habitats can be created. These in turn will be favorable to some plant PETS species and habitat for some animal species. They will also add visual and recreational setting diversity not currently available.

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