Forest Interior Birds

Affected Environment

Habitat fragmentation is a key issue for viability of local populations of breeding birds in some mature mesic deciduous forest settings. Birds in this group (Appendix E, Tables L1 and L2: Mature Forest Interior) avoid forest edges during nesting and are adapted to forest interior conditions. Most are neotropical migrants that primarily nest and raise young in the temperate Americas. These species are grouped for effects analysis due to their sensitivity to forest fragmentation and edge effects (Hamel 1992: Appendix G, G1-G2).

Studies conducted in the mid-western U.S. have documented that forest interior species may not successfully breed in small patches of otherwise suitable habitat. Quality of their forest interior habitat is measured in part by proportion of edge, an artifact of juxtaposing forested and non-forested habitats. Edges fragment forest interior habitats and are associated with increased predation and brood parasitism by the brown-headed cowbird in agricultural settings (Primack 1993; Yahner 1998). However, characteristics of the surrounding landscape, such as percent forest cover, determine the magnitude of local edge effects. Findings of Robinson et al. (1995) indicate that large landscapes with at least 70-80 percent forest cover offer high potential as quality habitat for forest interior species, where adverse effects of edge are reduced to levels compatible with productive populations.

Donovan et al. (1997) found that abundance of the brown-headed cowbird in a Midwestern U.S. setting was significantly greater in highly fragmented landscapes (less than 15 percent forested) than in moderately fragmented (45-55 percent forested) or unfragmented (more than 90 percent forested) landscapes, but abundance in moderate and unfragmented landscapes did not differ. Landscape-scale habitat patterns significantly influenced overall nest predation patterns and cowbird abundance. However, local effects of livestock grazing and horse corrals caused high variation between landscape units with similar percent forest characteristics. The specific types of non-forested habitats present may be important.

As a general rule, parasitism levels of 25 percent or less and daily nest predation rates of 4 percent or less should give most forest interior species "at least a chance" (Robinson 1995) of having self-sustaining local populations (also May and Robinson 1985; Donovan et al. 1997). Based on the work of Robinson et al. (1995), these parasitism rates are associated with a minimum of 70 to 80 percent forest cover at a landscape (75,000 acre) scale for a Midwestern U.S. setting.

Duguay et al. (2001) found that in a forested setting in West Virginia (Monongahela National Forest, more than 88 percent forest cover), “fifteen years after harvest, cuts placed within otherwise extensively forested areas do not result in the type of edge effects (population sinks) observed in areas fragmented by agriculture in the Midwestern U.S.” They also concluded that implementing relatively small cuts that create edge on a small proportion of the landscape may not result in increased nest failure, provided that other factors such as proximity to cowbird feeding sites are not

prominent. The study involved tracking 556 nests of 46 species over a four-year period and calculation of daily nest survival rates.

Other habitat factors are known to influence productivity of this species group. Presence of young forest patches within a forested landscape is likely to have positive benefits for immature birds. Vega Rivera et al. (1998) and Anders et al. (1998) found that after fledging, juvenile wood thrushes disperse from mature forest habitats and enter early-successional forests where they fed on invertebrates and fruit. Use of these habitats was very high relative to their availability. Later in the season, they shifted back into mature forest habitats. Fledglings preferred areas with dense understory and ground cover with species such as blackberry, sumac, and grape. Such areas may be provided by relatively small even-aged regeneration areas or by smaller dispersed canopy gaps. Scattered canopy gaps and associated dense understories likely were characteristic of old growth mesic deciduous forests. Open habitats such as pastures, old fields, and managed wildlife openings were rarely used.

The significance of National Forest lands to this species group was analyzed at both regional and forest scales in the Southern Appalachian Assessment (SAMAB 1996e: 69-73). This analysis of forest interior habitat focused primarily on patterns of land use (forested vs. non-forested) and measures of edge effects at a landscape scale. Based on this analysis, there are approximately 9 to 10.5 million acres of suitable habitat in the Southern Appalachian Assessment (SAA) Area with about 4.7 to 5.4 million acres (52 percent) located within tracts greater than 5,000 acres.

Approximately 70 percent of suitable habitat and 51 percent of the largest tracts are privately owned, while 23 percent of suitable habitat and 39 percent of the largest tracts are on national forest land. A notable difference is found within the Blue Ridge Mountains, where approximately 40 percent of suitable habitat and half of the largest tracts occur on national forest land. Within the SAA area, the majority of forest interior habitat occurs within the Blue Ridge Mountains, followed by the Northern Ridge and Valley/Cumberland Mountains. The Southern Ridge and Valley and Southern Cumberland Plateau have the smallest relative amount (SAMAB 1996e: 73).

To determine the landscape context of the Chattahoochee and Oconee National Forests, a shifting window analysis was conducted using 1990 National Land Cover Data (U.S. EPA 2002). Percent forest cover within a surrounding landscape of 75,000 acres (per Donovan et al. 1997) was calculated for each 90-meter grid cell located on the national forest and nearby private land. For this analysis, Deciduous, Evergreen, and Mixed Forest, and Woody Wetlands were classified as forested lands. All other land cover types, including recent clearcuts (transitional cover type), were classed as non-forest cover. This analysis indicates the great majority of the Chattahoochee and Oconee National Forests occur within a landscape that is more than 70 percent forested (Table 3- 96, Figure 3 - 22 and

Figure 3 - 23).

Table 3- 96. Acres (And Percent) Of National Forest Lands By Percent Forest Cover Class On And Near The Chattahoochee And Oconee National Forests.[1]

Percent Forest Cover	Chattahoochee	Oconee
90-100%	594,671 (79%)	52,583 (46%)
80-90%	115,382 (15%)	43,463 (38%)
70-80%	38,943 (5%)	15,668 (14%)
<70%	594 (<0.1%)	3,461 (3%)

[1] *Source: 1990 National Land Cover Data (US EPA 2002).*

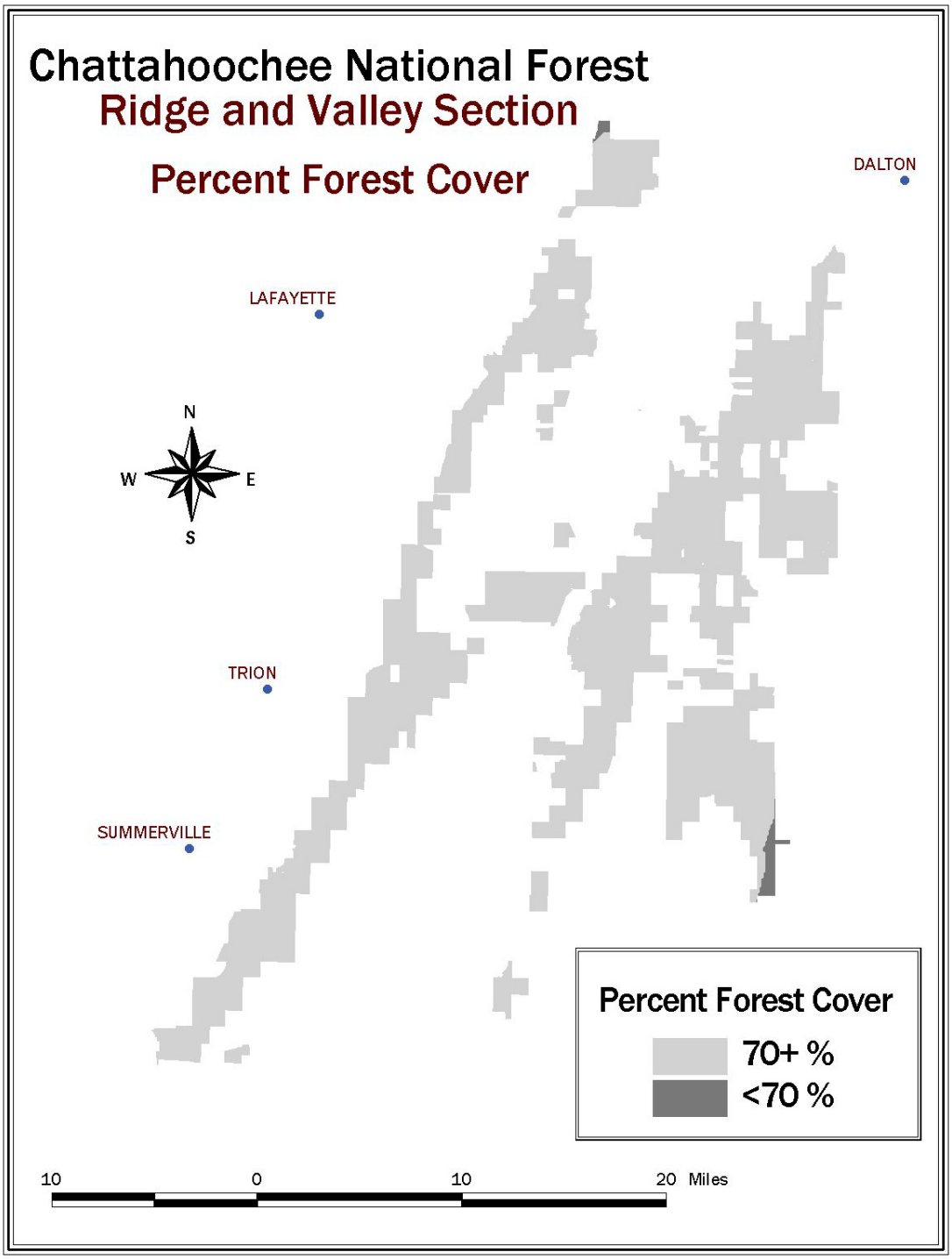

Figure 3 - 22. Composite Map Of Percent Forested Land Cover On And Near The Armuchee Ranger District, Chattahoochee National Forest, Based On 1990 National Land Cover Data (US EPA 2002).

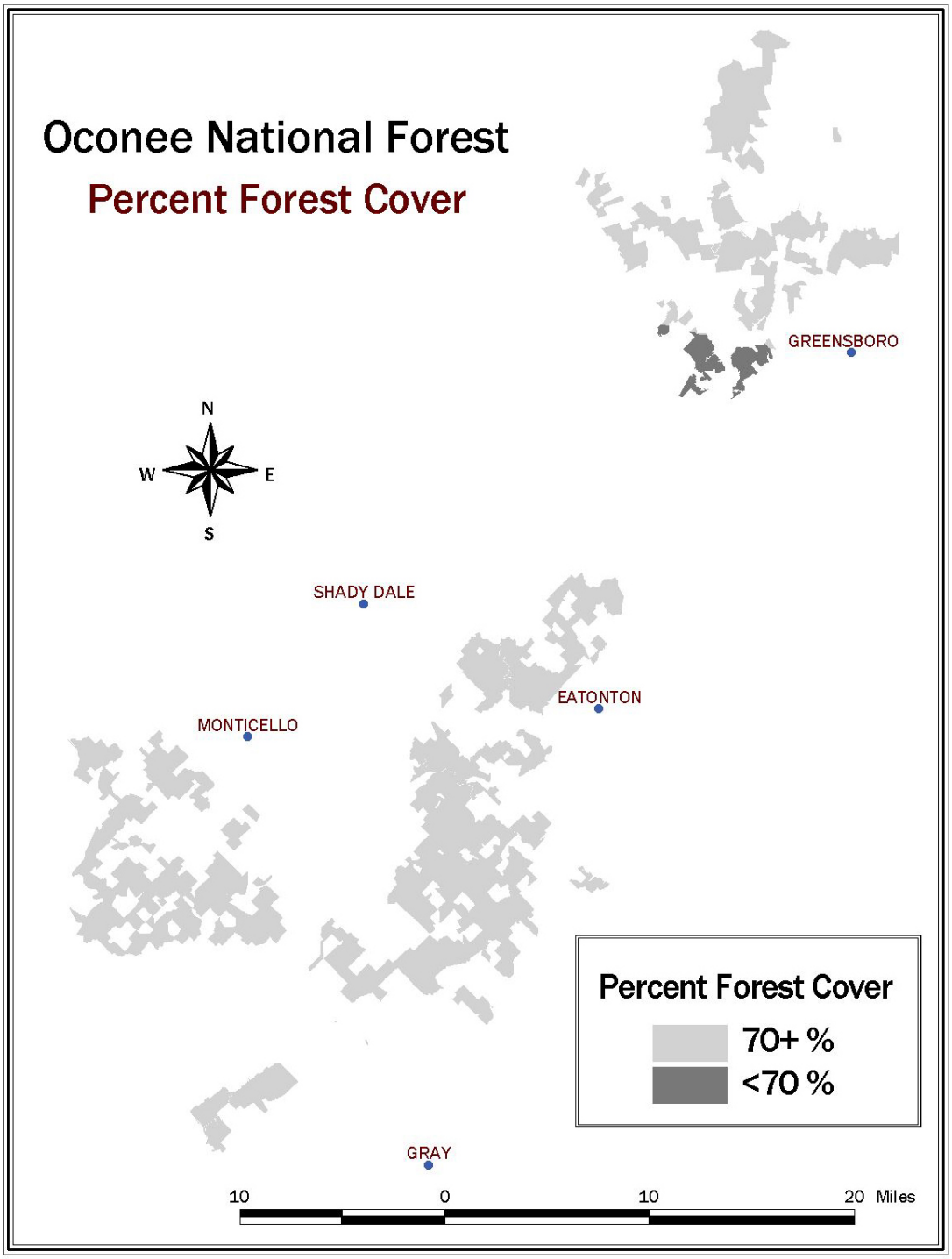

Figure 3 - 23. Composite Map Of Percent Forested Land Cover On And Near The Oconee National Forest, Based On 1990 National Land Cover Data (US EPA 2002).

On the Chattahoochee and Oconee National Forests, three areas comprising 4,055 acres have settings that are less than 70 percent forested, where edge effects could adversely affect productivity of forest interior birds (Table 3- 96). There are two small areas on the Armuchee Ranger District, which total 594 acres (Figure 3 - 22). One is along the southwestern edge of the district, west of Calhoun and the second is in the northwest edge of the district between Lafayette and Dalton. The third area is on the Oconee Ranger District, west of Greensboro (Figure 3 - 23). There are several tracts in this portion of the Forest totaling 3461 acres that have settings that are less than 70 percent forested. All of these tracts are on the edge of the National Forest adjacent to private land in largely agricultural landscapes.

Currently, the Chattahoochee National Forest provides 338,082 acres of mid- and late-successional mesic deciduous forest, comprising 45 percent of total forest acres. About 91 percent of total mesic deciduous forest acres are in mid- and late-successional stages. There are 31,204 acres of mid- and late successional mesic deciduous forests on the Oconee National Forest, comprising 28 percent of the total forest acres. Approximately 96 percent of the mesic deciduous forests are in mid- and late successional stages.

Several bird species are associated with forest interior. For the Chattahoochee National Forest, the ovenbird (*Seiurus aurocapillus*) is deemed the most appropriate of these as an MIS. It is strongly associated with mature forest interior habitats (Hamel 1992, Crawford et al. 1981), and it is also common enough to be feasibly monitored for trends. This species is selected to help indicate the effects of management on the availability of suitable mature forest interior habitats. Other elements, such as landscape analysis of forest fragmentation using remote sensing data, would supplement information received from monitoring this species. Ovenbirds are uncommon on the Oconee National Forest, which would limit the ability to monitor population trends. For this reason, the wood thrush (*Hylocichla mustelina*) is selected as the MIS for mature forest interiors on the Oconee National Forest.

Direct and Indirect Effects

Implementation of forest plan alternatives would create edge in mesic deciduous forest interior habitats during creation of early-successional forest habitats, road construction, some types of recreation development, and routine maintenance and permitting of small clearings including easements and rights-of-way. These edges could cause adverse effects to productivity of forest interior species in some settings.

Amount of edge generated would vary by alternative, particularly as caused by creation of early-successional forest habitats in or near mid- and late-successional mesic deciduous forests (Table 3- 97 and Table 3- 98). On the Chattahoochee National Forest, these older forests are allocated to prescriptions with medium and high objectives for early successional forest habitats at the highest rate in Alternatives F, D and B. Alternatives G and E are expected to result in associated edge at the lowest levels. For all alternatives except Alternative F, over 50 percent (range 54-96 percent) of these older forests are in prescriptions with low to no early-successional forest objectives. The differences among alternatives are much less

pronounced for the Oconee National Forest. In all alternatives, the majority of the existing mid and late successional mesic deciduous forests are allocated to prescriptions with medium or high objectives for early successional habitat. The associated edge effects are expected to be higher in Alternatives F, A, D, and B and lower in Alternatives G, I, and E.

Table 3- 97. Percentage Of Mid- And Late-Successional Mesic Deciduous Forest Acreage Allocated To Prescription Objectives For Early-Successional Forest By Alternative, Chattahoochee National Forest.[1]

Prescription Objective For Overall Percent Of Early-Successional Forest	Alternative						
	A	B	D	E		G	I
None	30	32	34	44	30	59	30
Low (0-4% of area)	40	22	22	50	13	37	44
Medium (4-10% of area)	29	44	21	4	1	4	24
High (10-17% of area)	1	3	23	3	57	0	1

[1]Source: IMI analysis using GIS stands data as modified for plan revision, Alt A-G 12/02/02; Alt I 8/26/03, Base year 2000.

Table 3- 98. Percentage Of Mid- And Late-Successional Mesic Deciduous Forest Acreage Allocated To Prescription Objectives For Early-Successional Forest By Alternative, Oconee National Forest.[1]

Prescription Objective For Overall Percent Of Early-Successional Forest	Alternative						
	A	B	D	E	F	G	
None	9	8	14	10	3	15	16
Low (0-4% of area)	5	9	1	15	<1	15	9
Medium (4-10% of area)	85	83	85	70	20	71	76
High (10-17% of area)	<1	0	<1	5	77	0	0

[1] Source IMI analysis using GIS stands data as modified for plan revision, Alt A-G 12/03/02; Alt I 8/23/03, base year 2000.

In the short-term, adverse effects of edge are most likely to occur in the three areas shown by analysis to be within landscapes less than 70 percent forested (Figures 3-10 and 3-11). Regardless of varying levels of edge created under plan alternatives, edge created on the rest of the forest is not expected to have significant short-term effects due to the current landscape context. High levels of forest regeneration on national forests could negatively shift percent of forest cover as calculated for this analysis; however, such effects would require simultaneous implementation of relatively high levels of regeneration over large landscapes. For the Chattahoochee National Forest, this situation is unlikely due to the prevalence of prescriptions with low to no early-successional forest objectives. These types of effects are more likely on the Oconee National Forest because of the greater representation of prescriptions with medium to high objectives for early successional habitat. However, even on the Oconee National Forest is in a largely forested landscape and these levels of early successional habitat are not expected to have significant effects. No alternative includes high levels of forest conversion to other land use types, and therefore no meaningful long-term change in landscape cover type is expected due to direct or indirect effects of national forest management. In the long-term, effects of forest

edge on the national forest will largely depend on the cumulative effects of land-use changes on private lands surrounding the national forest.

Alternatives that shift age-class distribution of mesic deciduous forests to younger age classes would have negative effects on interior birds through reduction in acreage of suitable habitat. Alternatives that include the highest rates of forest regeneration would most limit abundance of suitable habitat for these species.

Some positive effects may be expected where alternatives permit low to moderate levels of vegetation management for creation of young mesic hardwood forest patches, due to use of these habitats by fledgling birds for food and cover (Vega Rivera et al. 1998, Anders et al. 1998). The relative balance of these positive effects and potential negative edge effects is dependent on the landscape context and the relative abundance of mature and young forests. On balance, effects are expected to be positive where mid- and late-successional forests are common, and forest cover on surrounding landscapes predominate. The balance shifts to negative as landscapes go below 70 percent forest cover and young forests or forest openings become common.

Expected population trends for the MIS representing mature interior forests are shown in Table 3- 99 and Table 3- 100. To a large degree, population trends are expected to vary by alternative in direct relation to the abundance of mid- and late-successional forest habitats (Table 3- 65 and Table 3- 66). On the Chattahoochee National Forest, ovenbird populations are expected to be maintained near current levels or increase in all alternatives except Alternatives D and F (Table 3- 99). The greatest increases are expected in Alternatives E and G. On the Oconee National Forest, at year 10, wood thrush populations are expected to decline under Alternatives F, D, and A and be maintained near current levels in all other Alternatives (Table 3- 100). At year 50, wood thrush populations on the Oconee National Forest are expected to increase under all alternatives except Alternative F. Population trend estimates are based on expected trends in habitat quantity and quality.

Table 3- 99. Expected Population Trend[1] Of The Ovenbird 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- 100. Expected Population Trend[1] Of The Wood Thrush On The Oconee National Forest by Alternatives 10 And 50 Years Following Plan Adoption.

Time Period	Alternative						
	A	B	D	E		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

Regional Landscape Setting

Although the current supply of forest interior habitat on national forests within the analysis area is good to excellent (a range of 68 percent to 96 percent forest interior habitat; SAMAB 1996e), the context of land use trends is relevant, because conditions on surrounding private lands can adversely affect habitat suitability for forest interior bird on national forest land by increasing densities of cowbirds and nest predators. Currently, about 75 percent of the Southern Appalachian area is rural and privately owned. Forested private land within the region has declined by about 220,000 acres since 1982. Similarly, pasture and cropland have also decreased by about 300,000 acres. In contrast, developed acreage has increased by more than 600,000 acres, most prominently in the Blue Ridge and the Southern Mountain and Piedmont Sections (SAMAB 1996d).

Like agriculture and pasture land uses, developed acreage has a negative influence on forest interior species by encouraging nest predation by crows, jays, and mid-sized mammals, including domestic cats (Wilcove 1985; Crooks and Soule 1999; Hawkins 1998) and brood parasitism by cowbirds.

Rapid population growth, economic growth and diversification, better employment and wages, declining farming, and better housing translate into rising pressures on the natural resources of the Southern Appalachian region for the foreseeable future (SAMAB 1996d). New transportation corridors connecting communities will have direct and cumulative influences on development and subsequent loss of forested land.

Forested private lands adjacent to national forests reduce the influence of developed land on core areas of forest interior habitat on national forest. However, the continued forested condition is tenuous, and acreage will most certainly decrease. Future land use trends over the next 15 years will likely include a decrease in suitable forest interior habitat acreage found in large tract sizes, primarily due to development and increasing urbanization. The severity of edge effects and fragmentation will be most prominent in the currently agriculture-dominated landscapes (SAMAB 1996e: 72) especially in locations where national forest ownership occurs in small to medium patch sizes.

Chattahoochee and Oconee National Forests Landscape Setting

Projected population growth in the counties in proximity to the Chattahoochee and Oconee National Forests were used to assess the future risk of impacts from landscape-level edge effects (Table 3- 101 and Table 3- 102). On the Chattahoochee, bird productivity is likely most secure from landscape-level edge effects in Rabun, Fannin, and Towns Counties, which have moderately low projected human population growth, a high percentage of public land ownership, and very consolidated patterns of public ownership, both in Georgia and in adjacent National Forest lands in Tennessee, South Carolina and North Carolina. Bird productivity is least secure in Dawson, Catoosa, Walker, Whitfield, and Banks Counties, Georgia, which are characterized by more rapid predicted growth, smaller acreage in public ownership, and more fragmented public land ownership. In these counties critical social trends coincide with possible existing fragmented landscape conditions. Similarly on the Oconee National Forest, bird productivity is likely most secure from landscape-level edge effects in Jasper, Greene, and Putnam Counties, and less secure in Oconee and Morgan Counties.

Table 3- 101. Percent Of County In National Forest Ownership And Projected Population Change 2000-2010 For Counties In Proximity To The Chattahoochee National Forest.

COUNTY	% of County in NF Ownership	% Projected Population Change 2000-2010[1]
Catoosa	<0.1	15
Banks	0.4	12
Floyd	2.0	-<1
Gordon	3.5	11
Dawson	5.0	38
Whitfield	6.3	14
Walker	6.6	14
Chattooga	9.7	-7
Gilmer	20.0	10
Stephens	20.3	10
Habersham	22.4	5
Murray	23.3	14
White	26.7	18
Lumpkin	32.3	19
Fannin	43.0	12
Union	47.4	31
Towns	53.9	17
Rabun	62.6	5

[1]Source: U.S. Bureau of Census as reported by the Georgia State Data and Research Center 2002)

Table 3- 102. Percent Of County In National Forest Ownership And Projected Population Change 2000-2010 For Counties In Proximity To The Oconee National Forest.

COUNTY	% of County in NF Ownership	% Projected Population Change 2000-2010[1]
Monroe	<0.1	6
Morgan	0.1	17
Oconee	0.1	22
Oglethorpe	1.3	8
Jones	6.5	10
Greene	10.7	12
Jasper	12.8	9
Putnam	17.0	18

[1]Source: U.S. Bureau of Census as reported by the Georgia State Data and Research Center 2002)

Because of land ownership patterns, the majority of the Chattahoochee and Oconee National Forests are expected to remain within predominantly forested landscapes under all alternatives. Within these lands, mid- and late-successional mesic deciduous forests are expected to be common under all alternatives. Due to the combination of these factors, most national forest habitats are expected to support varying degrees of productive populations of forest interior birds under short-term implementation of all alternatives. As long as small regeneration areas and other openings constitute a relatively small proportion of the total landscape and cowbird foraging areas do not dramatically increase, most Chattahoochee and Oconee National Forests will likely continue to serve as source populations for surrounding, lower quality habitats for the foreseeable future. All alternatives would include monitoring of bird populations within these habitats, as well as changes in landscape context through re-evaluation of percent forest cover as new land cover data become available. Validation of forest interior bird productivity on national forests is a research need.

Permanent Openings, Old Fields, Rights-of Way, Improved Pastures

Affected Environment

Habitats considered here include permanent openings and old fields, utility right-of way, and improved pastures. Other early successional habitats such as woodlands, grasslands, and early successional forests are discussed elsewhere in this document.

Permanent Openings and Old Fields

Permanent grass/forb and seedling/sapling/shrub habitats are important elements of early successional habitat. Permanent openings typically are maintained for wildlife habitat on an annual or semi-annual basis with the use of cultivation, mowing, or other vegetation management treatments. These openings may contain native grasses and forbs or may be planted to non-native agricultural species such as clover, orchard grass, wheat, or small grains. Old fields are sites that are no longer maintained and are succeeding to forest or are maintained on a less frequent basis (5-10 year intervals, usually with burning and mowing). They are largely influenced by past cultural activities and may be dense sod or a rapidly changing field of annual and perennial herbs, grasses, woody shrubs and tree seedlings.

Permanent openings are used by a variety of wildlife, both game and non-game species. Parker et al. (1992) reported use of agricultural openings by 54 species of birds and 14 species of mammals in a study on the Chattahoochee National Forest. Bird species observed included wild turkey, several species of raptors and woodpeckers, and numerous songbirds including a number of neotropical migrants such as pine warbler, ovenbird, and black-throated green warbler. The greatest number of avian species and highest bird species diversity was found within the edge zone of the openings. Mammals observed included species such as white-tailed deer, striped skunk, woodchuck, bobcat, black bear, red bat, eastern cottontail, opossum, and several small mammals.

The benefits of permanent openings to white-tailed deer are well documented. Permanent openings, especially those containing grass-clover mixtures, are used most intensively in early spring, but also are an important source of nutritious forage in winter, especially when acorns are in short supply (Wentworth et al. 1990b, Kammermeyer et al. 1993). Kammermeyer and Moser (1990) found a significant relationship between openings and deer harvest with only 0.13 percent of the land area in high quality openings. Forest openings also are a key habitat component for wild turkeys throughout the year (Thackston et al. 1991, Brenneman et al. 1991). Maintained openings provide nutritious green forage in the winter and early spring and seeds during late summer and fall. Because of the abundance of insects and herbaceous plants produced in these openings they are especially important as brood rearing habitat for young turkeys (Nenno and Lindzey 1979, Healy and Nenno 1983). Linear openings, especially those associated with young regenerating forests provide optimal brood habitat conditions for ruffed grouse (Dimmick et al. 1996).

There also are numerous wildlife benefits from openings maintained in native species. Native warm season grasses provide nesting, brood-rearing, and roosting habitat for northern bobwhite and other grassland species of wildlife (Dimmick et al. 2002). Native species are well adapted to local environments and generally require less intensive maintenance following establishment.

Old fields provide food and cover for a variety of wildlife species. A number of disturbance-dependent birds, such as northern bobwhite, grasshopper sparrow, golden-winged warbler, and blue-winged warbler are associated with old field habitat (Hunter et al. 2001). Recently abandoned fields are important for rabbits and many small mammals (Livaitis 2001). Woodcock use old fields as courtship, feeding, and roosting sites (Straw et al. 1994, Krementz and Jackson 1999). Although managed less intensively than other types of permanent openings, some degree of periodic management is necessary to maintain these habitats.

There currently are approximately 1,300 acres and 350 acres of permanent openings (including old fields) on the Chattahoochee and Oconee National Forests, respectively (Table 3- 103). This represents 0.17 percent and 0.30 percent of the total national forest acres for these 2 units. A number of the openings are old farm sites that were in cultivation when the Forest Service lands acquired the lands. Others were created by the expansion of log landings following timber harvest or by closing and seeding old roads to create linear openings. Of the 1650 acres of existing openings on the Chattahoochee and Oconee National Forests, approximately 1175 acres are on State Wildlife Management Areas (WMAs) and are maintained by Georgia DNR personnel. USFS personnel maintain approximately 475 acres of openings outside of the WMAs. Many are planted in high quality grass-clover mixtures, which include combinations of white and red clovers along with wheat, rye, oats, orchard grass, and ryegrass. Some of the older openings are dominated by fescue and/or annual weed species, and some of the recently renovated openings are planted to grain sorghum.

Table 3- 103. Current Acreage And Percent Of Total Forest Acres Of Permanent Openings, Rights-Of-Way, And Improved Pastures On The Chattahoochee And Oconee NFs, 2002.

	Chattahoochee	Oconee
Total acres permanent openings [1]	1300 acres	350 acres
% of total Forest acres	0.17%	0.30%
Total Acres of ROW	324	997
% of total Forest acres	0.04%	0.86 %
Acres of Improved Pastures	0	627
% of total Forest acres	0%	0.54%

[1] *Includes old fields that are managed for wildlife*

Right-of-Way and Improved Pastures

Utility right-of-way (ROW) and improved pastures typically are managed for purposes other than to provide wildlife habitat. However, they can provide wildlife benefits if managed appropriately. Rights-of-way can be established and maintained in

plantings that enhance their benefits to wildlife. Once established, right-of-way maintenance costs generally are reduced. The conversion of fescue pastures to native warm season grasses improves habitat conditions for northern bobwhite and numerous grassland species (Dimmick et al. 2002).

Although pastureland acreage has declined over the last 50 years, pastures still comprise approximately 7 percent of the Southeastern United States (USDA Forest Service 2001). For the Southern Appalachian Assessment area, pastures comprise approximately 17 percent of the area, 99 percent of which is on private land (SAMAB 1996e). There are no comparable estimates for rights-of-way.

The current acreage in utility rights-of-way and improved pastures is shown in Table 3-103. There are 324 acres and 997 acres of right-of-way on the Chattahoochee and Oconee National Forests, respectively. Right-of-way acreage was estimated by multiplying the existing miles of ROW by an average width of 75 feet. The majority of these ROWs is in a mixture of herbaceous plants and shrubs and is maintained by periodic mowing/saw down. On the Oconee National Forest, approximately 20 acres of ROW have been established in wildlife food plants under the W.I.N.G.S. (Wildlife Incentives for Nongame and Game Species) program (E. Caldwell, pers. comm.). There are approximately 627 acres of fescue and Bermuda grass pastures on the Oconee National Forest managed under existing grazing allotments. There are no improved pastures on the Chattahoochee National Forest.

Direct and Indirect Effects

Permanent Openings and Old Fields

The management prescriptions vary in how they treat the creation and maintenance of permanent openings. Each prescription has been assigned to one of three options.

> Option 1 - Existing old fields and wildlife openings are not maintained, but are allowed to succeed to forest. In some cases, existing openings may be obliterated through tree planting and elimination of non-native species. New permanent wildlife openings are not created.
>
> Option 2 - Existing old fields and openings for wildlife may be present and maintained, but no expansion of openings or creation of new permanent openings of this type occurs. Native species are emphasized where feasible when establishing food plants for wildlife. Some openings provide permanent shrub/sapling habitats as a result of longer maintenance cycles.
>
> Option 3 - Existing old fields and openings for wildlife may be present and maintained. Expansion of existing openings and/or creation of new openings may occur. Non-invasive non-natives are sometimes used when establishing food plants for wildlife, but native species are used where feasible and cost effective. Some openings provide permanent shrub/sapling habitats as a result of longer maintenance cycles.

No specific objectives for the quantity of permanent openings are established in the revised forest plan. Through the prescription allocation process described above, the forest will be zoned into areas of varying intensity of opening maintenance and development. The desired amounts of openings for a specific portion of the forest will be determined through site-specific analysis.

Table 3- 104 and Table 3- 105 display the acres of existing permanent openings in each permanent opening option by alternative for the Chattahoochee and Oconee National Forests, respectively. Table 3- 106 and Table 3- 107 display the proportion of each forest by permanent opening option. The tables provide information both for the portion of the forests in State WMAs and for the Forests as a whole.

Existing openings located in prescriptions assigned to option 1 will not be maintained and over time, will revert to forested conditions. Examples include areas proposed for recommended Wilderness Areas, Research Natural Areas, Wild River corridors, and Old Growth areas with natural process emphasis. For the Chattahoochee National Forest, all Alternatives except Alternative F would result in the abandonment of some existing openings (Table 3- 104). Alternatives G and E would result in the abandonment of the greatest number of openings, resulting in a loss of approximately 10 and 5 percent of the existing acreage in openings, respectively. Given the very limited acreage in existing high-quality openings, this represents a substantial loss of valuable wildlife habitat. It also represents a significant loss in investment of money and manpower that was required to establish these 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, Chattahoochee, and Lake Burton, WMAs. The openings off the WMAs would be most impacted in Alternatives G and B. For the Oconee, Alternatives E and G would result in the abandonment of the largest acreage of existing openings, all of which are on Redlands WMA (Table 3- 105).

Table 3- 104. Acres of Existing Permanent Openings in each Permanent Opening Option by Alternative for State WMAs (WMA) and All National Forest Lands (TOTAL) on the Chattahoochee NF[1].

Alternative	Permanent Opening Option					
	Option 1 No Maintenance of Existing Openings		Option 2 Existing Openings Maintained/ No new openings		Option 3 Existing Openings Maintained/ New openings allowed	
	WMA	TOTAL	WMA	TOTAL	WMA	TOTAL
Alternative A	10.5	17.6	83.7	106.3	831.4	1176.6
Alternative B	3.1	18.9	88.7	123.4	833.9	1158.2
Alternative D	24.6	35.6	110.1	132.3	790.9	1132.6
Alternative E	58.8	65.9	142.7	177.1	724.1	1057.6
Alternative F	0	0	37.7	42.6	887.9	1257.9
Alternative G	105.9	134.2	342.0	445.0	477.5	721.3
Alternative I	5.2	6.6	105.8	136.4	814.6	1157.4

[1]Source: Plan Revision GIS permanent opening data layer, Alt A-G as of 11/27/02; Alt I as of 8/25/03, Base year 2002.

Table 3- 105. Acres of Existing Permanent Openings in each Permanent Opening Option by Alternative for State WMAs (WMA) and All National Forest Lands (TOTAL) on the Oconee National Forest[1].

Alternative	Permanent Opening Option					
	Option 1 No Maintenance of Existing Openings		Option 2 Existing Openings Maintained/ No new openings		Option 3 Existing Openings Maintained/ New openings allowed	
	WMA	TOTAL	WMA		WMA	TOTAL
Alternative A	6.4	6.4	0	11.2	242.0	332.7
Alternative B	6.4	6.4	0	3.3	242.0	335.6
Alternative D	6.4	6.4	14.9	21.6	227.1	321.4
Alternative E	23.3	23.3	0	8.3	225.1	318.7
Alternative F	6.4	6.4	0	6.0	242.0	337.9
Alternative G	22.4	22.4	4.0	14.7	222.0	313.2
Alternative I	6.4	6.4	3.9	3.9	238.0	328.5

[1]Source: Plan Revision GIS permanent opening data layer, Alt A-G as of 11/27/02; Alt I as of 8/25/03, Base year 2002.

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 (Table 3- 106). Alternative F would allocate the most acres to prescriptions that would allow new openings. 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. For all alternatives, some individual WMAs such as Chattahoochee, Chestatee, and Rich Mountain are allocated to prescriptions that would prohibit the construction of new openings over the majority of the WMA. In Alternative G, only 3 percent of the Chattahoochee WMA, less than 1 percent of Rich

Mountain WMA, and 0 percent of Warwoman WMA would permit new permanent opening construction. On the Oconee National Forest, all alternatives would allocate the majority of the forest to prescriptions that would allow new openings (Table 3-107).

Table 3- 106. Percentage Of The Chattahoochee NF In State WMAs (WMA) And For The Forest As A Whole (TOTAL) In Each Permanent Opening Option By Alternative[1].

Alternative	Permanent Opening Option					
	Option 1 No Maintenance of Existing Openings		Option 2 Existing Openings Maintained/ No new openings		Option 3 Existing Openings Maintained/ New openings allowed	
	WMA	TOTAL	WMA		WMA	TOTAL
Alternative A	27.8	20.3	7.3	8.3	64.9	71.3
Alternative B	26.2	21.8	5.0	8.3	68.7	69.9
Alternative D	29.5	22.4	5.8	7.2	64.6	70.4
Alternative E	31.2	23.7	13.0	10.8	55.7	65.5
Alternative F	24.7	16.8	4.9	3.9	70.4	79.3
Alternative G	36.7	30.6	19.8	33.5	43.4	35.9
Alternative I	25.9	17.8	9.3	13.0	64.8	69.2

[1]Source: Plan Revision GIS Management Prescription Allocations data layer, Alt A-G as of 11/27/02; Alt I as of 8/25/03.

Table 3- 107. Percentage of the Oconee NF in State WMAs (WMA) and for the Forest as a Whole (Total) in each Permanent Opening Option by Alternative[1].

Alternative	Permanent Opening Option					
	Option 1 No Maintenance of Existing Openings		Option 2 Existing Openings Maintained/ No new openings		Option 3 Existing Openings Maintained/ New openings allowed	
	WMA	TOTAL	WMA	TOTAL	WMA	TOTAL
Alternative A	1.5	0.9	1.5	4.9	97.0	94.2
Alternative B	1.5	0.9	1.5	4.1	97.0	95.0
Alternative D	1.5	0.9	6.9	9.4	91.6	89.7
Alternative E	6.0	3.2	1.5	3.3	92.5	93.6
Alternative F	1.5	0.9	<0.1	0.2	98.5	98.9
Alternative G	11.9	6.1	8.1	8.7	80.1	85.1
Alternative I	1.5	0.9	3.2	7.4	953	91.7

[1]Source: Plan Revision GIS Management Prescription Allocations data layer, Alt A-G as of 11/27/02; Alt I as of 8/25/03.

For the Chattahoochee and Oconee National Forests as a whole, all alternatives except Alternative G would permit the continued maintenance of the majority of existing openings and would allow for the creation of new permanent openings on a substantial portion of these forests. However, as discussed above, for some

individual WMAs on the Chattahoochee National Forest, some alternatives would result in the abandonment of a substantial number of openings and the ability to create new openings would be greatly limited. The same prescription allocations that would limit the ability to create and maintain permanent openings also would likely result in decreased hunter access and reduced vegetation management activities such as prescribed burning and the development of early successional habitats. These factors in combination could adversely affect hunting opportunities, especially on some individual WMAs.

Rights-of-Way and Improved Pastures

In general, existing utility rights-of-way will be treated similarly under all alternatives. Rights-of-way typically are managed by third parties who should be encouraged to manage these to the extent possible to enhance their value to early-successional species.

Improved pastures are limited to the existing grazing allotments on the Oconee National Forest. The forest has established a goal phase out individual grazing allotments when there is no immediate demand for a particular allotment. Because of the benefits of native warm season grasses to numerous species of wildlife, as they become available, the existing fescue pastures would be converted to native warm season grasses. These activities along with restoration efforts for grassland habitats (See Woodland, Savannah, Grassland section) should increase the availability of these habitats for grassland species.

Cumulative Effects

Permanent openings are a very important habitat element for a variety of wildlife species including both game and non-game species. However, they comprise a very small portion (0.2 percent) of the landscape of the Chattahoochee and Oconee National Forests. The habitat conditions provided in these permanent openings are very different from that provided by lawns, ball fields and golf courses that are much more common on adjacent private land. Generally, the openings on private land are not maintained in the high quality grass-clover mixtures available in the permanent openings. Therefore, most of the openings on private land do not provide comparable benefits to wildlife. In addition, the Forest Service does not have control of the management of the openings on private land. Areas that currently provide habitat may be developed in the future and therefore cannot be relied on to provide long-term wildlife benefits. It is important, therefore, to maximize the benefits from this limited acreage on the Forests by maintaining these openings in high quality habitat conditions. Other open-land habitats such as rights-of way and improved pastures are very abundant on private land. Because of the abundance of these habitats on private land, management of these habitats not a major focus of National Forest management.

SPECIAL HABITAT ATTRIBUTES

Riparian Habitats (Terrestrial)

Affected Environment

This section focuses on terrestrial habitat aspects of riparian areas; aquatic aspects of these ecologically important areas are covered under assessment of watersheds and aquatic systems.

Terrestrial riparian habitats encompass the transition area between aquatic systems and upland terrestrial systems. All wetlands (including beaver ponds), as well as margins of varying widths along streams, rivers, lakes, ponds, and reservoirs, are contained within terrestrial riparian habitats. These areas provide a number of critical functions for associated species. Most importantly, they provide rich, moist environments, not often found in upland areas. Riparian terrestrial habitats may serve as corridors for wildlife movement, allowing for daily travel and seasonal migration. The riparian area may serve as a connector of habitats and populations allowing gene flow to occur, thus keeping populations genetically vigorous (Harris 1988).

Riparian habitats ideally include a mosaic of native plant and animal communities and successional stages, with a predominance of late-successional forests. Late-successional riparian forests contain multiple canopy layers that provide a variety of ecological niches, thermal and protective cover, and maintenance of moist conditions. Decadence of older forests provide an abundance of snags and downed wood, which also help retain moisture and provide important habitat substrate for reptiles, amphibians, small mammals, invertebrates, and mosses and liverworts. The majority of riparian dependent species are associated with late-successional riparian forest conditions due to the diverse structure and the moist, temperature-moderated microclimates they provide. However, there are also species that require early-successional or shrubby riparian habitats. Terrestrial species of viability concern associated with riparian habitats on the Chattahoochee-Oconee are listed in Appendix E, Tables L1 and L2.

Disturbance regimes in riparian areas differ from those of adjacent uplands in important ways. Sheltered topographic positions and moist conditions generally reduce disturbance caused by wind and fire. Disturbance sources more common in riparian areas are beaver activity and flooding and channel scour, especially along stream banks. These operate in addition to more universal factors, such as insect and disease outbreaks. One of the most important disturbance factors in riparian areas for at least the past thousand years is anthropogenic clearing, which, even prior to European settlement, was sufficient to create large areas of early-successional riparian habitats such as canebrakes (Brantley and Platt 2001). Concentration of anthropogenic disturbances in riparian habitats was the result of the high fertility and level terrain of these areas. Such effects were likely most predominant along larger streams and rivers. Today, these same factors continue to

drive anthropogenic disturbance in these areas. The value of these areas for human uses has resulted in many riparian zones along major watercourses remaining in private ownership while upper reaches were converted to public ownership. Prior to European settlement, anthropogenic disturbance along smaller streams, which are more typical of national forest lands, was likely less extensive, resulting in a greater predominance of late-successional conditions in these riparian areas. The challenge for Federal land managers today is to try to restore, to the extent possible, the network of mature forest riparian corridors critical to many species and to water quality, while providing some level of quality habitats for those species adapted to early-successional riparian habitats.

The Southern Appalachian Assessment (SAA; SAMAB 1996) included analysis of cover classes within 100 feet of watercourses for the entire study area. Satellite data with 30-meter resolution were used, resulting in only larger watercourses being detected. The 100-foot corridor width was selected due to the precision of the database and because riparian corridors of 100-160 feet can be useful for correlation of the riparian landscape to stream habitat and biological integrity (SAMAB 1996: 72). Based on this analysis, within the SAA study area there are approximately 2.3 million acres in the riparian zone. Land cover classes for the riparian study area were: 70 percent forested, 22 percent pasture/herbaceous, 3 percent cropland, 4.3 percent developed/barren, and 0.7 percent wetland. Riparian forest cover varied across the study area from more than 90 percent to less than 25 percent, with the Ridge and Valley ecoregion tending to have less forest cover in the riparian zone than the Blue Ridge and other ecoregions. The analysis also found that "lands in Federal ownership, such as national forests and national parks, have significantly more forest cover in the riparian zone than do lands in other ownerships." Ownership of land in the riparian zone in the SAA area is mainly private, (approximately 85 percent) with national forests being the next major owner at approximately 10 percent. The remaining 5 percent is in national parks, the Cherokee Indians' ownership, other Federal holdings, and state parks and forests (SAMAB 1996:71-74).

Riparian areas are important habitat elements that are found in all of the management prescriptions. On the Chattahoochee-Oconee National Forest there are approximately 66,234 acres of riparian habitat associated with perennial and intermittent streams. This represents 8 percent of the forested acres on this unit.

Direct and Indirect Effects

Under all alternatives, riparian corridors are managed under the Riparian Corridor Prescription (MRx 11). Where the corridor has not been site-specifically determined, these corridors are defined by setting minimum widths of 100 feet on either side of perennial and intermittent streams on the Chattahoochee. On the Oconee the corridors are a minimum width of 100 feet either side of perennial streams and 50 feet on either side of intermittent streams. The management goal for riparian corridors is to maintain or enhance the structural and functional integrity of riparian areas and associated aquatic and upland systems. Riparian corridor characteristics important to structural and functional integrity for terrestrial wildlife include habitat connectivity, vegetation diversity (including age, species composition, and vegetation

layer diversity), vegetation vigor, abundance of snags and woody debris, and a width that is adequate to retain riparian habitat functions (Knutson and Naef 1997, Lassetre and Harris 2001). Riparian corridors include the concept of buffering streams to retain important stream functions, but they also encompass the functional aspects of riparian areas relative to uplands. Therefore, they present the opportunity to manage riparian habitat as a more completely functioning system in which streams and uplands mutually influence each other (Knutson and Naef, 1997, Tiner 1999). Zones around scoured ephemeral streams are also recognized as special areas, with standards designed to ensure their function as part of the riparian network

To provide for riparian integrity, management standards in the Riparian Corridor Prescription include provisions for maintaining desirable levels of woody debris, and controls on impacts from grazing, recreational uses, mineral development, and fireline construction. Vegetation management is limited to that needed to maintain or improve riparian function. Objectives and standards in the Rare Community Prescription (9.F) provide protection to wetland rare communities such as beaver ponds occurring in the riparian corridor. Lands in the riparian corridor are classified as not suitable for timber production. All of these standards and protective measures are present across all alternatives.

Implementation of the Riparian Prescription under all alternatives is expected to increase the acreage within riparian corridors that is in late-successional forest as a result of allowing forests in these areas to age. Increases in older forests would result in increases in abundance of snags and downed wood, important habitat components for many riparian associated species. It would also result in abundant and well-distributed habitats characterized by shaded, low-disturbance, moist-soil microsites, which are preferred habitat for a large number of species.

Forestwide objectives for canebrake restoration, creation of early-successional riparian forests, and creation of canopy gaps to increase structural diversity in closed canopy riparian forests, are included in all alternatives to provide for community diversity where needed within riparian areas. Only small proportions of riparian areas would be intentionally set back in succession to create habitat for dependent species, and would only be implemented where such conditions are lacking. Because of their small size and relative rarity, as well as their occurrence within a predominately mature forest matrix, patches of early-successional habitat are not expected to diminish the role of riparian areas as landscape corridors. Overall, trends are expected to create a distribution of both late and early-successional riparian forest on national forest land that is roughly similar to the conditions that supported associated species prior to European settlement.

Prescribed fire may occur within riparian corridors, most often as low intensity backing fires using streams as control lines. Because of their low intensity, these fires are not expected to substantially alter vegetation or leaf litter conditions. To maintain and restore fire-dependent rare communities such as canebrakes, prescribed fire also may be used more purposefully.

The Acadian flycatcher (*Empidonax virescens*) is selected as the Management Indicator Species (MIS) to indicate management-induced changes to mid- and late-successional riparian forest habitat on the Chattahoochee-Oconee. It is highly associated with mature deciduous forests along streams and bottomland hardwood habitat, which it uses for feeding and reproduction, and is not often found outside of these habitats during the breeding season (Hamel 1992). It is also effectively monitored using proven, consistent protocols. Presence of the Acadian flycatcher indicates riparian forests with relatively high levels of canopy cover and low levels of management disturbance - conditions required or preferred by many riparian associated species. It is relatively common in these habitats, providing enough data for evaluation. This species is selected to help indicate the effects of management activities on mature riparian habitats.

The direct and indirect effects of all alternatives would be positive for the Acadian flycatcher. Analysis indicates that under all alternatives, in 50 years the riparian corridors would move toward the desired condition for the species, i.e. mature to older-aged forests. Acadian flycatcher populations are expected to follow trends in mature riparian forest due to the close association between this species and habitat type. The population trend estimates in Table 3- 108 are based on expected trends in habitat quantity and quality.

Table 3- 108. Expected Population Trend[1] Of Acadian Flycatcher On The Chattahoochee-Oconee 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.*

The Swainson's warbler (*Limnothlypis swainsonii*) is selected as the MIS most appropriate to indicate the effects of management on the availability of early-successional riparian habitats on the Oconee, primarily canebrakes, and the effectiveness of management activities designed to favor the wildlife assemblages that rely on such habitats. Swainson's warbler is strongly associated with canebrakes, tangles, and thick shrubby understories of open bottomland hardwoods, and mixed forests (Hamel 1992). On the Oconee, the warbler is found primarily in an area with dense patches of cane. In some situations this species may be uncommon, making trend analysis difficult. Swainson's warbler populations would primarily be evaluated based on presence or absence in targeted habitat types.

Swainson's warblers would have less abundant habitat and thus lower total populations on the forest than would Acadian flycatchers. In addition to using management-created, early-successional riparian habitat, breeding Swainson's warblers could be present in older riparian forests that are open enough to support dense understories. Restoration and maintenance of early-successional riparian

habitat, primarily canebrakes, under all alternatives would ensure provision of a minimum base of available habitat for Swainson's warblers and other associated species. Population trend estimates are based on expected trends in habitat quantity and quality.

Table 3- 109. Expected population trend[1] of Swainson's warbler on the Oconee 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.

Cumulative Effects

Cumulatively, networks of riparian corridors across the national forest landscape have been fragmented by mixed ownerships and land use conversion. This condition is expected to persist across all alternatives. Alteration of riparian areas from conditions needed to support dependent species is most prevalent along larger rivers and streams, where the land is in private ownership. Although private land management actions often provide early-successional riparian habitat, they usually do not provide the quality of habitat required for associated species. The Riparian Corridor Prescription would provide management goals to maintain or enhance the structural and functional integrity of riparian areas and associated aquatic and upland systems on the Chattahoochee-Oconee, across all alternatives. The Rare Community Prescription would provide management and protection across all alternatives for rare wetland communities that occur in the riparian corridor. Expected trends for riparian areas on national forest land (i.e. moving toward mature forest dominance with a small component maintained in early-successional habitat) would contribute to sustaining and increasing the various associated species on the landscape.

Snags, Dens, and Downed Wood

Affected Environment

Large woody debris (including branches, large logs, stumps, and root wads) is an important habitat component both to streams and terrestrial areas. It is important both structurally and as a source of energy. Large snags provide birds with nesting and feeding sites, singing perches, and as lookout posts for predators and prey (Howard and Allen 1988). Bats roost and produce maternity colonies under exfoliating bark. Amphibians, reptiles, small mammals, and invertebrates utilize woody debris as cover. Animals use snags, logs, and stumps as den sites. Downed wood and logs are used for drumming by grouse to attract mates. Turtles and snakes use logs in streams and overhanging branches for basking and sunning. Large woody debris in riparian areas is used as cover by amphibians, insects, and other invertebrates, and small mammals. Small mammals utilize logs as travel ways. Fungi and other decomposers of woody debris are key components of food webs. Rotting wood tends to absorb moisture during wet periods and release it in dry periods thus helping to maintain a cooler microclimate (Ernst and Brown 1988, Knutson and Naef 1997).

Within the stream system, downed wood from riparian trees and shrubs greatly influence channel morphology and aquatic ecology. By obstructing stream flow, large woody debris stores and distributes sediment, and creates channel features, such as pools, riffles, and waterfalls. Wood also traps organic matter, which allows this material to be processed by instream organisms. Fish and insects occupy the pools and riffles created by the large woody debris, and riparian forest regeneration occurs on deposited sediment (Lassettre and Harris 2001).

Den trees, defined as living trees with hollows or cavities inhabited by animals, also are a critical habitat component for many species. They are used for nesting, roosting and hibernating. A number of species of potential viability concern are associated with snags, downed wood, or den trees (Appendix E, Tables L1 and L2).

Hunter (1990) states that little information is available on how much large woody material is sufficient to support associated species. He cites literature that reviews expert opinion on snags, with a recommendation of two to four snags per acre being a “reasonable target.” Generally, for most dependent wildlife, the more snags the better for associated species.

Snags, downed wood, and den trees are typically most abundant in late-successional forests. Mortality events such as storms and insect and disease outbreaks also influence the availability of snags and downed wood. Current abundance of late-successional forest by community type is shown under the section on Successional Forests. This information indicates late-successional forests are abundant on the Chattahoochee National Forest, comprising over half of the forested acres. Less than 20 percent of Oconee National Forest is in late-successional conditions. Recent southern pine beetle outbreaks have also increased the availability of snags and downed wood on these forests.

Based on information was gathered by the Forest Inventory Analysis (FIA) unit of the Southern Research Station, there are approximately 10.6 snags per acre on the Chattahoochee and Oconee National Forests combined. This estimate includes all dead trees greater than 5 inches dbh. By Ecological Section, these estimates ranged from 9.7, 10.6, and 15.9 snags per acre for the Blue Ridge Mountains, Southern Appalachian Piedmont, and Southern Ridge and Valley Sections, respectively.

Acres of late-successional forest is an appropriate indicator of the effects of management on these habitat elements because their relative abundance in this successional stage. The pileated woodpecker (*Drycopus pileatus*) is the best management indicator species for snags, dens, and downed wood. It requires large cavity trees for nesting, and forages on dead trees and downed logs across a variety of community types (Hamel 1992:190). Populations of this species are tracked by the annual Breeding Bird Surveys (BBS) and bird point counts conducted throughout the Southeast. The pileated woodpecker is common on both the Chattahoochee and Oconee National Forests and populations have remained relatively stable over the last decade (USDA Forest Service 2000).

Direct and Indirect Effects

Forestwide direction under all alternatives states that, unless necessary for insect or disease control or to provide for public and employee safety, standing snags and den trees would not be cut or bulldozed during vegetation management treatments unrelated to timber salvage. For timber salvage treatments, all live den trees, and a minimum of five snags per acre from the largest size classes would be retained. Distribution of retained snags may be clumped.

In even-aged regeneration areas where at least two snags per acre are not present or cannot be retained as residuals, at least two standing snags/acre would be created from the larger diameter classes within the original stand. In addition, a minimum of five of the largest living mature trees per acre would be retained to provide potential future snags during the early and mid-successional stages of stand development. Distribution of snags and live residuals may be scattered or clumped. Live den trees would not to be used for snag creation, but could count toward live residuals.

Forestwide direction for potential black bear den trees under all alternatives states that den trees would be left during all vegetation management treatments occurring in habitats suitable for bears. Potential den trees are trees that are greater than 20 inches dbh and hollow with a broken top.

With these provisions included under all alternatives, existing snags, downed wood, and den trees would be well maintained on national forest land. Fire may reduce snags and downed wood in fire-dependent communities, but can also cause some tree mortality creating new snags and downed wood. Reduced density of these habitat elements in fire-dependent communities is expected to be within the range of variability that typically occurred in these communities under historical fire regimes.

Recruitment of new snags, downed wood, and den trees is most dependent on providing abundant late-successional forests. Expected percentages of late-successional forests are presented under the Successional Forests section. For the Chattahoochee National Forest, the quantity of late-successional habitat would decrease at year 10, but increase by year 50 for all alternatives (Table 3-75). Alternatives G and E would provide the greatest amount of late successional habitat with associated snags, dens, and downed wood, while Alternatives F and D would provide the least.

For the Oconee National Forest, for all alternatives the quantity of late-successional habitat would slightly decrease at year 10 as compared to current conditions. However, at year 50, the availability of late-successional habitats and associated snags, dens, and downed wood would increase substantially under all alternatives.

With the above protection and management provisions and the continuous creation of more habitats through aging age-class distributions, all alternatives will result in an increasing abundance and improved distribution of these habitat elements over the next 50 years, with benefits to associated species. Increased mortality of trees due to forest health threats potentially would increase abundance of snags and downed wood regardless of management approaches (see cumulative effects discussion below). 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.

Because of their dependence on large snags, pileated woodpecker populations are expected to follow trends in snag availability and the abundance of older forests. Long-term population trends, therefore, should be positive under most alternatives. On the Chattahoochee National Forest, population levels are expected to be maintained at current levels at year 10 for all alternatives except D and F (Table 3-110). Alternatives D and F are expected to result in slight decreases in population levels at year 10. However, pileated woodpecker populations are expected to increase under all alternatives in year 50. The largest increases are expected under Alternatives A, E, G, and I. On the Oconee National Forest, pileated woodpecker population levels are expected to be maintained at current levels at year 10 and increase substantially at year 50 (Table 3- 111).

Because pileated woodpeckers breed at relatively low densities (2.1 pairs per 100 acres on average, Hamel 1992:C-4), obtaining robust datasets on populations is difficult. Therefore, to examine national forest trends in abundance of this species, data will likely need to be pooled with that from other national forests within the ecoregion and evaluated by comparing national forest trends with overall regional and range-wide trends. Population trend estimates are based on expected trends in habitat quantity and quality.

Table 3- 110. Expected Population Trend[1] Of Pileated Woodpecker On The Chattahoochee NF by Alternative, 10 And 50 Years after 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- 111. Expected Population Trend[1] Of Pileated Woodpecker 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

Across landscapes containing the national forest, national forest lands are expected to provide a disproportionately large share of the best quality habitats for species associated with snags, downed wood, and den trees. This result is expected because of the greater abundance of older forests on national forest as compared to private lands (see section on Successional Forests). This disparity is expected to increase over time as other land uses affect abundance of older forests on private lands. Forest health threats also are expected to substantially add to cumulative effects on these habitat elements, by increasing tree mortality. The increasing number of threats and increasing severity of effects has created an abundance of snags and downed wood at many locations on the national forest. This trend is expected to continue into the foreseeable future as forests age and many threats expand their zone of influence (see section on *Forest Health*). While national forest management can reduce the severity of tree mortality in some locations, forest health threats are nevertheless expected to have a substantially positive effect on abundance and distribution of snags and downed wood under all alternatives. Den trees, which generally need longevity to become high quality habitat elements for wildlife, are likely to be negatively affected by forest health threats across alternatives.

Aquatic Habitats

Affected Environment

The Chattahoochee National Forest (NF) has 2,436 miles of perennial streams (Table 3- 112). About 1,770 miles (72 percent) are classified as cold water streams. The remaining 666 miles (28 percent) are classified as cool water streams.

Most of the cold water streams have steep gradients (more than 4 percent) and are small, order 3, to medium sized streams, order 7 (Strahler 1957). Cold water aquatic habitat consists primarily of narrow, shallow pools with numerous cascades and waterfalls. Predominate fish cover is of boulders and rock ledges. Lower gradient stream segments in these headwaters provide more optimum fish and macro-invertebrate habitat of long riffles and deep, long pools with abundant woody debris.

In these cold water streams, the diversity of fish species and number of individuals is low compared to warm or even cool water streams. The dominant predatory fish in these streams is trout (Salmonidae). Coldwater streams generally have water temperatures that seldom exceed 72^{o} F in the summer. Factors attributing to low biological diversity are water chemistry parameters, as well as the comparatively low number of species adapted to cold water with high flow regimes. Water quality in coldwater habitats is generally described as infertile with total alkalinity less than 20 ppm; total hardness less than 20 ppm; and neutral (pH 7.0) to slightly acid (pH 5.5).

Salamanders are the most abundant at these higher elevations. The most important limiting factor to the occurrence of salamanders is moisture content. Salamanders depend on their skin remaining moist at all times. In higher elevations, temperatures are cooler, resulting in lower evaporation rates. In addition, moisture content is high in these headwater streams due to dense canopy cover and high rainfall. The highest diversity as well as number of salamanders is in areas of high elevations within the Blue Ridge ecoregion. This richness is due to the topography structure and habitat diversity of this ecoregion.

Below about 1,200 feet in elevation, streams are generally cool water. These streams are less suitable for trout but the diversity of fish increases due to increased nutrients, warmer water, slower stream flows and increased stream widths and depths creating more habitat niches. The habitat within these streams consists of longer, deeper pools with less gradient than those of cold water. Woody debris provides additional cover to boulders and rock ledges. Mussels are likely to occur in slow riffles, long pools and backwater areas. The highest diversity of mussels on either forest occurs in the Conasauga River. The dominant predatory fish is redeye bass, *Micropterus coosae*, except in the Tennessee drainage where smallmouth bass, *Micropterus dolomieu*, are the dominant predator. Cool water habitats generally have slightly higher alkalinity and hardness levels but the pH levels are comparable to the coldwater streams. These streams have water temperatures that exceed 72^{o} F in the summer for extended periods. Stream size (order) is similar to

coldwater streams with only a small percentage being classified as large rivers, order 8 or 9 (Strahler 1957).

Cold and cool water streams are stocked with trout. The Georgia Department of Natural Resources, annually stocks 144 miles of stream with brown and rainbow trout on at least 35 streams on the Chattahoochee NF. An annual average of 500,000 trout are stocked in streams across the Chattahoochee NF. An annual average of 120,000 trout stamps are sold by the Georgia Department of Natural Resources (Georgia DNR pers. comm.). Most of the trout stamps sold are for fishing on Chattahoochee NF streams.

The Oconee National Forest (NF) is within the Piedmont ecological section. There are 393 perennial stream miles on this forest (Table 3- 112). These are cool to warm water streams and have a high diversity of fish species, dominated by predators in the sunfish and catfish families. These waters are described as fertile with high nutrient levels, neutral pH and low gradients. A relatively high number of fish species are adapted to live in these waters in niches of pools, riffles and glides with abundant cover of undercut banks, woody debris and rock substrate.

Approximately 100 miles of the perennial streams on the Oconee NF supports a fishery of shoal bass (*Micropterus* sp.), redeye bass (*Micropterus coosae*), white bass (*Morone chrysops*), largemouth bass (*Micropterus salmoides*), redbreast sunfish (*Lepomis auritus*), bluegill (*Lepomis macrochirus*) and redear sunfish (*Lepomis microlophus*), as well as members of the catfish family (Georgia DNR pers. comm.). The best fishery on this forest is on the Ocmulgee River, where shoals and long, deep pool habitat are abundant.

Table 3- 112. Perennial Stream Habitats That Occur on the Chattahoochee-Oconee NF

Forest	Supports Aquatic Habitat for	Miles	Fishable
Chattahoochee	Aquatic invertebrates, amphibians, fish	2,436	800 miles
Oconee	Aquatic invertebrates, amphibians, fish	393	100 miles

In addition to streams, impoundments occur within the proclamation boundaries on both forests. The Forest Service only manages waters inside the forest boundary. Waters outside the forest boundary but inside the proclamation boundary are managed by the Tennessee Valley Authority, Georgia Power Company and University of Georgia. However, these impoundments outside of the forest boundary may be affected by Forest Service activities, such as aesthetics, sedimentation and special designations (eg. Wilderness).

Impoundment acreage is approximately 19,449 within the proclamation boundaries of the Chattahoochee NF and 34,555 acres within the Oconee NF (Table 3- 113 and Table 3- 114); however, only 16 small impoundments, a total of 265 acres, occur on Forest Service lands. Twelve of these impoundments are on the Chattahoochee NF and four occur on the Oconee NF.

The largest impounded waters under Forest Service ownership, occur on the Chattahoochee NF, with six impoundments ranging in size from 10 to 95 acres. Four of these are cold-to-cool water impoundments and are stocked with trout. No federally-listed threatened, endangered or Forest Service sensitive aquatic species depends on this type habitat on the forest. The other two larger impoundments are within the Piedmont ecological section of the Chattahoochee NF and are stocked primarily with catfish.

All impoundments are managed for the primary purpose of providing recreational fisheries. On the Chattahoochee NF, impoundments in the headwaters are inherently infertile reflecting the alkalinity, hardness and pH values of their tributaries. On the Oconee NF and within the Piedmont physiographic region on the Chattahoochee NF, impoundments are warm water and reflect higher fertility levels. Impoundments may be limed periodically to raise alkalinity levels to uptake the addition of fertilizer. Only one forest-sensitive aquatic species depends on this habitat type.

Impoundments are surveyed during early summer, when the young of the year of the sunfish family are in shallow water. Seining the shoreline aids in determining the predator to prey ratio (bass to bream) within the impoundment. This information is used to determine management activities.

Game fish of trout, bass, catfish and bream are managed to yield the highest fishing return. This return is achieved by maintaining a balance of prey fish to those of predators, providing adequate fish cover and high nutrient levels.

Table 3- 113. Impoundments Within the Chattahoochee NF Proclamation Boundary.

Reservoir	Acres in Proclamation Boundary	Ownership
Lake Burton	2,775	Georgia Power Company
Seed Lake	260	Georgia Power Company
Lake Rabun	780	Georgia Power Company
Tallulah Falls Lake	63	Georgia Power Company
Tugalo Lake	597	Georgia Power Company
Yonah Lake	293	Georgia Power Company
Lake Chatuge	6,950	Tennessee Valley Authority
Lake Nottely	4,181	Tennessee Valley Authority
Lake Blue Ridge	3,290	Tennessee Valley Authority
Duckett	1	Forest Service
Irwin Pond	1	Forest Service
Nancytown	10	Forest Service
Lake Russell	94	Forest Service
Toccoa Water Supply	3	Forest Service
Winfield Scott	18	Forest Service
Rock Creek	12	Forest Service
Conasauga Lake	17	Forest Service
Jones Creek Lake	95	Forest Service
Murray's Lake	4	Forest Service
Peeple's Lake	2	Forest Service
Dockery Lake	3	Forest Service
Total Acres	19,449	

Table 3- 114. Impoundments Within the Oconee NF Proclamation Boundary

Reservoir	Acres in Proclamation Boundary	Ownership
Lake Oconee	19,160	Georgia Power Company
Lake Sinclair	15,300	Georgia Power Company
Rock Eagle Lake	80	University of Georgia
Miller Creek Lake	12	Forest Service
Hillsboro Lake	1	Forest Service
Mt Gilead Pond	1	Forest Service
Oconee Work Center Pond	1	Forest Service
Total	34,555	

Aquatic Biota

There are 156 species of fish in watersheds with Chattahoochee NF ownership and 70 fish species within watersheds with Oconee NF ownership. Most of these fish species do not occur on Forest Service lands. There are 43 watersheds (5th level) on the forests which occur within 3 different ecological sections: Piedmont, Blue Ridge and Ridge and Valley. These ecological sections have been instrumental in the evolution of their associated fish taxa. Differences in ecological sections are changes in water chemistry, habitat substrate and elevation. The highest diversity of fish of the 43 watersheds for both of the Forests is the upper Conasauga watershed with 73 fish species, 9 of which are federally-listed threatened or endangered, or Forest Service sensitive (Table 3- 115).

Numerous introductions of salmonids have occurred on the Chattahoochee NF. These include all three trout species, brown (*Salmo trutta*), rainbow (*Oncorhynchus mykiss*) and brook (*Salvelinus fontinalis*). Brook trout are thought to be native only to the Tennessee watersheds. Both forests have had numerous other introductions, primarily of the catfish and sunfish families.

Table 3- 115. Total Number Of Fish Species, Including Non-Natives, Occurring For The 43 Watershed Management Areas.

Watershed Name	5th HUC	Fish Species
Chattooga River	306010201	38
Tallulah River	306010207	37
Tugaloo River-Panther Creek	306010206	43
Broad River-North and Middle Forks	306010401	45
Oconee River-Big Creek	307010106	45
Oconee River-Greenbrier Creek	307010107	48
Appalachee River-lower	307010109	45
Richland Creek	307010111	46
Oconee River-Sugar Creek	307010110	47
Little River-upper	307010114	49
Little River-lower	307010115	47
Murder Creek	307010116	48
Big Cedar Creek	307010117	48
Ocmulgee River-Big Sandy Creek	307010310	67
Ocmulgee River-Rum Creek	307010313	69
Chattahoochee River-Chickamauga Creek	313000101	37
Soque River	313000102	36
Chestatee River-Dicks Creek	313000105	38
Chestatee River-Yahoola Creek	313000106	38
Conasauga River-upper	315010101	73
Conasauga River-middle	315010102	68
Coahulla Creek	315010103	50
Holly Creek	315010104	48
Conasauga River-lower	315010105	70
Cartecay River	315010201	29
Ellijay River	315010202	34
Mountaintown Creek	315010203	21
Coosawattee River-Carters Lake	315010204	63
Oostanaula River-upper	315010301	56
Johns Creek	315010303	39
Little Armuchee Creek	315010304	35
Armuchee Creek	315010305	39
Etowah River-upper	315010401	64
Amicalola Creek	315010402	48
Chattooga River-upper	315010504	40
Chattooga River-lower	315010505	40
Little Tennessee River	601020201	42
Little Chickamauga Creek-East Chickamauga Creek	602000109	67
Hiawassee River-Chatuge Lake	602000201	57
Brasstown Creek	602000204	51
Nottely River-Nottely Lake	602000208	51
Toccoa River-upper	602000301	50
Toccoa River-middle	602000302	50

The following federally-listed threatened or endangered, and Forest Service sensitive species occur within watersheds which have some Forest Service ownership (Table 3-116). For all species, occurrences are noted as occurring on or off Forest Service lands. 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.

Table 3- 116. Total Number of PETS Fish, Mussel, Crayfish and Insect Species Occurring On and Off the Chattahoochee-Oconee NF For Each of the 43 Watersheds.

Watershed Name	PETS(ON)				PETS(OFF)				Total
	Fish	Crayfish	Mussels	Insects	Fish	Crayfish	Mussels	Insects	
Chattooga River				5	1				6
Tallulah River	1			3					4
Tugaloo River-Panther Creek				3	1				4
Broad River-North and Middle Forks				3	1				4
Oconee River-Big Creek	2		1	2					5
Oconee River-Greenbrier Creek			1	2	2				5
Appalachee River-lower				2	2				4
Richland Creek				2	2				4
Oconee River-Sugar Creek				2	2				4
Little River-Upper				2	2				4
Little River-lower	2			2					4
Murder Creek	2			2					4
Big Cedar Creek	1			2	1				4
Ocmulgee River-Big Sandy Creek	3			2					5
Ocmulgee River-Rum Creek	2				1				3
Chattahoochee River-Chickamauga Creek				3	1				4
Soque River				3	1				4
Chestatee River-Dicks Creek					1				1
Chestatee River-Yahoola Creek				3	2				5
Conasauga River-upper	3		4	5	5	1	4		22
Conasauga River-middle	2			5	7	1	8		23
Coahulla Creek				5	3		1		9
Holly Creek	1			5	2		7		15
Conasauga River-lower				5	3		1		9
Cartecay River				5	1				6
Ellijay River	1			5	1				7
Mountaintown Creek	1			5	1				7
Coosawattee River-Carters Lake				5	3				8
Oostanaula River-Upper				5	2				7
Johns Creek				5	1				6
Little Armuchee Creek				5					5
Armuchee Creek			1	5			1		7
Etowah River-upper	2			5	4				11
Amicalola Creek		1		4	4				9
Chattooga River -upper	1			5	1				7
Chattooga River-lower				5	1				6
Little Tennessee River	1	1		2	3				7
Little Chickamauga Creek-East Chickamauga Creek	1	1		2	1				5
Hiawassee River-Chatuge Lake	1	1		2	2				6
Brasstown Creek				2	3				5
Nottely River-Nottely Lake	1			2	2				5
Toccoa River-upper	3			2					5
North, East, West Forks Chattooga River			1	4					5
Toccoa River-middle				2	3				5

There are six federally-listed fish species within watersheds with Chattahoochee NF ownership, three of these fish occur on the forest within the Coosa watershed: blue shiner (*Cyprinella caerulea*), Conasauga logperch (*Percina jenkinsi*) and Etowah darter (*Etheostoma etowahae*) (Table 3- 117). The three federally-listed fish species which occur off forest at distances greater than one mile from the furthest downstream Forest Service boundary are the Cherokee darter (*Etheostoma scotti*), goldline darter (*Percina aurolineata*) and amber darter (*Percina antesella*). There are no federally-listed fish species on or near the Oconee NF.

Of the 16 Forest Service sensitive fish species, 13 occur in watersheds of the Chattahoochee NF. Six sensitive fish species are within the Coosa watershed, with four fish occurring on the Forest: the holiday darter (*Etheostoma brevirostrum*), trispot darter (*Etheostoma trisella*), lined chub (*Hybopsis lineapunctata*) and frecklebelly madtom (*Noturus munitus*). The other two Forest Service sensitive fish within the Coosa watershed occur off forest at distances greater than one mile from the furthest downstream Forest Service boundary: freckled darter (*Etheostoma lenticula*) and coldwater darter (*Etheostoma ditrema*). There are four Forest Service sensitive listed fish in the Tennessee watershed, the olive darter (*Percina squamata*), wounded darter (*Etheostoma vulneratum*), mountain brook lamprey (Ichthyomyzon geeleyi) and fatlips minnow (*Phenacobius crassilabrum*), all of which occur on forest. The other two sensitive species occur in the Chattahoochee watershed, the bluestripe shiner (*Cyprinella callitaenia*), occurs off the forest and within the Tallulah watershed, the highscale shiner (*Notropis hysilepsis*) occurs on the forest.

Three of the 16 Forest Service sensitive fish occur in watersheds on the Oconee NF, all of which occur on the forest: Ocmulgee shiner (Cyprinella callisema), Altamaha shiner (*Cyprinella xaenura*) and robust redhorse (*Moxostoma robustum*) (Table 3-118).

On both forests, all federally-listed mussels occur only in the Coosa watershed. The Conasauga River, within the Coosa watershed, historically supported 37 mussel species, only 27 of these species of mussels currently exists (Ryan 2001). Of these 27 mussel species, 9 are federally-listed within the Conasauga watershed. Only 2 of the 9 federally-listed species occur within the Chattahoochee NF boundary, the fine-lined pocketbook (*Lampsilis altilis*) and southern pigtoe (*Pluerobema georgianum*). On the Chattahoochee NF, there are 5 species of mussels listed as Forest Service sensitive within the Coosa River watershed, only 2 of these species occur on the forest, the Alabama rainbow (*Villosa nebulosa*) and Alabama creekmussel (*Strophitus connasaugaensis*) .

The only other Forest Service sensitive listed mussel species occurring on the Chattahoochee NF, the brook floater, is within the Savannah watershed. Only one mussel species listed as Forest Service sensitive occurs on the Oconee NF, the inflated floater (*Pyganodon gibbosa*), an endemic to the Altamaha watershed.

There are 27 species of crayfish within Chattahoochee NF watersheds, none of which are federally-listed . Six of the 27 crayfish species are Forest Service sensitive, four are known to occur on or within close proximity to lands of the Chattahoochee NF:

Cambarus chaugaensis, Cambarus extraneus, Cambarus georgiae and *Cambarus parrishi. Cambarus speciosus* and *Cambarus cymatilis* occur off of the forest at distances of greater than one mile from the furthest Forest Service downstream boundary. Only three crayfish species are known from the watersheds of the Oconee NF, none of these have conservation concerns.

There are no federally-listed aquatic insects on either forest. Five aquatic insect species are listed as Forest Service sensitive: Georgia beloneurian stonefly (*Beloneuria georgiana*), Cherokee clubtail (*Gomphus consanguis*), mountain river cruiser (*Macromia margarita),* Edmund's snaketail (*Ophiogomphus edmundo)* and Appalachian snaketail (*Ophiogomphus incurvatus*). Two of these five species occur within all 43 watersheds. Only the Coosa watershed has all five species occurring on or near the forest. The Chattahoochee watershed and the Savannah watershed have an additional two species, a total of four sensitive species on or near the forest. The Oconee NF does not have any additional sensitive species other than the two that occur throughout both forests.

Table 3- 117. Four Groups Of PETS Aquatic Species With Conservation Concerns On Or Within Watersheds Of The Chattahoochee NF.

Group	Number of Species		
	Endangered	Threatened	FS Sensitive
Insects			5
Crayfish			6
Mussels	8	1	6
Fish	4	2	12

Table 3- 118. Four Groups Of Aquatic PETS Species With Conservation Concerns On Or Within Watersheds Of The Oconee NF

Group	Number of Species		
	Endangered	Threatened	FS Sensitive
Insects			2
Crayfish			0
Mussels			1
Fish			3

Several fish species are imperiled within watersheds that contain National Forest lands. National Forest lands, however, make up only a small fraction of their associated ranges. Forest Service activities should not negatively affect aquatic species due to the use of site specific planning/mitigation and guidance requiring the use of the latest BMPs, forestwide standards and the Riparian Corridor Management Prescription.

Direct And Indirect Effects

Riparian health is imperative for the quality of the aquatic community. A healthy riparian corridor along the stream ensures stabilization of water temperature, soils and food sources. In addition, trees within the corridor fall into the stream to provide fish cover. Deep pools, which provide thermal refuge, are created from stream flows scouring around fallen trees or around root wads along the stream bank. Trees within the corridor also provide woody debris and leaf litter providing habitat cover and food sources for aquatic macroinvertebrates. The riparian corridor also captures sediment and other non-point pollutants, preventing them from entering the stream. To protect aquatic habitats and organisms, riparian corridors (refer to *Riparian Corridor* section) are maintained or established along all perennial and intermittent streams on Forest Service lands.

Management activities within these corridors are determined by site-specific analysis. Ephemeral streams outside of the riparian corridor are protected by forestwide standards. When projects are implemented with full consideration of these standards, no direct or indirect adverse effects to aquatic organisms or to the aquatic habitats that sustain them are expected (USDA Forest Service 1973).

Salamanders, diversity and abundance are strongly tied to moisture. There are 30 species of salamanders that occur on the Chattahoochee-Oconee National Forests. Life history traits of salamanders are interfaced with the terrestrial and aquatic habitats, except for three species (hellbender, *Cryptobranchus alleganiensis*, mudpuppy, *Necturus maculosus* and shovel-nosed salamander, *Desmognathus marmoratus*), which are entirely aquatic. Vegetation management that reduces canopy cover in mesic forests, decreasing moisture content, will have the greatest impact on salamanders as compared to harvesting in drier forest types (Dr. Camp, pers. comm. 2003). The loss of canopy shade from tree cutting in mesic forests is the greatest threat to salamanders (Ford et. al 2002). Mesic forests, especially those in high elevations, as well as cove hardwood stands have the greatest potential for speciation due to topographic isolation. However, the scale of vegetation management within high elevations and cove hardwoods is small for managing the Chattahoochee National Forest. The Chattahoochee National Forest has approximately 97 percent of the high elevation acreage (above 3,000 feet) in Georgia. This amounts to about 110,000 acres, 17% of the total acreage on the Chattahoochee National Forest. About 52,000 acres of the 110,000 acres (48%) is unavailable for vegetation management because it is allocated to Wilderness, Wilderness study, roadless and backcountry prescriptions. Of the 58,000 acres of the 110,000 acres available for active vegetation management, less than 1% above 3,000 feet in elevation is currently in early-successional forest type (0-10 year age class). Vegetation management of cove hardwoods is projected at 4% of the total acreage of cove hardwood every 10 years.

In addition, vegetation management on both forests would not occur in rare communities, such as glades, bogs and wetlands under any alternative, except where needed to maintain or restore composition, structure, or function of these communities. For these reasons, vegetation management is expected to have limited

adverse effects to salamander populations. Impacts will be further limited by site specific analysis, BMPs, forestwide standards and the Riparian Corridor Prescription.

Roads located within the riparian corridor that either parallel or cross a stream present the greatest potential for sediment impacts to surface waters. Roads affect the timing and volume of stream discharges by intercepting and concentrating surface and subsurface flows and expanding or decreasing the channel networks and reducing infiltration. The historic hydrological patterns within a watershed may be altered affecting the functions and processes to which the riparian and its inclusive aquatic communities have adapted. Studies (Van Lear 1995) have shown that the greatest source of sediments on Forest Service lands are from unpaved roads. There are 1,538 miles of permanent system roads on the Chattahoochee-Oconee NF.

Vegetative management (timber management) should have minimal-to-no effects to aquatic populations due to site specific analysis, BMPs, forestwide standards and the Riparian Corridor Management Prescription. Protective measures restrict activities within the riparian corridor. Shade cover along the streams will be maintained within these corridors, which aid in the regulation of water temperatures as well as stabilize the stream banks from erosion. In addition, these trees along the stream banks are essential components in the continuous replacement of large woody debris to stream channels. Large logs and stumps create diverse habitat niches in streams vital to aquatic organisms and provide spawning habitat by species such as the federally-listed threatened blue shiner, *Cyprinella caerulea.*

Stream temperature is routinely monitored in trout waters on the Chattahoochee National Forest. From 1990 through 2002, thermographs were placed in 161 stream segments of 45 streams. These measurements were taken during the late spring and summer months to determine if temperature was a stressor to trout during the warmest time of year. A number of thermographs were representative of the potentially warmest waters on the Chattahoochee NF by being placed at or near the downstream boundary of Forest Service lands. Even in areas of the Chattooga River watershed, which has one of the highest road densities on the forest, water temperatures were below thermal thresholds for trout. Of the 161 thermographs readings, only those in the main stem of the Chattooga River at Highway 76 (not designated as trout waters by the Georgia Department of Natural Resources) were above the threshold of 72 degrees Farenheit. This section of stream does not support trout and is considered a cool water fisheries, where redeye bass, is the dominant game fish.

No point source pollution sites are on Forest Service lands in Georgia. On Forest Service lands, the transport of some hazardous materials including diesel fuel, oil, and pesticides occurs but is usually limited to: 1) private individuals using roads that lead to private residences; 2) campers and other recreating publics; and 3) loggers and other contractors working under Forest Service contracts. Forest Service does transport diesel fuel, pesticides and herbicides, but there are very strict rules that regulate their transport (refer to VEG EIS in forest plan). In addition, Forest Service outside contracts specify safe handling measures for hazardous materials.

Impacts from impoundments are usually due to their placement in large rivers where large riverine fish move sometimes great distances to fulfill their life history traits. These large impoundments create barriers which may result in genetic fragmentation of populations by restricting movement for spawning. They may also affect the aquatic environment by altering flow, temperature and chemical composition. Impacts to the hydrologic functions may occur from impoundments, dewatering stream flows. This loss of stream water is due to higher evaporation rates in impounded waters as compared to streams.

The 12 small Forest Service impoundments on the Chattahoochee National Forest are on streams where fish diversity is naturally low, primarily trout waters. The four on the Oconee National Forest are in warm water, predominated by the sunfish and catfish families. All impoundments have little influence on stream flow or fragmentation. All impoundments within the Forest Service boundary do not alter flow because they are not used for water storage, flood control, water supply, power generation or other water uses (Georgia Department of Natural Resources, pers. comm.). There is no delay in the release of water coming into the impoundment to those flows exiting the impoundment. Flows are continuous and not restricted. Impoundments remain at capacity and incoming water flows are equal to out flow of waters. Flows are altered approximately every five years for each impoundment to reduce water levels in order to construct or maintain structures. These draw downs usually occur during low flow seasons, such as winter. During draw down, flows increase for two to three days to lower impoundment levels. The flow would then regain its former volume, where flow coming in would again equal out flow just with a lower impoundment pool level. Flows would be decreased for two to three days when the impoundment is refilling. However, flows would never be completely shut off. These small impoundments should have minimal affects on aquatic habitats and only affect localized short reaches of streams. The effect of dewatering would be minimal from Forest Service impoundments due to most are cool to cold water, reducing evaporation rates.

Road crossings may be a potential barrier to movement of aquatic biota on the forests. Migration and movement of aquatic species can be restricted at road crossings by culvert pipes that create high water velocity, inadequate swimming depths, or substantial drops off at the downstream end of the pipe or any combination of these factors. Culverts crossings were bi-directional barriers to fish movement despite a range of flow conditions (e.g., bank-full flows) (Warren and Pardew, 1998). These barriers may result in localized population fragmentation, primarily at large river crossings, where movement is imperative for spawning for some species. Forest Service ownership of large rivers sections is minimal on either forest in Georgia. In areas where the Forest Service does own large river sections or in river sections where federally-listed aquatic species occur, road crossings will be assessed to determine .

Recreational activity, developed and dispersed, can potentially affect riparian areas and water quality. At most sites on the forests, these impacts are confined to the immediate area and have minimal impact to the water body and are primarily visual impacts. However, there are recreational sites along the streams or along water

courses which drain into streams which have barren soils, little to no streamside vegetation, and streambank erosion from heavy ATV, horse, foot traffic or other recreational use. Erosion from these sites may impact the stream by sediments filling in pool habitats and interstitial spaces in rock substrates. These interstitial spaces are used for spawning by fish and are habitat for benthic fish and macroinvertebrates. Deep pools are especially crucial during summer months for thermal refuge for species sensitive to increases in water temperature.

Currently there are 680 miles of non-motorized trails and 134 miles of motorized trails on both forests. Impacts of sediment into the aquatic system can be substantial from these trails and their associated stream crossings. These impacts are usually a result of high use on highly erosive soils, resulting in deeply eroded trenches. These trenches deliver high amounts of sedimentation to streams during rain events. Other sources of sediment from trails are steep trail approaches to the stream crossings. Most damage, however, is primarily from illegal trail use.

Effects of prescribed fire on salamander populations on the Chattahoochee National Forest are expected to be minimal due to the timing of burning, which occurs primarily in February and March when salamanders are dormant and buried underground. In warm-winter areas such as the Oconee National Forest, frequent winter burns could potentially harm amphibians (Matt Elliott, pers. comm. 2003). Species active at this time of year include spotted, marbled, mole, and four-toed salamanders. They are found during this season primarily in moist habitats, such as bogs and wetlands. Since these areas, due to high moisture content, would be less likely to burn, and, when they do, burn at lesser intensity than upland areas, they may not be threatened by fire. Periodic fire may in fact be of benefit by preventing bogs from succeeding to shrub stages. In upland areas, loss of leaf litter from burning could potentially account for declines in salamander abundances. There are no consistent conclusions as to the effects of fire on amphibians: the majority of evidence suggests that effects are minimal (Bamford 1992; Bury et al. 2000; Ford et al. 1999; Kirkland et al. 1996; Means and Moler 1979; Means and Campbell 1981). However, Palis (1997) attributed declines of flatwoods salamanders to the timing of the burning. Determining how fire affects amphibians with different life history traits should enhance the ability to manage the forests with fire (Schurbon and Fauth 2003).

Effects of prescribed fire on the aquatic environment are mitigated with the forestwide standards. These mitigations prevent or greatly lessen sediment input into streams by maintaining the integrity of riparian corridors.

In rare cases of wildlfires, there is potential to cause impacts but it would be unlikely for the riparian corridor to burn extensively due to the associated dampness. If excessive burning did occur within the riparian corridor, results would be decreased shading from the loss of trees along the stream banks. In addition, heavy rains could deliver large amounts of ash material into the stream, altering the pH and overall water chemistry for water courses within the immediate area of the burn.

Livestock grazing occurs on 1,000 acres on the Oconee National Forest. Of the 15 allotments, all but two have the riparian corridors fenced and access to streams is restricted to designated points. Forest Service has worked cooperatively with state and other federal agencies to best protect the resources as well as with adjoining private landowners in practices to protect the streams. No increases of allotments are planned.

Mitigation Measures

Mitigation measures designed to minimize direct and indirect effects to soil and water resources include:

- Best Management Practices – Georgia's Best Management Practices for Forestry were developed in 1981 and revised in 1999 to minimize erosion and stream sedimentation from forestry practices.
- Riparian Corridor Prescription – this management prescription recognizes the riparian corridor and associated ecosystems. Riparian corridors will be managed to retain, restore and/or enhance the inherent ecological processes and functions of the associated aquatic, riparian, and upland components within the corridor.
- Forest Plan Standards – standards are required courses of action or levels of attainment that promote the achievement of Forest Plan goals and objectives. Standards are developed when: (1) unacceptable impacts are expected (without the standard); (2) they're critical to Forest Plan objectives; and/or (3) laws or policies do not address a proposed course or when they need further clarification. Standards are mandatory. A Forest Plan amendment is required in order to deviate from an established standard.

Currently, the biggest concerns for aquatic habitats on the Forests are sedimentation, future sources of large woody debris for self-maintaining diverse habitat components, canopy cover to maintain water temperature regimes, impacts from roads, and acid rain. Ground disturbing activities in watersheds, particularly in the riparian areas, have the most potential for effects on fisheries and aquatic habitat resources on the Forest.

Aquatic habitats are included in the Riparian Corridor Prescription, which does not vary by alternative. Under this Prescription, riparian areas and aquatic resources are managed to encourage the processes that maintain or lead to a desired future condition for fisheries and aquatic habitats. Riparian habitats and fisheries are sustained in a healthy condition. Vegetation management occurs only when needed to protect or enhance riparian-dependent resources. A slow progression toward a mature forest of more shade tolerant species occurs. More large woody debris is deposited into streams. Current fish management practices may be suitable such as stocking, streambank stabilization, use of habitat improvement structures and use of mitigation measures for stream acidification.

The Plan designates riparian corridors for perennial and intermittent streams and common standards for channeled ephemeral streams. The riparian corridor will be managed to retain, restore, and/or enhance the inherent ecological processes and

functions of the associated aquatic, riparian, and upland components within the corridor in all alternatives. These standards and guidelines may have a beneficial effect on the communities and their associated species.

When projects are implemented with full consideration of the Riparian Corridor Prescription and channeled ephemeral stream standards, no direct or indirect adverse effects to aquatic organisms or to the aquatic habitat that sustain them will occur. In order to verify that these standards are adequate, some ground disturbing projects will be monitored for:

- filter strip widths (implementation monitoring)
- off-site sediment movement (effectiveness monitoring)
- biological composition (validation monitoring).

Cumulative Effects

Direct and indirect adverse effects to aquatic communities are minimized by the implementation of the BMPs, Riparian Corridor Prescription and Forest Plan standards; however, they are not eliminated from the entire watershed. Cumulatively, Forest Service activities may contribute to sediment in the watershed.

Cumulative effects for aquatic resources were determined using the Watershed Condition Ranking (WCR) (see discussion in the *Watershed* section), Watershed Condition Ranking for viability summarized outcomes by impairment (see discussion in the *Aquatic Viability Analysis*), and modeled sediment yields from Forest Service activities (see further discussion in the *Watershed* section). The following table is a summary of the cumulative watershed condition for all alternatives in the Chattahoochee-Oconee National Forest Plan, within period one (the first decade). Ownership is the percentage of the watershed managed by the Forest Service. WCR is the watershed condition ranking score. Watershed Condition for viability has three categories:

- Low Risk
- Risk 1 (Iindicates watershed concerns, but Forest Service may influence conditions to improve the condition of the watershed.)
- Risk 2 (Also indicates watershed concerns; however, Forest Service opportunity to measurably affect the watershed is limited.)

Sources of impairment are as follows:

- S = sediment
- P = point-source pollution
- T = temperature
- F = Altered Flow

Table 3- 119. Watershed Condition For Forest Plan Alternatives On The Chattahoochee And Oconee National Forests (Period-1)

Watershed	Ownership	Current	Watershed Condition			Alt-A	Alt-B	Alt-D	Alt-E	Alt-F	Alt-G	Alt-I
HUC	%	WCR	Low Risk	Risk 1	Risk 2	WCR	WCR	WCR	WCR	WCR	WCR	WCR
306010201	42.84	A		S		A	A	A	A	A	A	A
306010207	55	A		S		A	A	A	A	A	A	A
306010206	25.59	E	X			E	E	E	E	E	E	E
306010401	12.10	E	X			E	E	E	E	E	E	E
307010106	4.09	E	X			E	E	E	E	E	E	E
307010107	19.73	E	X			E	E	E	E	E	E	E
307010109	4.25	A			S	A	A	A	A	A	A	A
307010111	0.59	A			S	A	A	A	A	A	A	A
307010110	0.01	A			S	A	A	A	A	A	A	A
307010114	0.74	A			S	A	A	A	A	A	A	A
307010115	28.03	E	X			E	E	E	E	E	E	E
307010116	11.15	A			S	A	A	A	A	A	A	A
307010117	15.79	E	X			E	E	E	E	E	E	E
307010310	11.78	E	X			E	E	E	E	E	E	E
307010313	12.79	E	X			E	E	E	E	E	E	E
313000101	40.11	E	X			E	E	E	E	E	E	E
313000102	17.22	E	X			E	E	E	E	E	E	E
313000105	31.64	E	X			E	E	E	E	E	E	E
313000106	19.20	A			S	A	A	A	A	A	A	A
315010101	40.98	E	X			E	E	E	E	E	E	E
315010102	19.57	E			T	E	E	E	E	E	E	E
315010103	1.66	E	X			E	E	E	E	E	E	E
315010104	26.65	A		S		A	A	A	A	A	A	A
315010105	7.51	E			P	E	E	E	E	E	E	E
315010201	17.86	A			S	A	A	A	A	A	A	A
315010202	21.98	A			S	A	A	A	A	A	A	A
315010203	29.04	A			S	A	A	A	A	A	A	A
315010204	2.42	A			S	A	A	A	A	A	A	A
315010301	10.83	E			P	E	E	E	E	E	E	E
315010303	37.73	E	X			E	E	E	E	E	E	E
315010304	15.44	E	X			E	E	E	E	E	E	E
315010305	24.23	E	X			E	E	E	E	E	E	E
315010401	23.37	E	X			E	E	E	E	E	E	E
315010402	7.05	A			S	A	A	A	A	A	A	A
315010504	1.47	E	X			E	E	E	E	E	E	E
315010505	3.37	E	X			E	E	E	E	E	E	E
601020201	21.34	A		S		A	A	A	A	A	A	A
602000109	3.96	E	X			E	E	E	E	E	E	E
602000201	39.63	A			S	A	A	A	A	A	A	A
602000204	18.93	A			S	A	A	A	A	A	A	A
602000208	35.75	A			S	A	A	A	A	A	A	A
602000301	68.41	A		S		A	A	A	A	A	A	A
602000302	18	B/A			S	B/A	B/A	B/A	B/A	B/A	B/A	B/A

The Watershed Condition for viability from the table above indicates which source of impairment (S, P, T or F), if any, is a major stressor in that watershed, and whether or not the Forest Service can measurably influence that impairment at the watershed level. Where the impairment is sediment (S), Forest Service influence is limited based on the WCR discussion below. Where the impairment is point source pollution (P) and altered flow (F), Forest Service influence is limited, since there are no point source discharges into streams on the Chattahoochee-Oconee NF, nor are there Forest Service proposals to build reservoirs or significantly modify flow. Where the impairment is temperature (T), the Forest Service can influence conditions on public lands, and decreased water temperatures may influence short distances of privately owned streams flowing immediately downstream of public lands. However, these decreases are only sufficient to mitigate temperature increases that come from private land for short distances. Therefore, the Forest Service influence on temperature at the watershed level is extremely limited.

WCR characterizes cumulative effects of sediment from private and Forest Service lands within a specific watershed. It takes into account biological thresholds for sediment. Possible Watershed Condition Rankings are: Excellent (E); Average (A); Below Average (BA).

Below average WCR rating indicates that a biological threshold for effects from sediment is being reached. There is one watershed with Forest service ownership with a BA rating, the middle Toccoa watershed. Forest Service ownership in this watershed is 18 percent, with all ownership occurring in stream sections of the extreme headwaters. Although rainbow trout were initially stocked on the Forest, the majority of streams on the Chattahoochee carry self-sustaining populations. These headwater streams on forest lands in the middle Toccoa watershed have self-sustaining populations of trout. Reproduction indicates that the water quality is good to excellent for trout. Trout are sensitive to sedimentation and to increases in stream temperatures. The Forest Service, in cooperation with Georgia Department of Natural Resources, will continue to monitor trout populations in this watershed to assess Forest Service activities. Furthermore, at the project level, the Forest Service will examine opportunities to improve watershed health in the middle Toccoa watershed.

Predicted contribution of sediment due to Forest Services activities (timber management, etc.) from all alternatives for all watersheds did not increase over the current range of sediment yields except for one watershed, Murder Creek watershed (refer to *Watershed* section). Increases remained well within the range of annual variability for all watersheds except for one watershed, Murder Creek; therefore, the cumulative effects for all watersheds, except for Murder Creek watershed, from Forest Service activities should be minimal.

Murder Creek watershed went from a WCR of excellent to one of average. This change in WCR of excellent to average for Murder Creek watershed was consistent for all alternatives. Forest Service ownership in the Murder Creek watershed is 11 percent. This ownership is located in the lower portion of the watershed. The WCR changed in this watershed because the initial WCR from current land use/cover was

near the threshold between “Excellent” and “Average” before any predicted erosion or sedimentation were calculated from Forest Service activities. The modeled land disturbance activity from Forest Service management was enough disturbance to change the condition rank, although actual erosion and resulting sedimentation is expected to be less than the modeled increase due to implementation of mitigation measures (BMPs, forestwide standards and the Riparian Corridor Prescription). These measures should mitigate any potential impacts. Partnership opportunities to improve watershed condition for the Murder Creek watershed as well as for other watersheds are, in part, the goal of the Forest Service.

Regardless of their ranking, public lands in all watersheds are managed (and where needed, restored) to provide resilient and stable conditions to support the quality of water necessary to protect ecological functions and support intended beneficial water uses. Management activities will be conducted with the implementation of the BMPs, Riparian Corridor Prescription and Forestwide standards. The probability is low for adverse effects to water quality or aquatic species and their associated habitats in these watersheds from Forest Service activities. Watershed assessments and surveys are conducted to determine the sources of impacts and prescribe appropriate treatments when they occur on Forest Service lands. Objectives for prioritization of watersheds can be found in chapter 2 of the Plan.