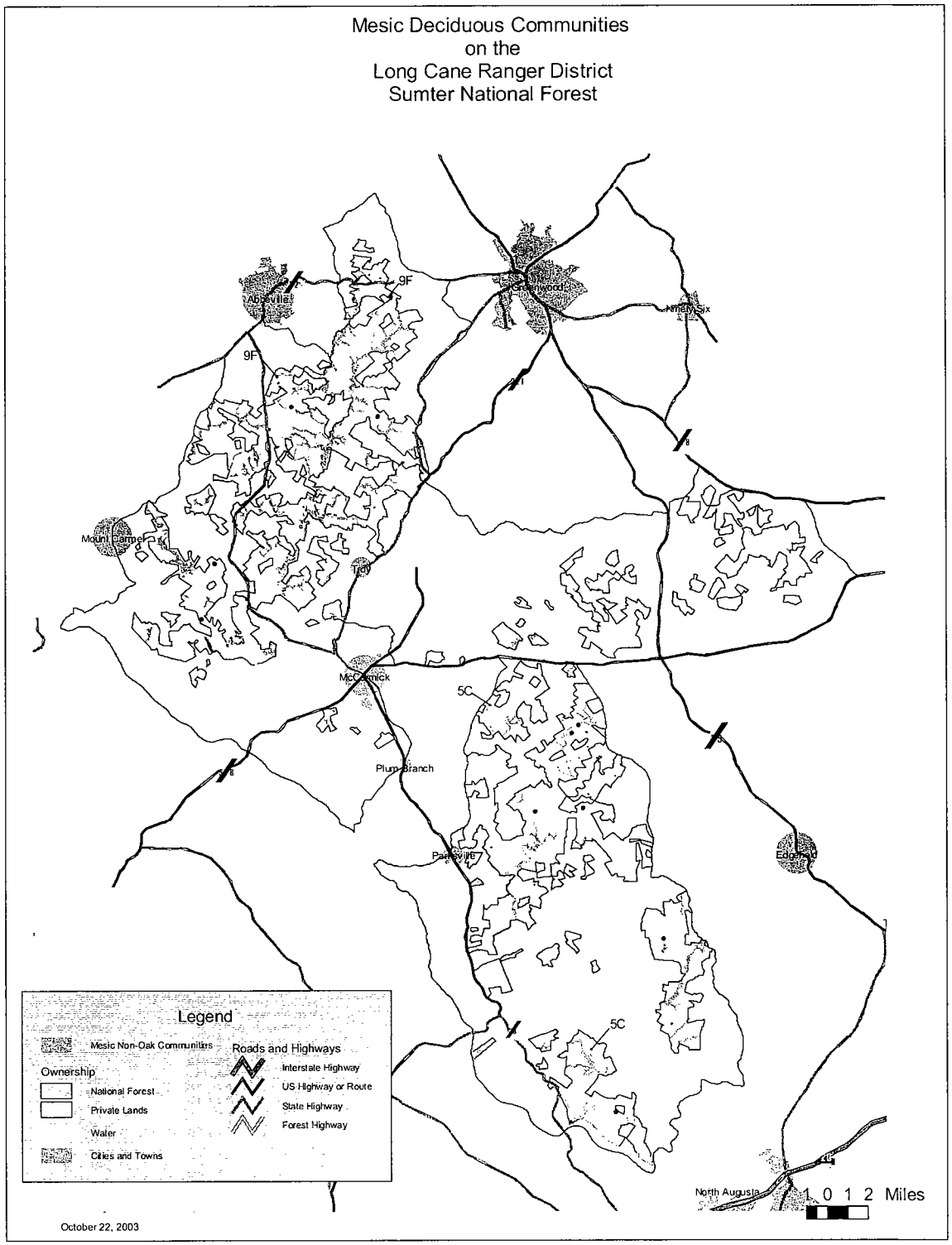

Mesic Deciduous Communities
on the
Long Cane Ranger District
Sumter National Forest
9F
9F
McCormick
5C
Plum Branch
5C
North Augusta
1 0 1 2 Miles
Legend
Mesic Non-Oak Communities
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 22, 2003

Abundance

In the Southern Appalachian Assessment Area, mesic deciduous forest communities such as northern hardwood, mixed mesophytic hardwood, and bottomland hardwood forests comprise 1.6, 8.4, and 1.2 % of the land area of the SAA area.

The current acreage of mesic deciduous forests for the Sumter National Forest is shown in Table 3-9. Although a relatively small proportion of the forest (8% in the mountains), mesic deciduous forests are well distributed on the Andrew Pickens District. Mesic deciduous forests are about as equally common on the piedmont districts (11%), but are primarily concentrated in the bottoms and drains of major river systems.

Table 3-9 Current acreage (m acres) and percent of mesic deciduous forest by successional class, the percent of total mesic deciduous forest acreage in mid- and late-successional stages, and the percent of total forest acres in mid- to late-successional mesic deciduous forests for the Sumter National Forest, 2002.

	Piedmont	Mountains
Early Successional	.01 (-)	0.4 (-)
Sapling/Pole	0.7 (2.2%)	1.8 (21 %)
Mid- Successional	3.4 (11%)	1.0 (17%)
Late-Successional (including Old Growth)	26.2 (87%)	4.5 (61%)
Total	30.2	7.4
Total acres of mid- and late-successional mesic deciduous forests	30.2	5.6
% of total mesic deciduous forest acres in mid- and late-successional stages	98%	93%
% of total forested acres in mid- and late-successional mesic deciduous forests	11%	6.7%

Age Class Distribution

For the Southern Appalachian Assessment Area, the majority of the mesic deciduous forests are currently in older age classes. Across all ownerships, approximately 75-80% of maple-beech-birch (northern hardwoods), oak-hickory, and elm-ash-cottonwood (bottomland hardwoods) forests are in mid- and late-successional stages (SAMAB 1996: 165). There are approximately 3.5 million acres of deciduous forest on national forest lands within the SAA area (SAMAB 1996:168). Of these acres, 2% are in early-successional forest, 6% are in the sapling/pole forest, 45% are in the mid-successional forest, and 46% are in late-successional forest.

A key management issue for this community is maintenance of a high proportion of this type in mid-and late-successional conditions to provide habitat for associated species. There are a number of viability concern species that are broadly associated with mature mesic deciduous forests, and others that are more specifically associated with such forests at high elevations (Appendix F).

The current age class distribution of mesic deciduous forests for the Sumter National Forest is shown in Table 3-9. Nearly all of these forest communities are in mid- and late-successional stages in the piedmont, and a majority in the mountains. These older deciduous forest make up less than 25% of the total forest acres in the mountains, and, because of its more limited distribution, approximately 11% in the piedmont.

Forest Structure

A number of bird species favor mature, mesic hardwood forests with a diverse and well-developed canopy structure including canopy gaps and associated midstory and understory structural diversity. (Ramey, 1996; Buehler and Nicholson, 1998; Rodewald and Smith, 1998; Nutt, 1998). Species of potential viability concern associated with canopy gaps and structurally diverse understories in mesic deciduous forests are identified in Appendix F. This structural diversity may be characteristic of the decadent, patchy conditions found in old growth forests, to which these species have presumably adapted. While a growing portion of the landscape in the Southern Appalachians consists of large hardwoods, most sites have very simple canopy structures (Runkle, 1985). This lack of structure is likely the result of previous even-aged timber management, resulting in forest stands of approximately similar-aged trees with low mortality and few canopy gaps. Most of these mid- and late-successional forests have not yet begun to develop the canopy gaps characteristic of old growth forests

Intermediate treatments such as thinning can be used to improve forest structure in mesic deciduous forests. Canopy gaps created by these treatments would stimulate the development of the desired midstory and understory structure. Single-tree selection or small group selection (generally <0.75 acre group maximum size), implemented at relatively low intensities, achieves very similar desired conditions.

Management Indicators

Several management indicators have been identified for assessing effects to mesic deciduous communities. These include both management indicator species (MIS) and key habitat variables.

The hooded warbler (*Wilsonia citrina*) is a neotropical migrant that is fairly common to common throughout the southeastern United States during the breeding season (Hamel 1992). It is found in mixed hardwood forests of beech, maple, hickory and oaks with dense undergrowth (DeGraaf et.al. 1991). It nests in saplings, shrubs, or herbaceous

vegetation. It also has been identified as a MIS for mesic deciduous forests with canopy gaps and structurally diverse understories. The hooded warbler is common throughout the Sumter National Forest. Population trends for this species are tracked by annual breeding bird surveys (BBS) and bird point counts conducted on the Sumter National Forest.

Key habitat variables identified for this community are total acres of mid- and -late successional mesic deciduous forests, and total acres treated to create canopy gaps.

Direct and Indirect Effects

Abundance and Age Class Distribution

The amount of regeneration treatments will affect the future quantity and distribution of mid- and late-successional mesic deciduous forests. The future age class distribution of mesic deciduous forests would vary among alternatives due to the differences in management intensity and emphasis. Table 3-10 shows the expected percentage in mid- and late-successional mesic deciduous forest for each alternative after 10 and 50 years of implementation based on SPECTRUM model outputs.

Table 3-10.. Expected percentage in acreage of mid- and late-successional mesic deciduous forest on the Sumter National Forest, after 10 and 50 years of implementing forest plan alternatives (derived from SPECTRUM models).

	Piedmont		Mountains	
Alternative	Yr10	Yr50	Yr10	Yr50
Alternative A	11	7.8	5.7	6.4
Alternative B	10	9.4	4.7	6.4
Alternative D	11	7.8	5.6	5.1
Alternative E	11	9.4	5.6	6.6
Alternative F	11	2.4	5.4	4.6
Alternative G	10	10	5.3	7.3
Alternative I	10	9.1	5.4	6.9

Forest Structure

Expected activity levels related to the creation of canopy gaps for all alternatives are shown in Table 3-11 for the Sumter National Forest.

Table 3-11. Expected activity levels related to the creation of canopy gaps in mesic deciduous forests for the Sumter National Forest by alternative.

	Mountains						
Activity	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Acres of mid and late successional mesic hardwood forests to be treated to create canopy gaps during first decade of plan implementation	0.3	0.5	0.4	0.6	0.4	0.1	0.6
Percent of current total acres of this habitat type to be treated	1.6	2.8	1.9	3.0	2.1	0.4	2.8

	Piedmont						
Activity	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Acres of mid and late successional mesic hardwood forests to be treated to create canopy gaps during first decade of plan implementation	0.7	3.1	0.6	3.1	0.2	0.1	1.8
Percent of current total acres of this habitat type to be treated	2.2	10.2	2.0	10.2	0.8	0.1	5.8

Canopy gap treatments that enhance structural diversity in mature mesic hardwoods would benefit species such as hooded warbler as well as numerous other species associated with these habitat conditions. In the short-term, alternatives that provide for more creation of structural diversity in close-canopied mesic deciduous forests are expected to support larger populations of this species than alternatives that provide less of this condition, in fact the highest population densities for hooded warbler are expected in these situations. Average breeding densities reported by Hamel (1990:C-8) are 16.0 pairs per 100 acres. Populations are expected to be highest under alternatives that provide for more creation of canopy gaps and older decadent forests (Alternatives B, E, I). In the long term, alternatives that provide the highest levels of late-successional mesic deciduous forests are most likely to support the largest populations of this species (Alternatives B, E, G, I). Inventory and monitoring of this species would be used to document occurrences and population response to effects of management on canopy structure in nearby habitat.

Cumulative Effects

Mesic deciduous forests are not very abundant (<10%) but are relatively common (36,000 acres) on the Sumter National Forest. The distribution of age classes is however, concentrated heavily (>90%) in the mid- to late-successional stages (Table 3-9). While increasingly vulnerable to insect and disease attacks because they are so similar in age

and condition, the vast majority of acres in mesic deciduous forests display a more linear pattern and are spotty across the landscape compared to other major forest communities on the forest. Management opportunities would allow for altering stand structure and regenerating some mesic deciduous forest in all alternatives except G. Maintenance and restoration of an age class distribution or "within stand" structural diversity for mesic deciduous forest may be necessary in the near future to provide for plants and animals associated with these habitats. It is not expected that private landowners will restore or manage to maintain significant amounts of high quality mesic deciduous hardwood forest, and they would remain limited in distribution and abundance on the landscape except for national forest maintenance and restoration efforts.

Eastern Hemlock and White Pine Forests

Affected Environment

Eastern hemlock and white pine forests are broadly defined to include those forested communities with a canopy that is either dominated or co-dominated by eastern hemlock (*Tsuga canadensis*) or eastern white pine (*Pinus strobus*). These forest types are the predominant components of the conifer-northern hardwood community type described in the regional old-growth guidance (USDA Forest Service, 1997). For the purposes of this analysis, forests with a significant component of eastern hemlock are classified as hemlock forests, even where white pine may be dominant. White pine forests include all other forest types where white pine is dominant. This division puts priority on the presence of hemlock as a key habitat component. Hemlock and white pine forests are a subset of the mixed mesophytic forest displayed in Table 3-12 (CISC types 3, 4, 5, 8, 9, 10).

Table 3-12. Current acreage (m acres) and percent of hemlock and white pine forest by successional class, the percent in mid- and late-successional stages, and the percent of total forest acres in mid- to late-successional hemlock and white pine forests for the Sumter National Forest (mountains only), 2002.

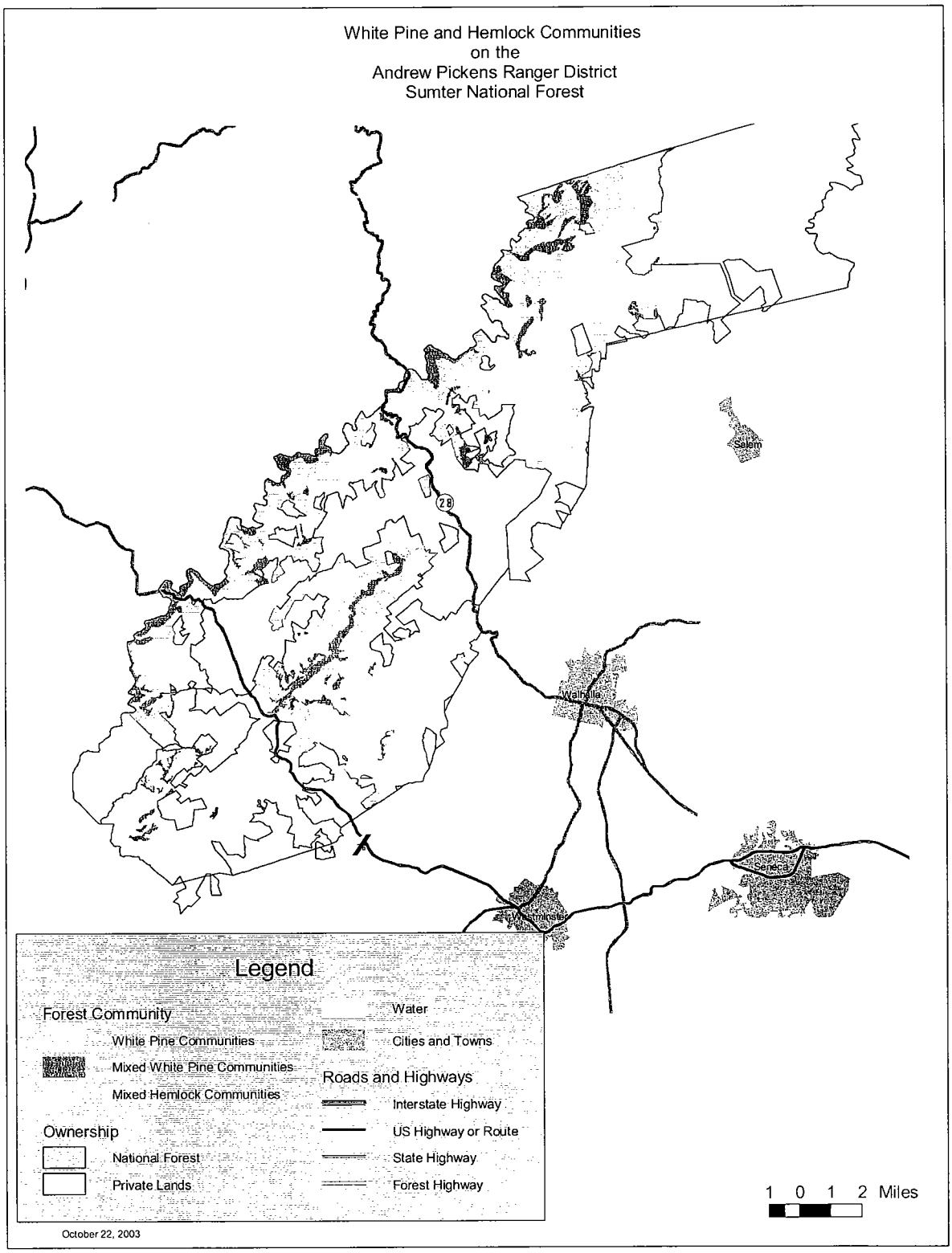
Successional Stage	M Acres and %
Early Successional	0.1 (0.6%)
Sapling/Pole	4.0 (27%)
Mid- Successional	2.3(16%)
Late-Successional (including Old Growth)	8.4 (56%)
Total	14.8
Total acres of mid- and late-successional hemlock white pine forest	10.7
% of total hemlock white pine forest acres in mid- and late-successional stages	72%
% of total forested acres in mid- and late-successional hemlock white pine forests	13%

Eastern hemlock forests typically occur on acidic soils and often have a dense shrub layer composed of ericaceous species. These communities are typically low in herbaceous diversity, but may support rich bryophyte communities. White pine forests occupy similar sites but also may occur on dryer locations, particularly in areas where fire has been suppressed. White pine forests have also been artificially created as timber plantations.

The combination of a largely evergreen canopy and a dense midstory in naturally occurring hemlock and white pine forests provide for a variety of benefits, including shading and cooling of riparian systems, thermal cover for wildlife, and nesting and foraging habitat for several species of neotropical migrant birds dependent upon the layered canopy structure and understory thickets (Rhea and Watson 1994). There is some evidence that hemlock-white pine forests provide necessary habitat components for the long-term conservation of red crossbills (Dickson 2001). Eastern hemlock forests may also be important refugia for species typically adapted to higher elevations. Dickson (2000) states that red-breasted nuthatches, winter wrens, and golden-crowned kinglets are found in late successional hemlock forests down to elevations of 2,000 feet, and several species of rare bryophytes that are known to occur primarily within the spruce/fir zone are also found at lower elevations in humid gorges, often under a canopy that includes eastern hemlock (Hicks 1992).

In 1996, the Southern Appalachian Assessment (SAMAB 1996) estimated that there were 617,687 acres of "white pine-hemlock forests" across all land ownerships in the Southern Appalachians representing 2.5% of the total land base. This figure represents data collected from FIA, CISC, and LANDSAT imagery. The current amount and distribution of mature eastern hemlock forests is threatened by the recent emergence of the hemlock woolly adelgid in the Southern Appalachians. First identified in the eastern United States near Richmond, VA, in 1924, this exotic pest has recently spread into the Southern Appalachians and threatens to spread throughout the range causing mortality within 5 years after initial infestation (SAMAB 1996).

On the Sumter National Forest, eastern hemlock forests are found primarily in association with north facing coves, slopes, and in riparian areas. Years of fire suppression across the Andrew Pickens District has allowed white pine, and occasionally hemlock, to creep upslope onto more xeric slopes and ridges. Once established, these species gradually alter the vegetative community from the dense shade and heavy needle cast. The Andrew Pickens District is at the southern end of the range for hemlock and there are approximately 3,500 acres of hemlock and hemlock/mixed forest types on the forest. There are currently approximately 7,500 acres of white pine forest types, 2,500 acres of which originated as plantations.


White Pine and Hemlock Communities
on the
Andrew Pickens Ranger District
Sumter National Forest
Salem
28
Walhalla
Seneca
Legend
Forest Community
White Pine Communities
Mixed White Pine Communities
Mixed Hemlock Communities
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
1 0 1 2 Miles
October 22, 2003

Management Indicators

Two key habitat variables are selected as management indicators to monitor the condition of eastern hemlock and white pine forests: the number of acres of hemlock forests infested with hemlock woolly adelgid and the number of acres of white pine plantations restored to diverse native communities. The selection and monitoring of management indicator species may be an appropriate tool when a clear correlation between a specific management activity and the population trend of the species is known. Because the main factor that may cause a decline in hemlock forests and associated species is the hemlock woolly adelgid rather than management, it is not meaningful to select management indicator species for this community type.

Direct and Indirect Effects

Abundance

The amount and distribution of white pine forests has increased over its natural abundance through the establishment of plantations and a process of upland encroachment that is a result of years of fire suppression. White pine plantations are often closed canopy stands with little botanical diversity. The draft forest plan includes objectives to restore these plantations back to diverse native communities appropriate to the site. With an additional renewed emphasis of introducing fire onto the landscape in areas where natural fire may have played a role in shaping historic vegetative patterns, it is likely that white pine distributions will shrink from areas where it has been able to become established in the absence of fire. Table 3-13 shows the estimated percentage of mid- and late-successional hemlock and white pine forests on the Sumter National Forest.

Table 3-13. Estimated percentage of mid- and late-successional hemlock and white pine forests on the Sumter National Forest (mountains only), after 10 and 50 years of implementing forest plan alternatives. (derived from SPECTRUM models)

Alternative	Yr10	Yr50
Alternative A	6.5	6.4
Alternative B	5.3	5.7
Alternative D	6.7	5.5
Alternative E	5.8	6.8
Alternative F	6.8	3.6
Alternative G	6.2	7.7
Alternative I	6.1	6.8

Eastern hemlock forests are naturally limited in distribution, occurring primarily in association with north facing coves and slopes and in riparian areas. Under all alternatives, forestwide standards are included that defer existing hemlock forests from

regeneration cutting during this plan period and maintains the hemlock component where it occurs as patches within other forest types. These provisions are included under all alternatives in an effort to maintain mature hemlock forests in the face of threats to this type from the hemlock woolly adelgid. As a result of these provisions, no changes to the distribution and abundance of eastern hemlock forest are anticipated as a direct or indirect effect of national forest management. However, long-term effects from the hemlock woolly adelgid may be large (see cumulative effects).

Objectives to restore white pine plantations to more diverse natural communities would benefit species dependant upon multi-layered canopies with an evergreen component. Because hemlock forests would not be subject to regeneration cutting this planning period, hemlock forests would move into older age classes with plan implementation, increasing abundance of mature forests of this type under all alternatives. Activities within hemlock stands would be limited under all alternatives and would promote mature forests with the desired multi-layered canopy condition that is needed by many species of wildlife.

Because hemlock and white pine forests would be managed to optimize their natural distribution, abundance, and condition in all plan alternatives, potential effects through plan implementation to these vegetative communities should be positive. There are 26 species of plants and animals with viability concerns that are associated with hemlock forests (Appendix F). The positive direct and indirect effects to hemlock and white pine forest communities should contribute to the viability of these associated species under all alternatives. Because provisions for maintenance of hemlock are similar across all alternatives, the magnitude of these positive effects would be similar for all alternatives.

Cumulative Effects

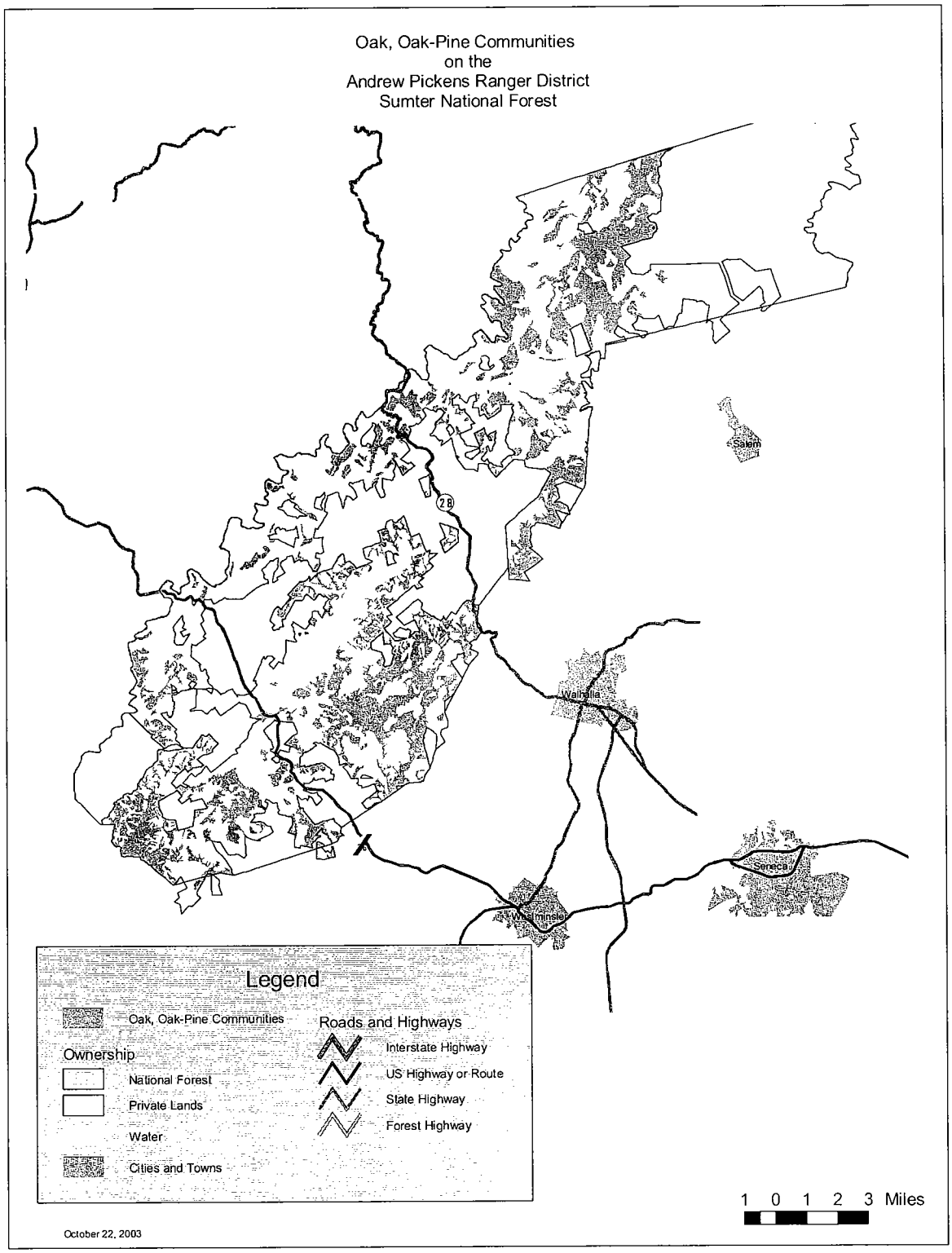
A 39% increase in the acreage of white pine-hemlock forests has been documented across both public and private ownerships in the Southern Appalachians since the mid 1970s (SAMAB 1996). This is largely attributable to an increase in managed stands of white pine (plantations) and upland encroachment of both white pine and hemlock into areas where it would not occur under a natural fire regime. The use of prescribed fire in the restoration of upland habitats will likely shrink these communities back to a more natural distribution on the landscape over time. Despite plan protection and restoration objectives, the current amount and distribution of mature eastern hemlock forests is threatened by the recent emergence of the hemlock woolly adelgid in the Southern Appalachians. The fact that this community type is naturally limited in distribution, coupled with the impending threats from the hemlock woolly adelgid which will imapct the species regardless of land ownership, leaves the long-term maintenance of historical distribution and abundance of this community type in question. The fate of associated viability concern species will be dependent upon their ability to adapt to changing environmental conditions associated with the decline of hemlock from within these communities. Species that utilize hemlock forests in addition to other vegetative

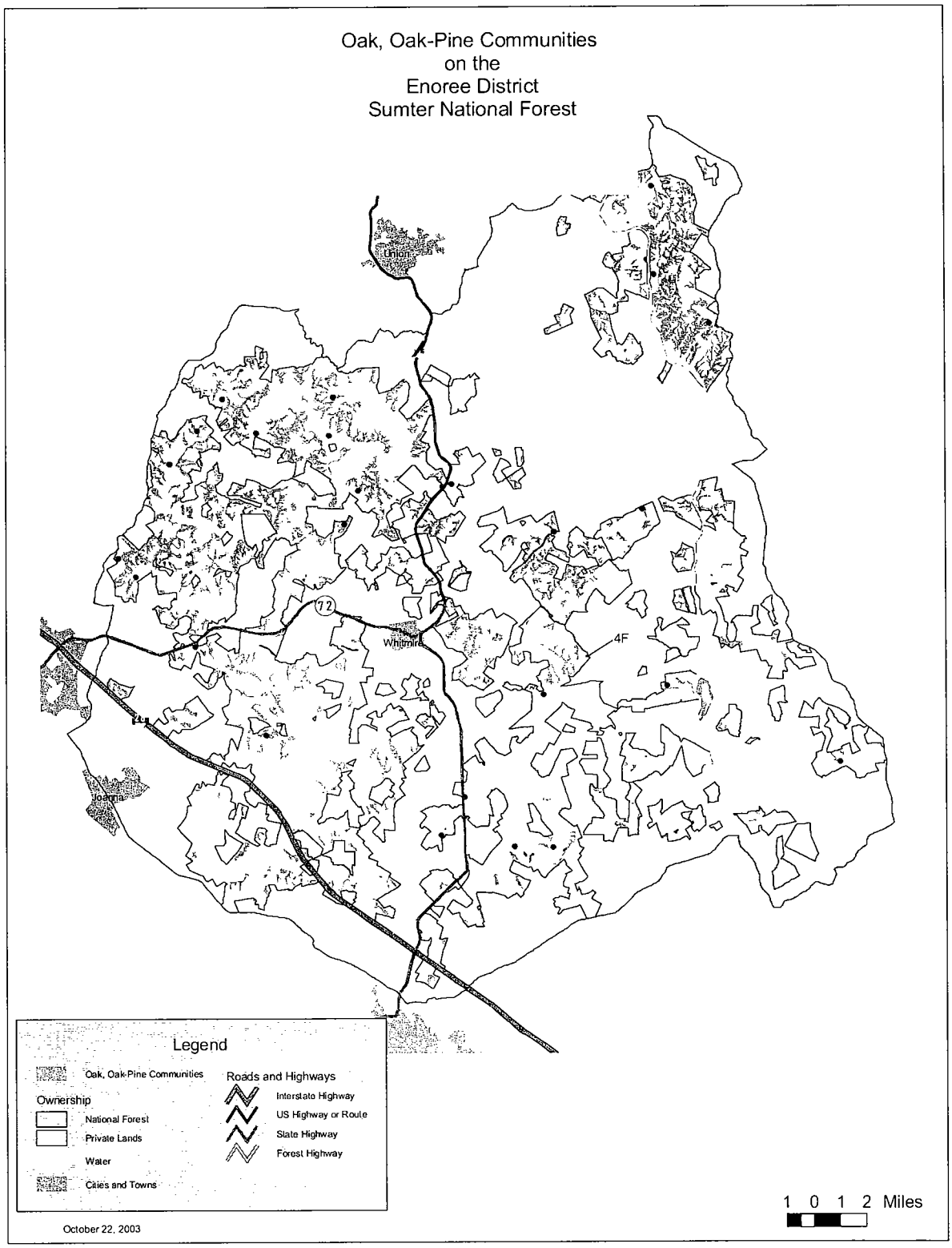
community types will be more likely to persist than species that are obligates to the hemlock forest community.

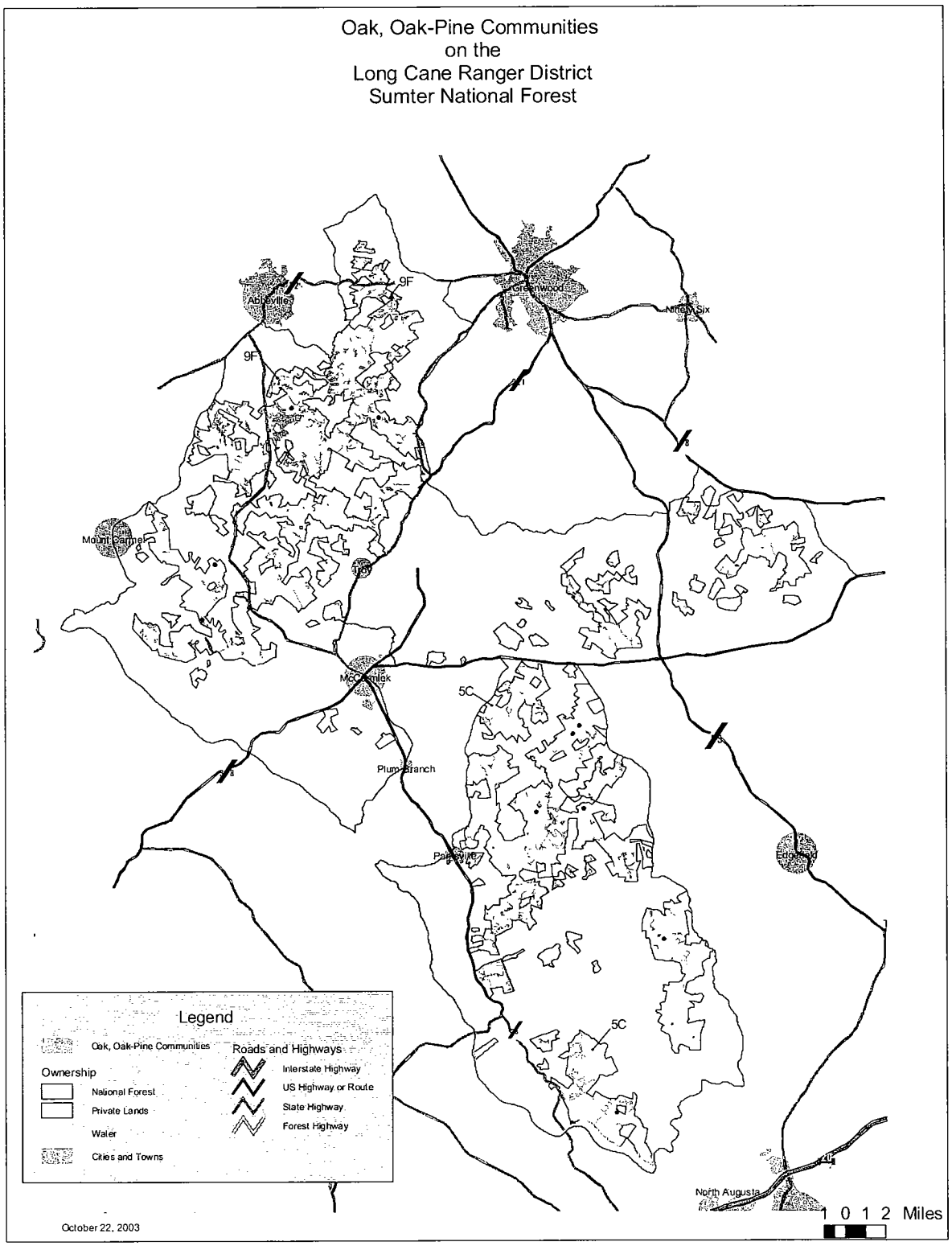
Oak and Oak-Pine Forests

Affected Environment

Oak dominated forests covered under this section include dry to mesic oak and oak-pine forests. Dry-mesic oak forests vary greatly in their species composition due to its wide distribution. The major species include chestnut oak (*Quercus montana*), northern red oak (*Q. rubra*), black oak (*Q. velutina*), white oak (*Q. alba*), and scarlet oak (*Q. coccinea*) (USDA Forest Service 1997:60). The dry to mesic oak-pine forests considered here are oak-dominated forests containing a significant pine component. Predominant pine species include white pine (*Pinus strobus*), shortleaf pine (*P. echinata*), Virginia pine (*P. virginiana*), and loblolly pine (*P. taeda*). These dry to mesic types are distinguished from oak and oak-pine woodlands and savannas, which are targeted at xeric oak, oak-pine, and pine-oak types. These xeric types are covered under the section on "Oak, Mixed, and Pine Woodlands, Savannas, and Grasslands."


Oak, Oak-Pine Communities
on the
Andrew Pickens Ranger District
Sumter National Forest
Salem
28
Walhalla
Seneca
Legend
Oak, Oak-Pine Communities
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
1 0 1 2 3 Miles
October 22, 2003


Oak, Oak-Pine Communities
on the
Enoree District
Sumter National Forest
Union
72
Whitmire
4F
Joanna
Legend
Oak, Oak-Pine Communities
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
1 0 1 2 Miles
October 22, 2003


Oak, Oak-Pine Communities
on the
Long Cane Ranger District
Sumter National Forest
Abbeville
Greenwood
Ninety Six
Mount Carmel
McCormick
Plum Branch
Parksville
Edgefield
North Augusta
9F
5C
Legend
Oak, Oak-Pine Communities
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
0 1 2 Miles
October 22, 2003

Abundance

In the southern United States, acres of oak-hickory and oak-pine forests have increased over the last 50 years. (USDA Forest Service 2001: 49). Oak and oak-pine forests are common throughout the South, comprising over half of the timberland of the region as a whole (USDA Forest Service 2001: 91-92). Oak-hickory forests are the dominant forest type in the Southern Appalachian Ecoregion, and are codominant with loblolly-shortleaf pine forests in the Piedmont Ecoregion. Southern yellow pine forest types dominate the Coastal Plain Ecoregion, but oak and oak-pine forests still comprise nearly 30% of the timberland in this ecoregion.

The current acreage of oak forests for the Sumter National Forest is shown in Table 3-14. Oak forests are abundant and well distributed on the Andrew Pickens District in the mountains. Oak forests are less common on the piedmont districts and are found primarily on lower slopes, in drains, and sporadically on upland sites.

Table 3-14. Current acreage (m acres) and percent of oak[1] forest by successional class, the percent of total oak forest acreage in mid- and late-successional stages, and the percent of total forest acres in mid- to late-successional oak forests for the Sumter National Forest, 2002.

	Sumter National Forest	
	Mountains	Piedmont
Early Successional	0.2 (0.7%)	0.1 (0.1%)
Sapling/Pole	1.2(4.8%)	1.1 (3.3%)
Mid- Successional	5.3 (21%)	18.4 (57%)
Late-Successional (including Old Growth)	19 (74%)	12.5 (39%)
Total	25.7	32.1
Total acres of M-L Succ. Oak	24.3	30.9
% of total oak acres acres in mid- and late-successional oak forests	94%	96%
% of total forested acres in mid- and late-successional oak forests	29%	11%

1 – dry-mesic oak and oak-pine based on old growth type definitions used in SPECTRUM

The abundance of these forests in the future will be primarily dependant on the management of existing oak stands to maintain oak dominance, restoring oak forests on appropriate sites, and increasing the oak component in mixed (pine/hardwood) stands.

Age Class Distribution

Across the southern United States, about 50% of upland hardwood forests (predominantly oak-hickory) and 30% of natural oak-pine forests are in mid- and late-successional stages (41-plus years-of-age) (USDA Forest Service 2001: 69-70). However, only about 1% of planted oak-pine forests are in mid- and late-successional stages. Approximately 75% of oak-hickory forests are in mid- and late-successional stages (SAMAB 1996: 165) for the Southern Appalachian Assessment Area (includes only the Andrew Pickens District on the Sumter).

The current age class distribution of oak forests for the Sumter National Forest is also shown in Table 3-14. In both the mountains and piedmont, oak forests are heavily weighted towards older age classes. The potential for increases in oak decline and less reliable mast crops is predictable for the mountains in the foreseeable future.

Forest Structure

The structural condition of oak forests is a key factor in the maintenance of these communities. Brose et. al. (2001) describe an emerging hypothesis that periodic, low-intensity surface fires were crucial to the perpetuation of mixed oak forests for millennia. Research indicates that oak forests may not perpetuate themselves without some level of disturbance, especially on mesic sites (Loftis 1991). Treatments such as shelterwood harvest combined with prescribed burning (Brose et. al. 1999) or basal area reduction from below using herbicides (Loftis 1991) have been shown to create conditions that promote adequate oak regeneration. Oak dominance can be maintained by maintaining suitable tree densities and moderate fire return intervals.

Treatments such as moderate thinning and prescribed burning also can be used to create the desired habitat conditions in closed canopy oak forests. There are a number of viability concern species that are associated with open canopy condition and moderate levels of prescribed burning in dry to mesic oak forests (Appendix F).

Mast Production

Mid- and late-successional oak forests provide an important source of hard mast and dens. Acorns are a critical fall and winter food for numerous wildlife species (Martin et. al. 1951). The availability of acorns has been shown to strongly influence population dynamics of species such as black bear (Pelton 1989), squirrels (Nixon et. al. 1975), white-tailed deer (Wentworth et. al. 1992), and white-footed mice (Wolff 1996). The large diameter hollow trees and snags found in these older oak forests also are an important source of dens for black bears (Carlock et. al. 1983). Hard mast production is an important habitat feature for several wildlife species in demand for sport hunting. These include white-tailed deer, wild turkey, squirrels, and bear. There are no mast dependent viability concern species identified for the Sumter National Forest.

Management Indicators

Several management indicators have been identified for assessing effects to oak and oak-pine forest communities. These indicators include both management indicator species (MIS) and key habitat variables.

Four key variables for tracking management effects on this community type are selected. To indicate the level of management activity directed at maintaining this forest type, acres of the type burned annually and acres thinned annually are projected. Restoration efforts are tracked by the annual acreage of oak and oak-pine forest restored to appropriate sites currently occupied by other forest types. Because older oak forests are an important source of oak mast and dens, total acres of mid- and late-successional oak and oak-pine forests are also projected. The scarlet tanager (*Piranga olivacea*) is selected as the wildlife management indicator species for this forest community. Population trends for this species are tracked by annual breeding bird surveys (BBS) and bird point counts conducted on the Sumter National Forest.

Direct and Indirect Effects

Abundance

The future abundance of oak and oak-pine forests is primarily related to the maintenance of stand conditions that ensure oak dominance, and to the restoration of oaks or oak-pine forests on appropriate sites currently occupied by pine plantations or other hardwood species such as gum and maple. Expected activity levels related to the maintenance and restoration of oak forests for all alternatives are shown in Tables 3-15 and 3-16, respectively, for the Sumter National Forest. Alternatives B, E, and I have the greatest potential for increasing oak in the mountains and the piedmont.

Table 3-15. Expected Activity Levels related to the maintenance and restoration of oak forests for the Sumter mountain district by alternative.

Activity	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Average annual acres of oak or oak-pine forests to be restored	.07	.07	.03	.06	0	0	.04
Average annual acres of oak and oak-pine forests to be burned	3.2	6.5	2.9	5.8	2.1	1.7	5.1
Average annual acres of oak and oak-pine forests to be thinned	.06	.07	.06	.08	.08	.08	.07

Table 3-16. Expected Activity Levels related to the maintenance and restoration of oak forests for Sumter piedmont districts by alternative.

Activity	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Average annual acres of oak or oak-pine forests to be restored	.1	.3	.3	.2	.1	.1	.2
Average annual acres of oak and oak-pine forests to be burned	1.8	4.2	2.7	5.1	2.3	1.4	3.8
Average annual acres of oak and oak-pine forests to be thinned	.01	.01	0	.01	.01	.05	.01

The ability to meet these activity levels, to manage these forests to ensure adequate oak regeneration, and to provide habitat conditions for species associated with open canopy condition and moderate levels of prescribed burning will vary among alternatives due to the differences in management intensity and emphasis.

Age Class Distribution and Forest Structure

All alternatives (except G) implement a strategy to provide a distribution of forest stages within the oak and oak-pine forest community. Table 3-17 shows the expected

percentage in mid- and late-successional oak forest for each alternative after 10 and 50 years of implementation. While total acres in oak and oak-pine would remain relatively stable in the mountains, restoration activities would add between 1,000 to 3,000 acres of oak and oak-pine forests per decade on the piedmont (Table 3-15).

Table 3-17. Expected percentage of mid- and late-successional oak[1] forest on the Sumter National Forest, after 10 and 50 years of implementing forest plan alternatives. (derived from SPECTRUM models)

	Mountains		Piedmont	
Alternative	Yr10	Yr50	Yr10	Yr50
Alternative A	26	19	11	4.6
Alternative B	25	20	10	8.7
Alternative D	23	13	11	4.8
Alternative E	27	22	11	8.0
Alternative F	22	8.6	11	3.3
Alternative G	29	30	11	11
Alternative I	27	21	11	7.9

1 – dry-mesic oak and oak-pine based on old growth type definitions used in SPECTRUM

Mast Production

Acorn production is widely recognized to be greatest in mid- and late-successional oak forests. Annual acorn crops are highly variable, however, and subject to climatic perturbations (i.e., late spring freezes, drought) and insect (gypsy moth, oak borer) or disease (oak decline) attacks. Current conditions (Table 3-14) depict nearly the entire acreage in oak forests on the Sumter to be in the mid- to late-successional stage. This places the oak forests on the Sumter in a vulnerable position for high mortality and mast crop failure similar to the relationship between extensive pine forests and the southern pine beetle. The expected quantity of mid- and late-successional oak forests will vary among alternatives (Table 3-17) as will the potential for oak mast. The potential for mast production will be greatest in Alternatives B, E, G, and I.

Cumulative Effects

Oak and oak-pine forests are common on the Sumter National Forest as well as on adjacent forest industry, non-industrial private, and other public lands. Management opportunities permitted in most alternatives would ensure continued oak dominance on national forest lands. However, the majority of these oak forests are on non-industrial private lands. These lands are the least likely to receive active forest management and therefore the loss of oak dominance is likely to be more problematic in these areas.

Insects and diseases such as gypsy moth and oak decline also are expected to have an overall negative effect on oak forests in the future (SAMAB 1996: 103-108, 114-117). Gypsy moth is expected to reach the mountains of South Carolina by 2020 and many of the older forests already are experiencing oak decline. The greatest impact of oak decline will be immediately behind the advancing front of gypsy moth due to repeated severe defoliations. As existing oak stands grow older, susceptibility to this disease will increase. Although oaks will not be eliminated from affected areas, oak abundance and diversity will be reduced. On both national forest and private lands, the future of oak forests will largely depend on active management such as thinning and burning that encourage oak reproduction to offset the impacts of these insects and diseases. (See further discussion of these threats in the Forest Health section.)

Woodlands, Savannas, and Grasslands

Affected Environment

Complexes of woodlands, savannas, and grasslands were once a frequent occurrence across the southeastern landscape, maintained with frequent fire on xeric ridgetops and south-facing slopes (DeSelm and Murdock, 1993; Davis et.al. 2002). Woodlands are open stands of trees, generally forming 25 to 60% canopy closure (Grossman et.al. 1998:21) and may be of pine, hardwood (typically oak), or mixed composition. Savannas are usually defined as having lower tree densities than woodlands; grasslands are mostly devoid of trees. All of these conditions typically occurred in mixed mosaics within a fire-maintained landscape. In all cases, a well-developed grassy or herbaceous understory is present.

Frost (2002) estimated that 55-70% of the landscape on the Sumter National Forest was once dominated by fire-influenced savannas and woodlands. Existing remnants of this habitat and several associated rare species in both the Southern Appalachians and Piedmont are limited to roadside and power line rights-of-way (Davis et.al. 2002), due to reductions in fire frequency across the landscape. Good examples of this community can be found in areas managed for featured species such as the red-cockaded woodpecker and northern bobwhite quail.

Many species of viability concern are associated with this community in both the Southern Appalachians and the Piedmont (Appendix F). Of these, the majority are vascular plants, followed by reptiles, birds, and insects.

Because existing woodland, savanna, and grassland complexes are rare and not consistently tracked, the current acreage in such condition is not well documented. One method for determining the potential for this community type on the Sumter National Forest is to display the acreage in xeric and dry pine and oak forest communities (Table 3-18). The xeric and dry sites were the most likely to support woodlands, savannas, or grasslands historically.

inches/year, 2,800 tons/acre/year or 1 billion acre feet as based on several of the stream gaging stations across South Carolina. Average water yield in the mountains is about 40 inches/year, with about 13 inches/year on the Long Cane Ranger District and 19 inches/year on the Enoree Ranger District. Water yield probably averages about 50% of the rainfall amounts, so increases up to 80-90% above existing levels are theoretically possible, assuming some losses for evaporation from surfaces.

To estimate increases in water yield associated with activities, many coarse assumptions had to be made. It was assumed that roads, trails, and other heavily compacted surfaces have a permanent increase in water yield of 60%; temporary roads, a temporary increase of 60% for 10 years; regeneration cuts, a temporary increase in water yield of 30% for 5 years; shelterwood, 15% for 5 years; thinning, 5% for 5 years; woodland conversion, 15% permanent; savanna or wildlife opening conversion, 30% permanent; site preparation by chopping, 5% for 5 years; and low intensity prescribed burning, 5% for 5 years. Activities that reduce water yield include gully and road restoration, -30% for 10 years, fertilization to increase plant cover and vigor on low site lands, -5% for 5 years.

The compiled results that suggest there might be an average annual increase in flow at 2.9% in Alternative G, Alternatives D and I, 4.9%; A, 5.1%; F, 5.4%; B, 5.5%; and E, 6.7%. Increases in flow as a result of the reduction in vegetation and associated transpiration typically are noticed primarily in the summer and fall as a result of higher localized water tables and soil moisture. Water yield is extremely variable in relation to the time of year, intensity and duration of storms, antecedent moisture conditions, as well as the timing of concentration of contributing flows. Water yield increases of less than 10% would probably go undetected. Because these increases are spread over the entire SNF, localized increases related to concentrated actions could be larger than those estimated. These effects should be analyzed on a site-specific basis.

Chattooga River Uses

A substantial amount of detail can be obtained from Amendment 14 of the Sumter Forest Plan. Currently, records show that in normal water years, nearly 100,000 annual floating users are spread along most of the tributaries and the river during some time each year. This situation constitutes a substantial potential and likelihood that there are some direct and indirect contributions associated with compaction, erosion, sedimentation, and fecal coliform problems from these and other recreational uses that concentrate in this watershed.

Wider portions of the floodplain and terraces that are accessible are sought out by river floaters and used for picnics and camping. Except for the river access points that must cross riparian areas, these camping and picnic areas are the most likely to be impacted by river users. Impacts include soil exposure, damage to riparian vegetation from compaction, and sometimes, soil erosion. The effects of these uses can generally be limited in extent and impact through quality design, location, monitoring, and maintenance.

Fecal contamination is a health and public safety issue of concern. Contamination comes from a variety of sources within the watershed. Hansen et. al., (1998) summarize many of the past references and conditions associated with fecal coliform problems of the Chattooga River, specifically Stekoa Creek. Past problems that were identified stem from the waste treatment facility in Clayton, GA, and were also assumed to come from cattle, septic systems, pets, wildlife, and other dispersed potential sources within the watershed, including public camping. Other data from the U.S. Geologic Service from 1997 were evaluated, showing one or more storm periods on most tributaries have fecal contamination problems during storm events. The river uses and associated activities such as swimming and camping are potential contributors to fecal contamination.

Most septic and water treatment facilities used by the majority of the Chattooga human population of 15,400 (1990) are normally very effective at removal of fecal coliform. Failed sewer lines and septic systems can be suspect, but when properly managed and maintained, are unlikely to cause problems. Of special concern are the limited data that suggest that besides the fecal problems in Stekoa Creek and tributaries, the Chattooga River, West Fork, and Warwoman Creek are showing increased signs of fecal contamination during low flow periods, especially when associated with storm events. Whetstone Creek also has fecal contamination problems that have been noted in reference materials. .

In comparison, the river activities may involve only 1,000 people in a day, but the activity involves access and close proximity to the river during the use, suggesting that the river activities may contribute to fecal problems. At this time, the data do not determine the sources of pollution. River uses are suspect along with other potential sources such as livestock, beaver, wildlife, camping, and communities. Streams with cattle access to streams, especially during hot summer days, are likely to be contaminated since cattle reside for extended periods within the channel for water and shade. Also during summer months, there is less flow to dilute the animal wastes discharged into the streams. Storm runoff from other animal, pet, and wildlife uses and industry are suspected as causing some of this problem. Other forest uses including camping, hiking, fishing, etc. that involve people temporarily residing near streams may be other sources.

During non-storm conditions, Chattooga River sections I, II, III and the upper half of IV (i.e., above Stekoa Creek) normally have water quality suitable for swimming. Stekoa Creek exhibits elevated fecal coliform levels even during many non-storm periods. During storms, fecal flushing often exceeds the water quality standard that supports swimming uses on most of the streams. Section I (West Fork Chattooga River) in 1997 has instances where the standard was exceeded by over an order of magnitude (i.e. ten times). Sections of the main stem of the Chattooga River are probably impacted at various times with excessive coliform levels. Stekoa Creek poses some ongoing degree of health risk to river users after it combines with the Chattooga River in the lower half of Section IV. Fecal contamination in Stekoa Creek is sometimes 100 or more times the allowed standards making it impossible for the flow in the Chattooga River to dilute this contamination to acceptable levels. This is the section of the river where swimming

limitations or warnings should be considered until the fecal records suggest the frequency and extent of contamination is greatly reduced.

Chattooga Erosion and Sedimentation

Access and river use exposes and displaces some soil, offering opportunity for causing erosion and sedimentation to occur. Sites that are used for picnics, camping, and/or boat "put-in" and "take-out" points have been identified. Sites on the West Fork are somewhat more deteriorated than those on other sections of the river. Sites along the lower portion of section III and section IV receive the most use. In general, most sites are relatively small in size, stable, and probably contribute some sediment, but nothing substantial. There may be localized aquatic habitats of concern that could be impacted. Periodic monitoring of sites to determine use and conditions is needed in order to implement mitigation measures to correct erosion and sediment problems in a timely manner. Without substantial ongoing monitoring and resource commitments, we are not completely aware of the conditions and are unable to manage, minimize, mitigate, or determine the extent of the effects.

Current regulated river floating use on the Chattooga River, as summarized in Amendment 14, shows a limit of annual self-guided use at 84,600; guided use at 151,400; clinics at 85,200; for a possible total of 321,000 users. Currently; the known use levels are less than 100,000 floaters each year. If river use continues to grow as expected, increased use will cause more effects to fecal coliform levels, soil erosion, sedimentation, compaction at recreational facilities, use of stream banks for transport, etc.

Alternatives A and E that consider increasing river uses above Highway 28 on the Chattooga River will also increase some congestion, compaction, soil exposure, erosion, and sedimentation at access points and similar effects to sites in this section of the river on both areas that are currently under use by campers and others, and also at probably some new sites that are accessible from the river and suit the needs of those that like to float small streams. Most of these effects will probably not be distinguishable from the fishing, camping, sight-seeing, and other effects, except these will probably occur during the high water periods, when some of those activities are reduced.

Cumulative Effects

Stream Sedimentation

To evaluate the alternatives, the 28 watersheds that intersect the Sumter National Forest were utilized to support hydrologic analysis of effects. The size of these watersheds range from 21 to 339 square miles and are USGS 5th level hydrologic units, as modified in a few circumstances. The average watershed size used in this analysis is approximately 160 square miles. The cumulative effects for each alternative were evaluated separately for each watershed, with the significance relative to those effects determined in part by the percentage of watershed within the national forest. Watersheds

with a low percentage of national forest have little or no significance in coarse forestwide or landscape level conditions being addressed (Clingenpeel, 2002, 2003, Hansen and Law, 2002). That does not mean that specific concentrations of National Forest within drainages and tributaries are not important or even critical in individual circumstances (e.g., presence of the Carolina Heelsplitter primarily within the Turkey and Upper Stevens Creek watersheds).

On National Forest System lands, sedimentation is typically the primary factor for ground disturbing activities to consider in reducing water quality. As previously discussed, the sedimentation estimated in this analysis is derived from surface erosion from soil disturbing activities such as roads, timber harvesting, ATV and horse trails, prescribed burning, fire lines and wildlife openings. On private lands, agriculure, pastureland, urbanization, rural development, timber harvest and other activities associated with coarse land use practices are included. A percentage of the erosion from these activities reaches streams and is delivered at the watershed boundary (Swank et. al., 1989). Since watershed sizes and existing sediment levels vary somewhat, sediment by unit area has been included for comparative purposes. Percent changes by watershed are the percent change with respect to the existing condition unless otherwise indicated. The numbers presented are based on many assumptions and information available at the time of this analysis (See process records from Clingenpeel, 2002, 2003). Erosion-based sediment is probably one of the best indicators of soil and water cumulative effects on National Forest System lands. The erosion estimates made in this sediment analysis are based in the Revised Universal Soil Loss Equation with adjustments for localized forest conditions (Dissmeyer and Stump, 1978, Dissmeyer and Foster, 1984, NRCS, 1982, 1989, Hansen and Law, 2002). Sediment delivery is based on Roehl (1962). The ability to estimate sediment for given treatments and conditions has improved through careful analysis and interpretation of available information with GIS and computer analysis capabilities. To evaluate existing and potential watershed conditions for each alternative, the methods consisted of estimating baseline sediment, compiling sediment increases based on existing and estimated land disturbing practices for each land use, determining the percent increase in stream sedimentation and comparing it to watersheds throughout the Southern Appalachian Mountains for each physiographic area. Some assumptions were made on future activities and development to carry out the model for 5 decades to insure the model was producing reasonable long-term results.

Due to natural variability, geography, climatic conditions, and assumptions on which stream sediment values are based, it is important to view these numbers as comparative, rather than absolute values. Stream sedimentation occurs as a result of soil exposure and storm runoff during and following temporary activities for the next several years. Permanent activities or recurrent treatments such as roads produce elevated sediment outputs which may decline somewhat with time as a portion of the exposed surfaces revegetate or stabilize. Roads, trails and wildlife openings produce continued sediment levels in the long term as they continue to be used and are maintained regularly, resulting in the exposure of fresh materials. Road surfacing with aggregate or paving helps to reduce erosion and properly placed surface drainage limits water concentration and

delivery of sediments. Erosion and sediment increases from bare soils are mitigated and stabilized with erosion control methods to help limit effects.

Stream Sediment Effects by Alternative

Existing sediment is estimated at what is occurring today from Forest Service, private, and road activities. Figure 3-3 below displays the estimated existing sediment levels in tons per square mile per year for the Sumter National Forest watersheds.

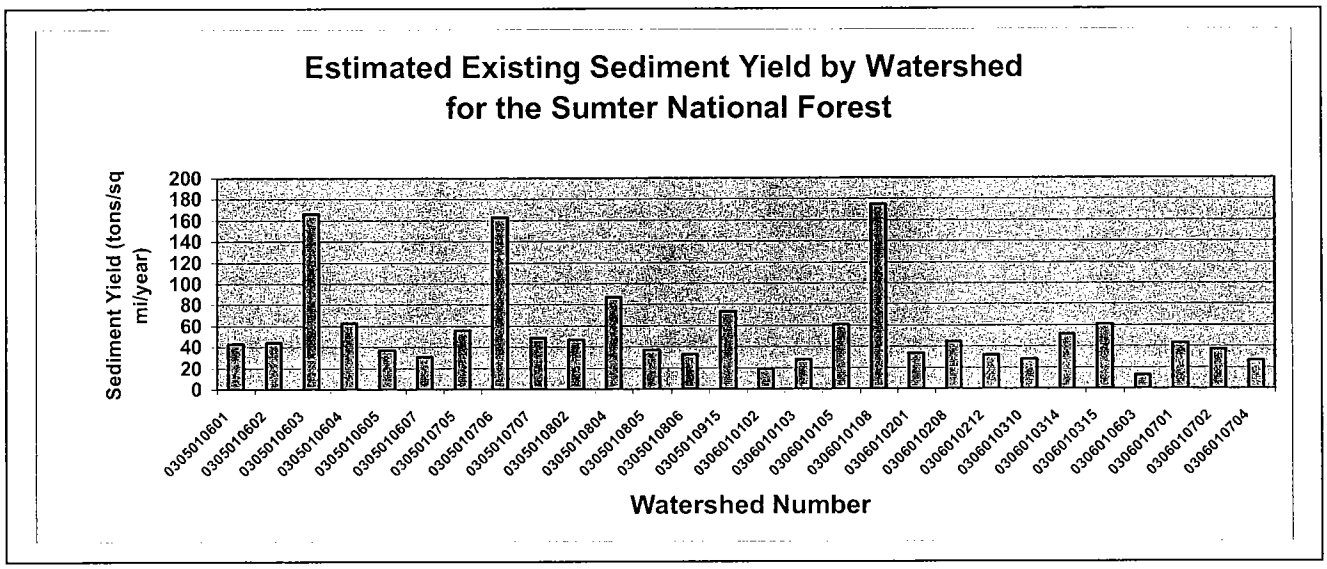


Figure 3-3. Estimated Existing Sediment Yield by Watershed for the Sumter National Forest

Figures 3-4 and 3-5 display a set of seven data points on the bar graph for each watershed. The set of seven points within each watershed are the estimated percent increase in sediment relative to existing sediment levels for the alternatives (A, B, D, E, F, G, I) for period 1. In Figure 3-4, USFS activities from land based activities for each alternative are compared to existing sediment activities. In Figure 3-5, total cumulative activities from Forest Service, private and roads are compared to existing sediment. <u>*Existing sediment*</u> is estimated at what is occurring today from Forest Service, private, and road activities from remote sensing and existing GIS databases on land uses. Forest Service land based sediment values in the model include sediment related to activities, but do not include the temporary roads, permanent system roads and highways that are managed by USFS, state, county, and private landowners. Tables 3-2 and 3-3 are the detailed data associated with Figures 3-4 and 3-5. In tabular form, the values were calculated and carried to two decimal places for convenience, to display the full range in values present, and are not intended to show level of precision or accuracy.

To summarize Figure 3-4 and Table 3-2, the average increase in watershed sediment from USDA-Forest Service land based activities over the existing conditions for the 28

watersheds ranged from the low with Alternative G at 0.7%; Alternatives E and I, 1.3%; Alternatives B, D, and A at 1.5%; and Alternative F, the highest at 1.9%. The maximum increase in sediment from any single watershed from Forest Service land based activities was 15% in Alternative F, with maximums for a single watershed for the other alternatives ranging from 5 to 11% increase. Relative to Forest Service land activities, the Lower Savannah watershed (number 0306010603) consistently had the highest increase in all alternatives except G. Over one-half of the watersheds had increases less than 1%. The percentage increase is based on the existing values as displayed in Figure 3-3. The percentages must be viewed with caution, as a watershed with existing low sediment yield will show a greater increase in percent sediment for a specific sediment increase as compared to one with a high existing sediment yield.

To summarize Figure 3-5 and Table 3-3, the average increase in watershed sediment from the accumulation of all estimated Forest Service, private, and road activities over the existing conditions for the 28 watersheds ranged from the low with Alternative G at 18%, Alternatives A, D, and E at 19%, and Alternatives F, B and I at 20%. The maximum increase in sediment from any single alternative and watershed was 106% in alternative F for the Lower Savannah watershed (0306010603), with the other alternative maximums ranging from 94 to 103% increase. The Lower Savannah has the lowest existing sediment levels of the 28 watersheds, so that explains why these values are so high. As can be seen in Figure 3-5 and Table 3-3, the only other watersheds to exceed a cumulative 30% increase are the Chauga and Whitewater River watersheds. Since the existing sediment levels are relatively low on all the watersheds (Figure 3-3) with high percentage increases in sediment, the magnitude of the increases are to some extent dependent on the existing sediment levels within the watersheds. Percentages are used primarily to help simplify comparisons among the alternatives for each watershed.

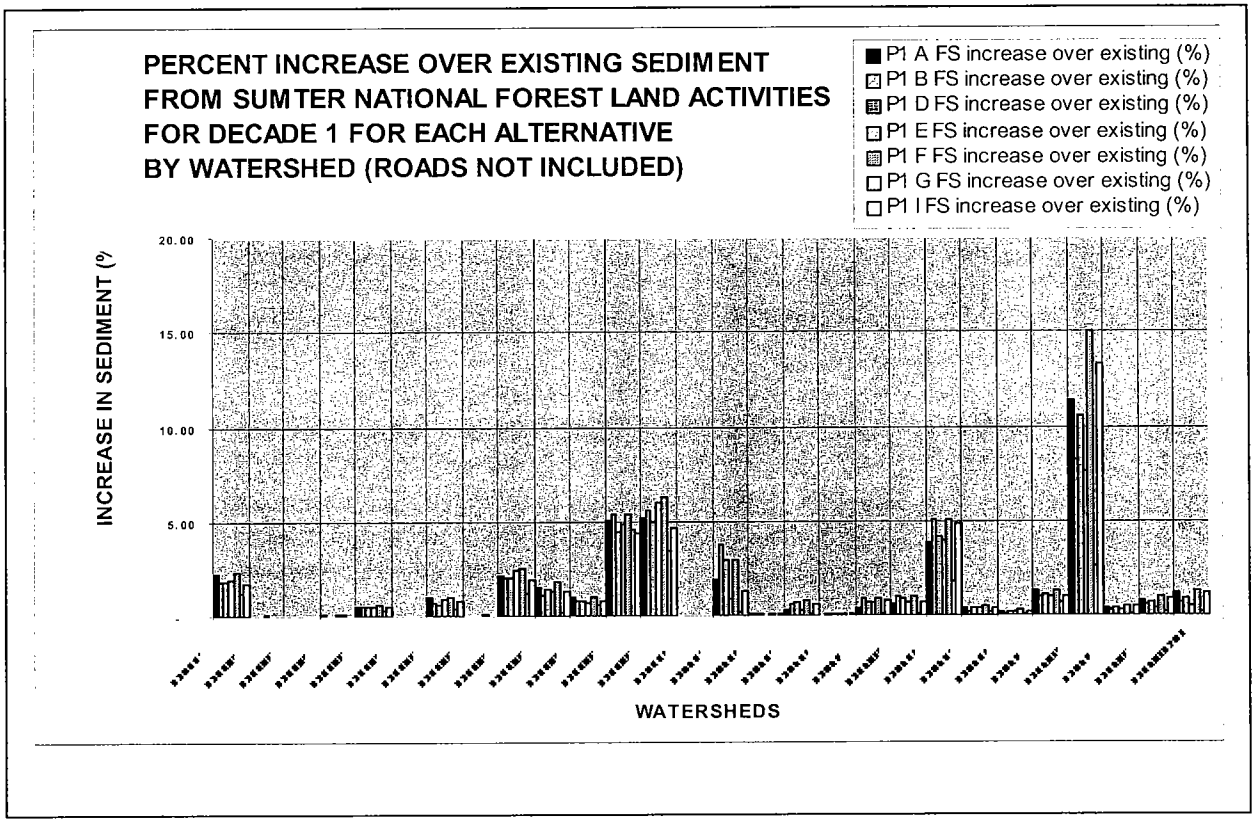


Figure 3-4: Forest Service activities increase in sediment yield by alternative for each watershed in period 1 as expressed as percent change over existing sediment yield.

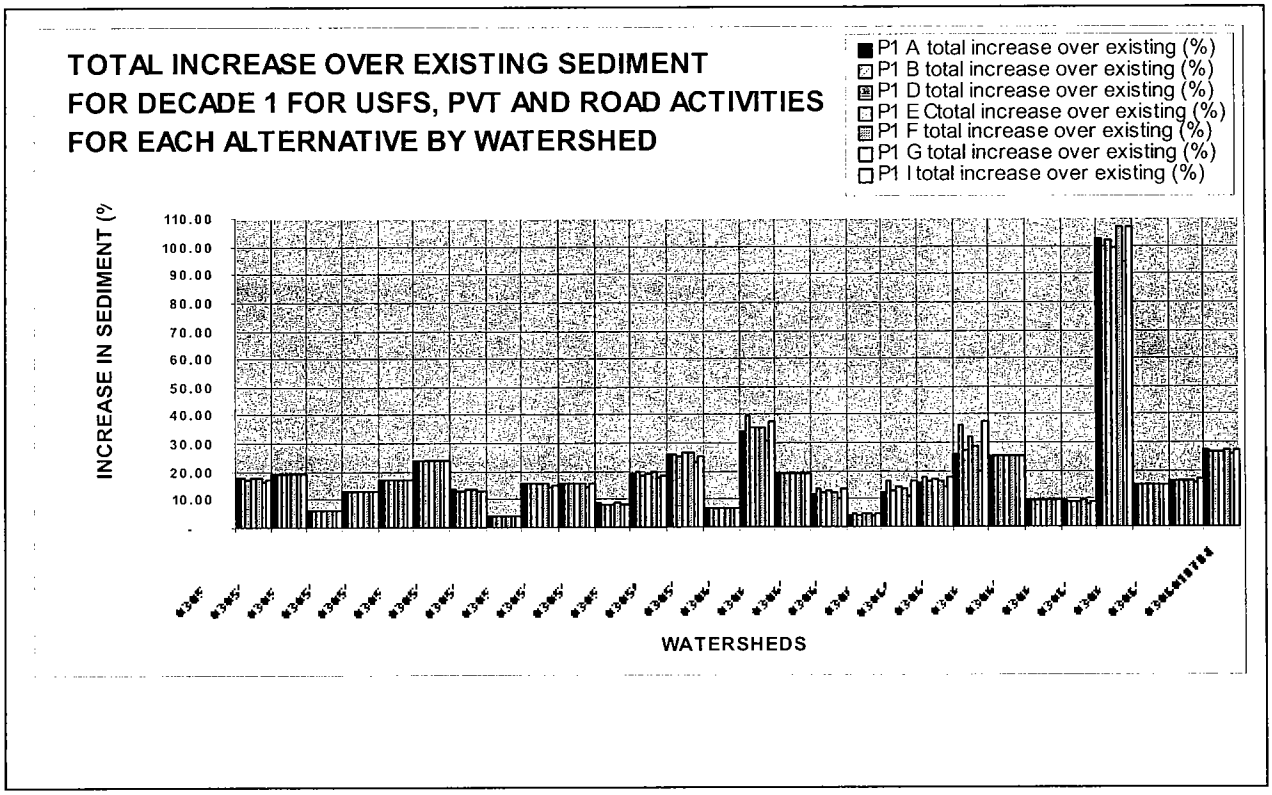


Figure 3-5: Total cumulative activities increase in sediment yield by alternative for each watershed in period 1 as expressed as percent change over existing sediment yield.

In Tables 3-2 and 3-3, columns 3 through 9 display the percentage increases in sediment for decade 1 by alternative and were estimated by the regional sediment modeling tool (Clingenpeel, 2002, 2003) with localized erosion coefficients based on estimated activities with the SPECTRUM model and estimated probable activities on both private and public lands within each watershed (Hansen and Law, 2002).

Table 3-2. Increase in sediment yield by watershed for period 1 from the estimated Forest Service activities as expressed as percent change over existing sediment yield.

Watershed number Watershed Condition Rank (WCR)	Watershed name	P1 A FS increase over existing (%)	P1 B FS increase over existing (%)	P1 D FS increase over existing (%)	P1 E FS increase over existing (%)	P1 F FS increase over existing (%)	P1 G FS increase over existing (%)	P1 I FS increase over existing (%)
0305010601 A	Upper Broad	2.20	1.80	1.85	1.96	2.33	1.26	1.57
0305010602 A	Turkey Creek (Broad)	0.04	0.04	0.04	0.06	0.04	0.03	0.03
0305010603 BA	Browns Creek	0.02	0.02	0.02	0.02	0.02	0.01	0.02
0305010604 A	Sandy Creek	0.05	0.05	0.05	0.06	0.06	0.03	0.04
0305010605 A	Lower Broad River	0.52	0.51	0.49	0.53	0.61	0.34	0.61
0305010607 A	Little River Broad	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0305010705 A	Middle Tyger	1.00	0.73	0.63	0.87	0.98	0.39	0.70
0305010706 BA	Fairforest Creek	0.05	0.03	0.04	0.05	0.06	0.03	0.04
0305010707 A	Lower Tyger River	2.14	2.00	2.03	2.46	2.54	1.17	2.19
0305010802 A	Middle Enoree River	1.54	1.13	1.47	1.31	1.85	0.24	1.33
0305010804 A	Duncan Creek	1.05	0.80	0.85	0.74	1.05	0.61	0.92
0305010805 A	Indian Creek	5.09	5.39	4.43	4.91	5.42	4.52	5.00
0305010806 A	Lower Enoree River	5.19	5.54	4.94	5.95	6.26	3.46	5.89
0305010915 A	Middle Saluda River	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0306010102 A	Whitewater River	1.89	3.73	2.95	0.93	2.92	0.24	1.23
0306010103 A	Upper Keowee	0.12	0.13	0.10	0.04	0.10	0.01	0.10
0306010105 A	Little River Seneca	0.30	0.61	0.69	0.32	0.78	0.09	0.51
0306010108 BA	Coneross Creek	0.05	0.05	0.08	0.06	0.09	0.03	0.08
0306010201 BA	Chattooga River	0.44	0.94	0.75	0.69	0.86	0.11	0.71
0306010208 A	Tugaloo River	0.64	0.98	0.87	0.74	0.98	0.08	0.84
0306010212 A	Chauga River	3.89	5.08	4.18	3.92	5.04	1.85	3.99
0306010310 A	Little Savannah Comp.	0.40	0.24	0.39	0.42	0.48	0.24	0.39
0306010314 A	Little River Sav.	0.25	0.12	0.24	0.25	0.30	0.12	0.28
0306010315 A	Long Cane Creek	1.30	0.97	1.07	1.06	1.34	0.69	1.15
0306010603 E	Lower Savannah	11.32	8.21	10.56	7.59	15.06	2.68	7.76
0306010701 A	Upper Stevens Creek	0.45	0.30	0.38	0.35	0.50	0.10	0.42
0306010702 A	Turkey Creek	0.86	0.59	0.74	0.44	0.99	0.20	0.80
0306010704 A	Lower Stevens Creek	1.20	0.74	0.95	0.53	1.27	0.19	1.02

FS Increase over existing sediment includes only USFS land activities, but no roads

Table 3-3. Increase in sediment yield by watershed for period 1 from the estimated total cumulative activities as expressed as percent change over existing sediment yield.

Watershed number Watershed Condition Rank (WCR)	Watershed name	P1 A total increase over existing (%)	P1 B total increase over existing (%)	P1 D total increase over existing (%)	P1 E Ctotal increase over existing (%)	P1 F total increase over existing (%)	P1 G total increase over existing (%)	P1 I total increase over existing (%)
0305010601 A	Upper Broad	17.64	17.48	17.38	17.64	17.94	16.61	17.25
0305010602 A	Turkey Creek (Broad)	19.15	19.15	19.14	19.17	19.15	19.13	19.14
0305010603 BA	Browns Creek	6.25	6.25	6.24	6.25	6.25	6.24	6.24
0305010604 A	Sandy Creek	12.79	12.79	12.79	12.80	12.80	12.77	12.79
0305010605 A	Lower Broad River	17.17	17.22	17.14	17.23	17.28	16.93	17.14
0305010607 A	Little River Broad	24.18	24.18	24.18	24.18	24.18	24.18	24.18
0305010705 A	Middle Tyger	13.40	13.19	13.02	13.34	13.41	12.70	13.19
0305010706 BA	Fairforest Creek	3.80	3.78	3.79	3.80	3.81	3.77	3.79
0305010707 A	Lower Tyger River	15.55	15.57	15.41	15.99	15.99	14.36	15.32
0305010802 A	Middle Enoree River	15.69	15.40	15.60	15.56	16.04	14.23	15.44
0305010804 A	Duncan Creek	8.59	8.41	8.39	8.33	8.62	8.06	8.38
0305010805 A	Indian Creek	19.10	19.73	18.39	19.17	19.54	18.09	18.37
0305010806 A	Lower Enoree River	25.63	26.26	25.34	26.66	26.80	23.46	25.10
0305010915 A	Middle Saluda River	7.09	7.09	7.09	7.09	7.09	7.08	7.09
0306010102 A	Whitewater River	34.03	39.91	35.56	35.53	35.72	30.89	37.61
0306010103 A	Upper Keowee	19.20	19.46	19.21	19.24	19.21	19.02	19.43
0306010105 A	Little River Seneca	11.41	13.83	12.05	12.66	12.21	10.46	13.80
0306010108 BA	Coneross Creek	4.39	4.56	4.44	4.50	4.46	4.31	4.57
0306010201 BA	Chattooga River	12.47	16.24	13.14	14.62	13.40	10.96	16.10
0306010208 A	Tugaloo River	15.69	17.65	16.12	16.90	16.32	14.45	17.68
0306010212 A	Chauga River	25.92	36.33	27.41	32.25	28.68	20.09	37.48
0306010310 A	Little Savannah Comp.	25.33	25.22	25.33	25.38	25.42	25.13	25.32
0306010314 A	Little River Sav.	9.70	9.60	9.69	9.72	9.76	9.54	9.68
0306010315 A	Long Cane Creek	9.26	9.05	9.02	9.11	9.35	8.52	9.01
0306010603 E	Lower Savannah	102.74	99.63	101.98	99.01	106.48	94.10	106.50
0306010701 A	Upper Stevens Creek	15.17	15.02	15.11	15.08	15.22	14.82	15.36
0306010702 A	Turkey Creek	16.55	16.28	16.43	16.13	16.68	15.89	16.97
0306010704 A	Lower Stevens Creek	27.21	26.75	26.96	26.54	27.28	26.20	27.61

Total Increase over existing sediment includes USFS, Private and all road activities

In general, the watersheds in Tables 3-2 and 3-3 (number in column 1, name in column 2) with the lowest existing sediment levels (Figure 3-3) have the highest percentage change in sediment (columns 3-9). The reverse is also true as those watersheds with highest existing sediments have the lowest percentage increases. So the values presented are most meaningful in comparing relative differences among the alternatives, so care should be used when applying the percentage increase values to compare differences between or among watersheds. Abbreviations used include: P1 is the first decade while A, B, D, E, F, G and I are the alternatives under consideration for plan revision. Only very minor changes were noted over the other four decades from the values presented in this table, so they are not presented in detail, but are available in the process records. The first 14 watersheds, 030501xxxx, have portions associated with the Enoree Ranger District. The next seven watersheds, with beginning numbers 03060101xx and 03060102xx, are associated with the Andrew Pickens Ranger District. The final seven watersheds,

beginning with 03060103xx, 0306010603 and 03060107xx, are linked to the Long Cane Ranger District.

Erosion-based sediment values do not include stream channel, gully, or mass movement types of erosion. In addition, legacy sediment sources based on historic conditions are not addressed. Substantial variability of watershed conditions exists among the watersheds, based on compiling information on a variety of activities, water quality, and biological factors at landscape or watershed scales (Holcomb et. al., 1999, Hansen et. al., 1999, 2001, Clingenpeel, 2002, 2003, Scott et. al., 2003). The piedmont watersheds with greater frequency of roads, more agriculture, silviculture, rural and urban development, tend to show substantial increases over baseline conditions as compared to mountain watersheds that typically have higher percentages in forests, with fewer roads and less development and agriculture.

Calculations suggest that watersheds with significant national forest ownership (over 17%) are within the average to excellent conditions when compared to the other watersheds in that physiographic area (Clingenpeel, 2002). As mentioned elsewhere, only the Upper Broad, Lower Tyger, Middle Enoree, Duncan Creek, Indian Creek, Lower Enoree, Chauga, Long Cane Creek, and Lower Savannah watersheds had over 17% of ownership within the Sumter National Forest and this level of ownership may have some potential to affect water quality and/or aquatic health (Clingenpeel et. al., 2002). The poorest or below average watersheds are those where Sumter National Forest management has ownership of less than 17%, and higher non-forest land uses such as agriculture, urban areas, and developments exist. The detailed calculations and assumptions by Clingenpeel (2002, 2003) associated with the regional sediment model, and Hansen and Law (2002), relative to localized erosion information for the Sumter National Forest, are available in the process records.

In a separate analysis, an estimate of watershed condition rank (WCR) was compiled by Clingenpeel et. al. (2003, Scott et. al., 2003). This analysis evaluated the sediment percent increase over baseline in comparison with other watersheds within the physiographic area, and categorized them into three groups, below average, average and above average. Of the twenty-eight watersheds, nine had 17% or more ownership on the Sumter National Forest, of which one rated excellent and eight rated average. The Chattooga Watershed (WS# 0306010201) does have substantial National Forest land if you consider Georgia and North Carolina. It rated below average in the WCR list using the localized erosion coefficients from South Carolina. However, the normalized sediment comparison of the 28 watersheds indicates that the Chattooga is estimated to produce relatively low sediment loading per unit area. More discussion relative to aquatic habitat effects relative concerning the WCR analysis is provided in the section on Watersheds and Aquatic Habitats. During the five decades under analysis, none of the alternatives change their watershed condition rank category in any of the alternatives based on sedimentation from projected land use practices.

Three other watersheds, Coneross, Fairforest and Browns Creek had substantial changes from estimated baseline conditions within their physiographic areas and were identified

as below average watersheds (Clingenpeel et. al., 2002, 2003). They are can be noted easily in Figure 3-3 with normalized sediment values exceeding 160 tons/square mile/year. The Sumter National Forest makes up only a small portion of each of these watersheds, so the increases associated with national forest management are not expected to be significant. The below-average watersheds contain the largest cumulative increases in stream sedimentation based on activities over natural conditions. However, their percentage increase over existing in the alternatives tends to be among the lowest increases. This is due to the high existing levels that are used in comparison. Based on the land use practices and sediment model results, these high sediment values are primarily on private lands from land use practices, not just roads. Significant urban, agriculture, or other types of concentrated and dispersed ground disturbing activities make the difference. Regardless of the alternative, most Forest Service activities tend to generate relatively minor effects. In addition, the effects of most vegetation management are temporary and infrequent, except for roads, trails, and special wildlife enhancements. Best management practices, which are consistently applied on the national forests, may further reduce these estimates to only a fraction of these amounts. The effectiveness of BMPs at reducing erosion and sediment are not well quantified, but in visual field checks and applying biological surrogates, they appear effective (Adams and Hook, 1993). In addition to the BMPs, the measures utilized in the riparian corridors and channeled ephemeral streams may provide even more reduction to erosion reaching stream systems. The reductions in sediment production from Alternative F would not have the full benefit of the riparian corridor. In Alternative F, the lands within the riparian areas are part of the suitable land base and still subject to BMPs and other measures to control the impacts of activities, especially sediment production. When appropriate, a subwatershed or drainage analysis would be used at the project level to assess cumulative impacts over more localized conditions.

The cumulative effects of mining and mineral development will not be much different between alternatives. The effects to soil and water resources do not depend very much on the acres that are available for development, because most of the acres available have little likelihood of mining or mineral concentrations. In addition, stringent standards to prospecting and mining activities will be applied to avoid or minimize surface occupancy and any direct or indirect discharges to streams and aquatic habitats. Private minerals will be administered the same in all alternatives. Some current recreational mining activities in the mountains will be given more scrutiny to insure that the permittees are sampling stream gravels, avoiding streambanks and native surfaces, and limiting water quality and aquatic habitat impacts. Alternative G will have the least federal mineral development and the cumulative stream sediment levels and water quality should be better than current conditions. Alternatives A, B, D, E, F, and I will involve slightly higher development potential but sufficient direction and standards exist to consider and protect water resources.

Sediment-producing factors not reflected in the stream sedimentation values in Table 3-2 are the impacts of undesignated OHV, ATV, and horse trails (officially designated trails were included), impacts of many private and public arterial roads, individual home developments, gullies, channel erosion, mass soil movements, and other fine features that

are not differentiated in landscape level analysis of land uses with remote sensing techniques. The lengths of ATV trails and arterial roads vary widely between watersheds and through time. Over the last five years numerous miles of arterial roads and ATV and OHV trails have been closed on National Forest System land. However, during this time frame, the miles of undesignated trails have increased substantially on the piedmont districts. Acquisition of mountain land with existing roads and trails that are in poor condition, that need reconstruction to forest standards or closure, is another concern. Based on field observations, undesignated trails primarily exist on national forest lands in proximity to existing trail systems and also sometimes are associated with other management activities such as skid trails, temporary roads, fire lines, and relatively open adjacent areas, regardless of the alternatives. These unauthorized trail mileage estimates vary widely, making it unrealistic to include them in the sediment model. Data for many of the arterial and private roads were also not available. Nonetheless, the data used and calculations made for this scale of analysis should indicate the major trends and differences among the alternatives and watersheds, and be meaningful for planning level comparisons and analyses.

Water Yield

Hydrologic impacts generally do not occur if less than 25% of the basal area (BA) is removed (Douglas and Swank, 1972). Recovery after forest harvests that exceed 25% removal of the BA is rapid and generally complete within 5 to 15 years (Hornbeck et. al., 1995; Swank et. al., 2001; Verry, 1988). These types of impacts are generally going to show up at the headwater, small drainage scales, where activities concentrate, in areas of extremely erosive channel materials andwithin watersheds with extensive modifications and development. Generally, flow dynamics are much less complicated in headwater streams. In stable terrain, channels may be more able to adjust to small or moderate, temporary increases in flow. However in headwater areas where activities concentrate, increases in flow may occur from vegetation change, road surfaces runoff, stream capture and/or diversion of stormwater onto slopes or into stream channels not used to the excess flow. Swank et. al., 1988 summarized that vegetation cutting alone without removal increased peakflow about 7 percent due primarily change in leaf surface area (evapotranspiration). They found that clearcutting about one half of a headwater drainage with relative high road density and tractor skidding increased peakflow 30 percent. Clearcutting with cable logging and low road density increased peakflow 15 percent. Conditions that focus excess flow into small streams may cause channel overload, adjustments, and water quality impacts. This is especially a critical consideration in gullied, unstable terrain or in entrenched channels in unconsolidated, fine materials. The actual specifics relative to when channel adjustment will or will not occur due to changes in flow are not well studied. Small or temporary increases in flow into stable channels with vegetated streambanks will have low risk for impacts. Extended or permanent flow changes are likely to produce some channel adjustment, and the environmental risk associated with those adjustments will vary with the circumstances. As indicated, many of the streamtypes in the mountains and piedmont are entrenched, and do not have access to a normal floodplain that reduces stress on the channel banks during flood events. In entrenched channels, floods put added stress onto the

streambanks and channel. Channels in unconsolidated materials adjust under these circumstances. The adjustments typically involve channel degradation and/or widening, streambank undercutting and failure, adjacent trees leaning with rotating rootwads, eventually causing bank slumping and/or trees falling into the stream. Bank caving and failure and coarse woody debris entry produce added stress on the adjacent channel as portions of the channel are blocked, restricting and deflecting flow with stress added on other areas. The processes are natural, but may be unduly accelerated when water yield changes exceed the normal range and frequency of flow on sensitive streams.

Swank et. al., 1988 indicated that conversion from hardwoods to white pine produced a 20% reduction in flow by year 10, with some possible further reductions in some years reaching 40-50% by year 25 as white pine matures. Thinning of pine generally increased flow to hardwood levels, to decline back to the 20% reduction again by year 10. They also indicated that grassed lands produced 10-15% more flow, which was reduced to no difference from hardwoods in years when the grasses were fertilized and productivity increased. Areas where the grasses were deadened with herbicide treatments produced about a 25% flow increase as compared to hardwood stands.

Water yield increases at landscape or watershed scales become much more complex from the variety of activities that may occur. Developments such as roads, parking, houses, buildings, and altered vegetation can increase impervious surfaces, modify the ability of the water to infiltrate and move in the soil, and/or change the evapotranspiration values that affect the hydrologic cycle and water yield. Since water yields are typically about one-half of the rainfall rate, impervious surfaces may be able to increase flow up to about 100 percent. Some of the larger developments use storm-water retention ponds or other structures to detain, retain and reduce the storm-water effects from large paved or developed areas. Frequent road drainage into forested or vegetated filter strips helps to reduce impervious road surface impacts to streamflow. Ponds and reservoirs also change water cycling and yields, reducing transpiration but increasing evaporation.

Substantial water yield decreases can also impact channels by reducing the frequency and extent of flooding, allowing channels to encroach with vegetation, diminishing their capacity and reducing the ability to transport sediments, causing channels to aggrade. Declining flows can also impact aquatic habitats directly by reducing the active channel area and altering habitats as channels aggrade with sediments. The extent of the changes depends on the specific circumstances and are likely to be more severe where activities are concentrated in time and space within a specific hydrologic unit.

Water Increase Effects by Alternative

At landscape or watershed scales, average water yield increases for each of the alternatives from Forest Service activities ranged from 3-7% within the national forest as discussed in the direct and indirect effects section. These effects may be of concern where activities concentrate, producing water yield increases several to many times higher into local drainages. Certainly at cumulative scales, there are a variety of activities and conditions that can influence water yield from exposed or impervious

surfaces, such as farming and urban development. However, these increases may be moderated by surface drainage features such as floodplains that adsorb and reduce the direct effects from storm-flow increases, and by small ponds and reservoirs that capture and retain surface flow. In some instances, grasslands and agricultural areas on private lands are being converted to forest uses, and these types of changes may cause some water yield decline, as trees utilize more water in transpiration processes.

Evapotranspiration from pine trees is higher than hardwood trees and there is some attention in all alternatives to increasing hardwoods or obtaining mixed stands. On much of the private lands, pine is the tree of choice for commercial forest lands, while hardwoods are desired by many rural landowners for their beauty, longevity, and wind firmness. Much of water yield increases due to vegetation cutting or conversion to grasses occur primarily in the spring and summer months when the trees would have been transpiring water. Water supply typically exceeds demand in most years within South Carolina, so the increases during the baseflow season may go unnoticed, but will generally augment local water users, instream uses, and aquatic habitats. In infrequent periods dominated by extended droughts, more attention may be given to elements within the hydrologic cycle with attempts to manage water quantity.

Water yield increases can influence water uses, and vice-versa. The potential impact of water uses is also not well documented in states with riparian rights such as South Carolina. Major water uses are known or estimated, but small uses are probably not quantified or known. Table 3-4 indicates the water withdrawals of record compiled by the South Carolina Department of Health and Environmental Control for the subbasins of interest to the Sumter National Forest. Water withdrawals and uses can impact water yields to downstream areas. Connections between the potential increases in flow from forest management and private land activities to most of the other water withdrawals would be speculation.

So as suggested, the cumulative effects to water yield are complicated by land management activities, the types and amounts of vegetation present, impervious surfaces, consumptive water uses that have been developed and nonconsumptive needs that may not be well documented, but are no less important. Effects on water yield are normally not a significant issue relative to Forest Service management activities in the southeast. Rainfall distribution and water yields are normally ample to accommodate many uses and conditions. The effects of land management under most scenarios are minor to moderate. These types of cumulative effects would be best addressed for specific conditions and circumstances where watershed management activities or developments that influence water yield are substantial, such as affecting the vegetative cover in the short term over 25% of an area or when altering normal hydrologic processes such as building dams, consuming water, substantially disturbing the soil surface or expanding the extent of roads, parking areas and other impervious surfaces within an area.

Water Uses

Consumptive uses of water are those that divert or remove water from the stream channels or lakes, with little return. A variety of consumptive uses may be present and include administrative uses, drinking water, fire suppression, irrigation, and other needs. Non-consumptive uses of water include instream flows for aquatic organisms, to maintain channel capacity and provide pleasing visual conditions at waterfalls or for streamside camping. Aquatic organisms can be affected by flow changes, especially those that alter or restrict the access to and emerging from spawning gravels, restrictions in water available for channel substrate flow, and those that reduce baseflow or minimum streamflows to the extent that water quality and habitat space produce limiting characteristics. There is increased evidence that normal hydrologic cycles benefit both physical and biological processes. Restricting or substantially altering these normal processes can produce impacts. Increases in baseflow are normally desired as beneficial to aquatic life. Increases in quickflow and storm-flow are usually not considered as beneficial in that they are apt to cause impacts by increasing erosion, sediment, pollutants, channel scour, flooding, etc.

Table 3-4. Total major water uses by subbasin (8 digit HUCs) compiled by the SC Department of Health and Environmental Control. Most of these uses are not associated with the Sumter National Forest.

Water Withdrawals by categories for 8 digit HUCs - South Carolina, 1995

HUC - 8		Water withdrawals (Mgal/d)									
		Public Supply	Commercial	Domestic	Industrial	Thermoelectric	Mining	Livestock	Aquaculture	Irrigation	Total
03050106	Lower Broad	1.33	0.27	6.65	2.32	858.25	0.00	0.27	0.03	0.02	869.14
03050107	Tyger	30.26	0.00	4.96	2.90	0.00	0.00	0.16	0.03	0.00	38.31
03050108	Enoree	3.53	0.14	5.02	122.78	0.00	0.00	0.24	0.02	0.12	131.85
03050109	Saluda	82.32	0.15	0.50	29.52	187.32	0.00	1.65	0.09	1.40	302.95
03060101	Seneca	14.48	0.00	3.45	1.77	2,523.51	0.00	0.27	3.54	0.12	2,547.14
03060102	Tugaloo	1.41	0.00	1.55	0.00	0.00	0.00	0.08	0.01	0.13	3.18
03060103	Upper Savannah	16.38	0.00	1.46	0.54	0.00	0.00	0.35	0.53	0.00	19.26
03060106	Middle Savannah	28.96	0.07	2.57	120.86	162.92	0.00	0.42	0.05	1.62	317.47
03060107	Stevens	1.96	0.20	0.53	0.03	0.00	0.00	0.26	0.02	0.01	3.01
Total:		180.63	0.83	26.69	280.72	3,732.00	0.00	3.70	4.32	3.42	4,232.31

A variety of methods exist to help evaluate water needs and determine the acceptable limits of water use, based on instream flow protection strategies and methodologies (USFS, 2000, IFC, 2002). Not only do humans need water to properly function, but streams, aquatic and riparian organisms also need water to maintain their function. The quantity and timing of this need varies with the conditions and the resources involved. Without identifying the needs, evaluating the uses and quantifying the needs, unnecessary impacts may occur to those species and uses that depend on sufficient water being there when it is needed.

Chattooga River Uses

Sediment sources include agriculture, development, roads, silviculture, and wildlife activities. From past water sampling and flow records by USGS, State of Georgia, EPA, and USDA Forest Service, Stekoa Creek produces over one-half of sediment and fecal

loading within the Chattooga watershed. Total maximum daily loads (TMDL) for sediment have been set by the EPA for sections of Stekoa Creek, Warwoman Creek, and West Fork Chattooga River (EPA, 2001).

The fecal coliform levels within the Chattooga River and tributaries found during storm events are often high enough to be of concern to swimmers and for other water contact sports that are often present when floating the river. This is especially true of storms that are intense or that follow dry periods. The water quality in Stekoa Creek suggests that even non-storm periods may intermittently or perhaps even regularly contaminate the lower portion of the Chattooga River with elevated fecal materials that are of concern for swimming and related water contact uses.

Other USGS information collected in 1997 provides more intensive fecal coliform sampling within the Chattooga River and major tributaries. Unfortunately, only a few samples collected were associated with storms. Individual samples were taken in the Chattooga River at Highway 76, Stekoa Creek, Warwoman Creek, West Fork Chattooga River, and North Fork Chattooga River. Maximum values reported for these streams included 490; 54,000; 7,900; 3,300; and 230 MPN fecal coliform/100 ml, respectively. Except for the North Fork of the Chattooga River, all major tributaries were at least an order of magnitude greater than the allowed water quality standard for swimming that is set at 200 MPN/100 ml. All of the above readings except for the North Fork locations were taken during the June 12, 1997, storm under moderate flow conditions. During that day, the measured flow at the Highway 76 stream gaging station was 929 cubic feet per second (cfs). From the past data records, elevated storm values in some of the tributaries are not uncommon, suggesting that there is a problem.

Sediment is a concern within the Chattooga watershed because of its effects to water quality, aquatic life, and recreational uses of the river. Erosion and sediment levels are naturally high, to some extent due to the high rainfall, well-weathered soils, and steep and dissected slopes. The Chattooga River has high sediment levels as a result of roads, developments, agriculture, and other land disturbing activities (Van Lear et. al., 1995).

Riparian, Wetlands, and Floodplains

Affected Environment

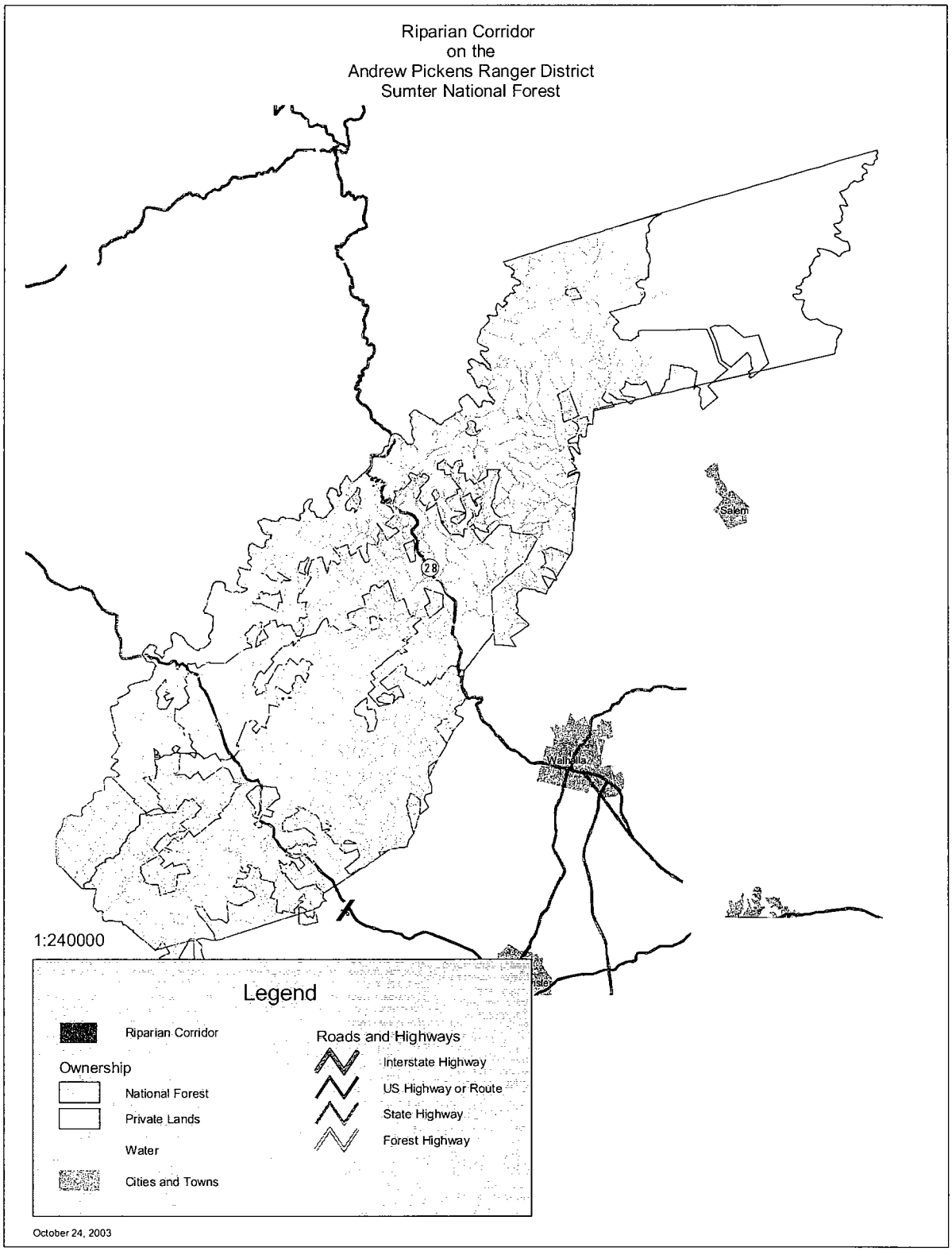
The Riparian Corridor is management prescription 11 in the Draft Sumter National Forest Plan, which includes true riparian areas and a fixed width area along perennial and intermittent streams and waters for management purposes, unless specifically evaluated and determined to need more or less. In some instances, the boundary may fall beyond the true riparian area and include an upland component. This prescription was designed to address a combination of water quality and habitat concerns associated with streams, streambanks, riparian areas, and wetlands. An estimated 60,000 to 70,000 acres are within the riparian corridor on the Sumter National Forest, based on the extent of alluvial soils, bottomland hardwoods, floodplains, mesic river terraces, estimating perennial streams to the extent of order 3 and larger streams, and intermittent streams to the extent

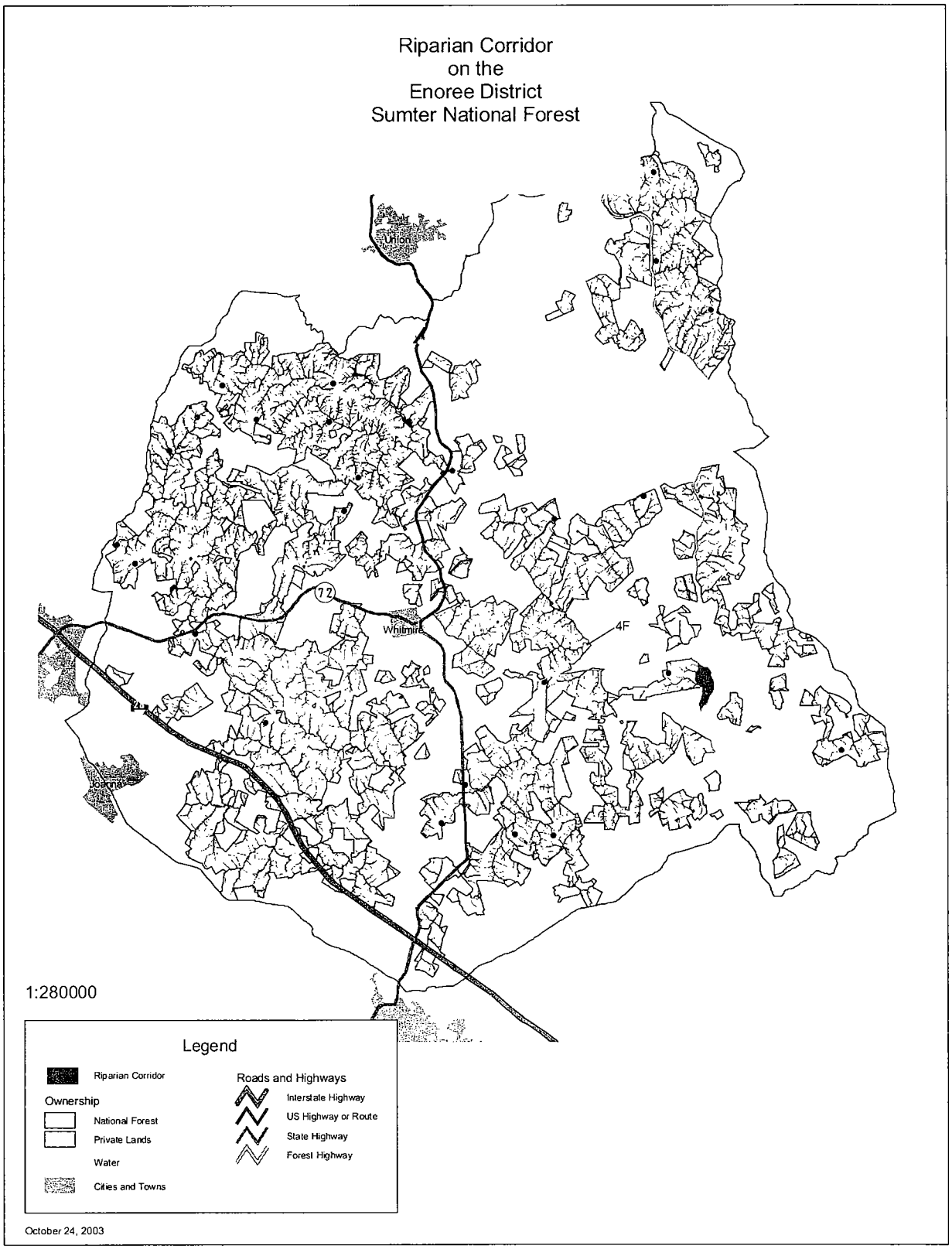
of order 2 streams. Due to its complexity and interconnections with much of the stream channel network, maps are difficult to display at small scales typically used in forest planning. The extent has been estimated and mapped in GIS and included in the process records and will be utilized in watershed analysis and verified for project planning.

Riparian areas are functionally defined as three-dimensional ecotones of interaction that include terrestrial and aquatic ecosystems, that extend down into the groundwater, up above the canopy, outward across the floodplain, up the near-slopes that drain to the water, laterally into the terrestrial ecosystem, and along the watercourse at a variable width (Ilhardt et. al., 2000). These areas are transitional between terrestrial and aquatic ecosystems and are distinguished by gradients in biophysical conditions, ecological process, and biota. They are areas through which surface and subsurface hydrology connect waterbodies with their adjacent uplands. They include portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e., a zone of influence). Riparian areas are adjacent to perennial, intermittent, and ephemeral streams and lakes and estuarine-marine shorelines. (National Research Council, 2002.)

Floodplains are lowland or relatively flat areas joining inland and coastal water including, at a minimum, that area subject to a 1-percent (100-year return period) or greater chance of flooding in any given year. Although floodplains and wetlands fall within the riparian area criteria, they are defined here separately as described in the Forest Service Manual. Responsibilities in floodplain areas include recognizing the functions and hazards within these areas and making sure that the public is aware of them, especially as related to forest management activities or facilities (Executive Order 11988, FSM 2527).

Wetlands are areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (40CFR232.2) and are found within some of the riverine and lacustrine systems on the Sumter National Forest. Protection of wetlands on federally managed lands is addressed in Executive Order 11990 (FSM 2527).


Riparian Corridor
on the
Andrew Pickens Ranger District
Sumter National Forest
Salem
28
Walhalla
1:240000
Legend
Riparian Corridor
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 24, 2003


Riparian Corridor
on the
Enoree District
Sumter National Forest
Union
72
Whitmire
4F
Joanna
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Legend
Riparian Corridor
Ownership
National Forest
Private Lands
Water
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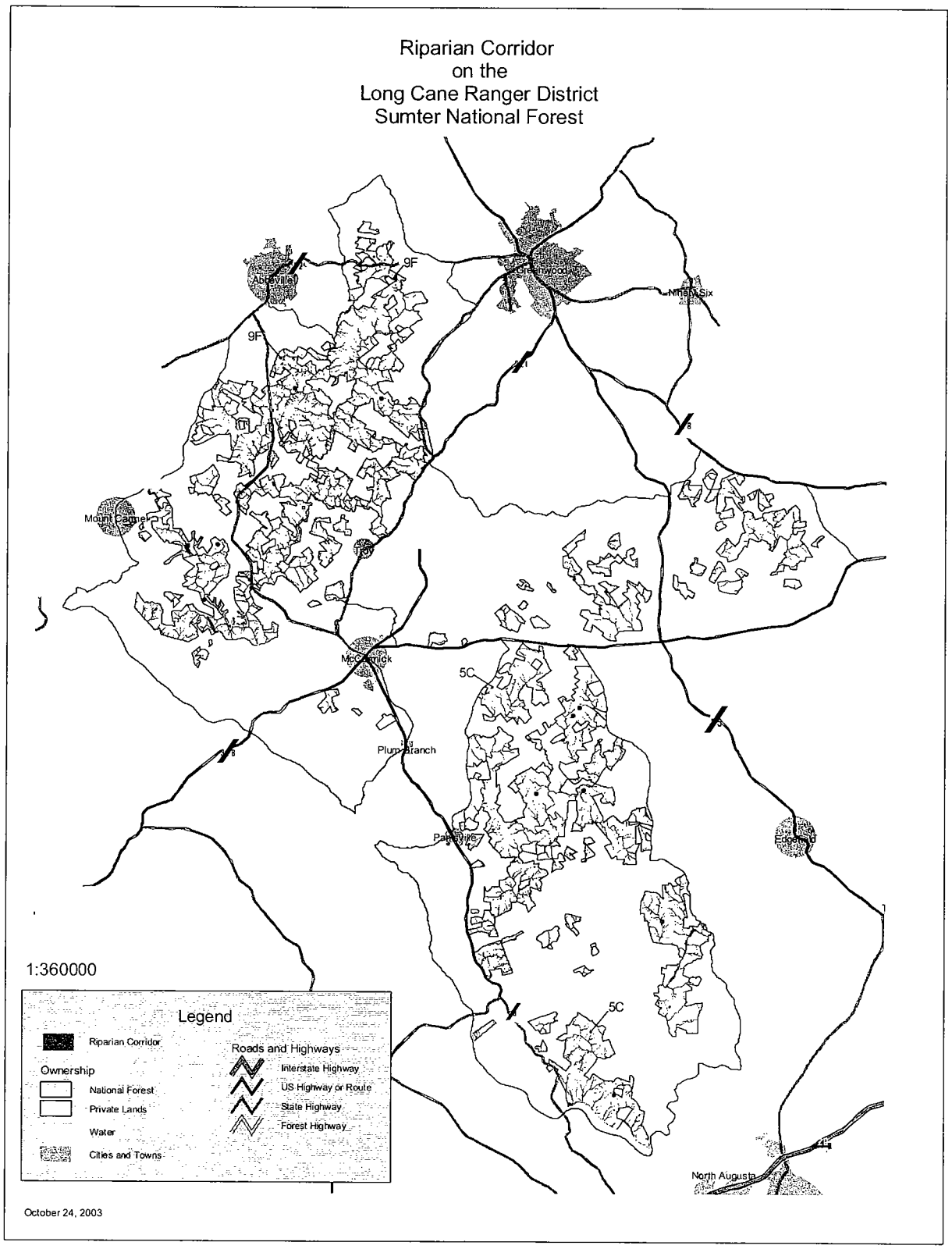
US Highway or Route
State Highway
Forest Highway
October 24, 2003


Riparian Corridor
on the
Long Cane Ranger District
Sumter National Forest
Abbeville
Greenwood
Ninety Six
Mount Carmel
McCormick
Plum Branch
Parksville
Edgefield
North Augusta
9F
5C
1:360000
Legend
Riparian Corridor
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 24, 2003

Wetlands on the Sumter National Forest are widely dispersed and usually are small inclusions of less than 10 acres. Jurisdictional wetlands must meet soil, plant, and hydrology criteria (Environmental Laboratory, 1987). Riparian areas may contain some of the conditions and functions of wetlands, and their extent can be estimated from the alluvial soils within soil survey maps. Wetlands typically have not been identified specifically on the Continuous Inventory of Stand Conditions (CISC). The bottomland hardwood stands typically qualify as riparian areas, but because many of these soils are well drained, only a small portion would qualify as meeting the soil, plant, and hydrology requirements of jurisdictional wetlands. Small-scale wetland mapping by U.S. Fish and Wildlife is underway and will provide remote mapping information on their approximate extent. However, many of these areas need to be field verified for accuracy and are when activities may damage, destroy or convert wetlands to non-wetlands.

When wetlands exist in the piedmont and mountains, they are usually found within the floodplain of streams or occasionally on shallow soils with a clay pan, fragipan, or geologic substrate that restricts water movement through the profile. Wetland soils are hydric and typically exhibit a variety of indicators. Most wetland soils are gleyed or mottled heavily with organic accumulations due to anaerobic conditions, except where the organics are removed during floods. Soils remain saturated into the growing season with predominately wetland adapted tree and plant species present, such as bottomland hardwoods. Wetland hydrology typically is based on one or more of a combination of factors including stream flooding, high groundwater table, and soil restriction with storage of rainfall or groundwater.

Most floodplains have well drained sandy soils, so the soils typically are not saturated long enough from stream flooding to meet the necessary hydric soil criteria for jurisdictional wetlands. However, these riparian areas often do provide some wetland-type functions and habitats. The identification and delineation of wetlands is typically a project level activity, as these areas are usually too localized in extent to show up with reliability in the inventory and mapping data (Environmental Laboratory, 1987).

In 1985, it was estimated that the Sumter National Forest contains approximately 13,400 acres of riparian areas based on alluvial soil mapping units that include floodplains and adjacent depositional terraces on the Sumter National Forest (Hansen and Law, 1993). Of this amount, approximately 1,500 acres are wetlands. Alternative F would hold to these estimates, and all of the riparian lands are suitable for timber production. Best management practices, including streamside management zones, would still be implemented. Alternatives A, B, D, E and G allocate 67,000 acres of land into riparian corridors, which includes streams, riparian areas, floodplains, wetlands, and some adjacent uplands along most perennial and intermittent streams with limited floodplains and terraces. Alternative I allocates approximately 63,000 acres into the riparian corridor. Another 3,300 acres of water (primarily lakes and wide streams) are also present within the national forest. In comparison to the piedmont, the mountain valleys limit the extent of riparian areas, floodplains, and wetlands because they are much more confined with higher gradients and topographic or geologic barriers.

Direct/Indirect Effects

Roads, trails, and other compacted or exposed surfaces often create problems when located in riparian areas because they tend to entrench, are difficult to drain, cause excessive compaction or displacement of soils, alter normal surface and subsurface flows, and increase pollution to streams.

Riparian and stream areas are often a desired focal point associated with many recreational activities. People just love the sights, sounds, life and movement associated with streams and riparian habitats. However, riparian areas and streams are often very sensitive from a physical and biological sense to many activities that people enjoy. Activities involving concentrated people or animal uses, heavy equipment, or horses can cause excessive soil compaction or exposure. Indirect effects from these include restricted drainage, surface runoff, and/or excessive holding of water on the surface. Damage to tree and plant roots from compaction can reduce health and increase mortality. Increased erosion, sediment, and stream temperatures can be a result of concentrated recreational uses.

Developments in riparian areas such as water bird habitats and green-tree reservoirs may cause modifications of hydrology and soil conditions, benefiting some types of habitat and impacting others such as aquatic migration. Some of these effects can be minimized or mitigated. Cane restoration and associated group selection harvesting and frequent prescribed burning in riparian areas may involve some new approaches to improve vegetative and biotic habitat conditions without damaging soil and water resources. Riparian timber harvesting can be problematic due to poor access and difficulty in getting equipment to the treatment areas. Restrictions on soil moisture and proximity to streams may limit these projects to suitable river terrace areas.

Emphasis is given in management prescription number 11 for all alternatives except F to protect and improve floodplains, wetlands and riparian areas, as well as reducing impacts to species at risk. Alternative F would still utilize laws, executive orders, planning regulations, BMPs and other protective measures in riparian areas to avoid many impacts. Probable activities suggest that Alternatives B and E would stress riparian harvest and forest health; Alternatives A, E, and I, trail construction; Alternatives F, E, D, A, and I, wildlife openings; Alternatives G, B, and I, canebrake restoration; and E, B, F, and I, water bird developments that would likely influence the riparian corridor directly or indirectly. Alternative B emphasizes soil and water restoration, some of which may occur along unstable streambanks.

Cumulative Effects

Roads, trails, and other compacted or exposed surfaces on the national forest and private lands often create problems when located in riparian areas because they are difficult to drain, cause excessive compaction or displacement of soils, alter normal surface and subsurface flows, and increase pollution to streams. Activities that remove trees and other supporting vegetation from streambanks and adjacent riparian areas, or otherwise

promote other uses in riparian areas, often increase stream temperatures, streambank instability, channel adjustments, and loss of riparian and aquatic habitats. Some partial vegetation harvest can be beneficial to tree health as long as removal activities do not excessively compact, rut, or expose riparian soils.

Riparian and stream areas are a desired focal point with many recreational activities. However, riparian areas and streams are often very sensitive from a physical and biological sense to many activities that people enjoy. Concentrated people or animal uses, heavy equipment, or horses can cause excessive soil compaction or exposure. OHV/ATV trails have high impacts in riparian areas from soil disturbance, compaction, displacement, rutting, productivity loss, erosion, sediment, streambank damage, and channel damages. Conversion, expansion, or maintenance of wildlife openings into these areas need to focus on continuing cover, maintaining stream shade and bank stability with forest vegetation. Indirect effects from these include restricted drainage, surface runoff, and/or excessive holding of water on the surface from activities that compact or rut the soil surface. Damage to tree and plant roots from compaction can reduce health and increase mortality. Increased erosion, sediment, and stream temperatures can be a result of concentrated recreational uses. Besides native forests that provide shade, deep roots, woody debris and other benefits in the riparian areas, the resilient native plant species, adapted to moderate to high moisture regimes are also beneficial. Some attention to removal of non-native invasive species may be needed in some locations, necessitating local applications of herbicides or other methods for control. Most effects associated with activities and treatments in riparian areas need special attention so they can be avoided, minimized or mitigated.

Emphasis is given in management prescription number 11 for all alternatives except F to protect and improve floodplains, wetlands, and riparian areas, as well as reduce impacts to species at risk. Alternative F would still utilize BMPs and other protective measures in riparian areas to avoid many impacts.

Conversion or loss of effective floodplains and wetlands is restricted on the National Forest through Executive Order. On private lands, although regulated under the federal and state permitting, some alterations and development into these areas are more likely to occur. The overall increase in federal and state support for riparian buffers is increasing the protection and limiting management in these areas. Essentially all alternatives will provide protection to riparian, floodplain, and wetland areas. Alternative F does not have these areas specifically allocated, but they are still addressed in BMPs, standards, executive orders, and other direction. The other alternatives, except Alternative I, allocated an estimated 67,000 acres in the riparian corridor (prescription 11), which will be adjusted in time with ground verification of boundaries during project planning or resource inventories. Alternative I adjusted slope factors slightly resulting in about 63,000 acres in the estimated riparian corridor. The riparian corridor widths will be expanded as needed to protect riparian and aquatic functions and values. Smaller or larger widths may be used upon interdisciplinary review and analysis.

Cumulative effects to riparian areas may occur from many types of activities and land uses. They may come in the form of natural occurrences such as floods, fire, wind, ice, disease, insects, and human-induced changes such as roads, culverts and dams that can influence migration barriers of aquatic species or alter flow dynamics. Excessive surface disturbances that cause a variety of effects separately and cumulatively. Erosion may overload sediment delivery affecting channel morphology, sediment aggradation, and flooding. Compaction, displacement, puddling and rutting of soils that cause changes to surface soil structure and subsurface water movement. Changes in soil moisture and water tables can affect plant types and densities which may influence the habitat and stability of these areas. Riparian corridors also function to delay, absorb, filter, accumulate and/or breakdown pollutants from surface runoff. The variety of conditions within the riparian moisture gradients from uplands to streams, lakes and other waters produce a wide diversity of habitats. Riparian areas are both resilient and sensitive. Activities need extra analysis to consider factors that are not normally a concern for upland areas. Because riparian corridors are very much connected to the rest of the landscape, there may be cumulative effects to consider, but evaluating these are most applicable and appropriate at the project level. Restrictions in laws, executive orders, and directives, along with the desired conditions, goals, standards, BMPs, prescription 11 and implementation guides assure a high degree of riparian awareness, protection and conservation associated with the forest plan and Forest Service actions.

Air Resources

Affected Environment

The Sumter National Forest has no wildernesses classified as Class I, according to the Clean Air Act. However, the term air quality related values (AQRV) will apply to any resources within the national forest boundary that might be affected by air pollution. Through a series of legislative and regulatory requirements, federal land management agencies have the unique responsibility to not only protect the air, land, and water resources under their respective authorities from degradation associated with the impacts of air pollution emitted outside the borders of agency lands (Clean Air Act, 1990), but to protect those same resources from the impacts of air pollutants produced within those borders (Clean Air Act, 1990, Organic Act, 1977, Wilderness Act, 1997). Activities from within the forest such as prescribed burning, road construction/maintenance, recreational use, and timber harvesting all have an impact on the air quality of the forest. It is the responsibility of federal land managers to minimize the impact of these activities on the forest's AQRV, as well as the forest's contribution to air pollution. In light of this responsibility, it is important for federal land managers to not only understand the impacts of pollution sources from activities within the national forest, but also to be familiar with the impacts from pollution sources outside the forest boundary.

The Sumter National Forest is found in an area of the United States with an increasing population and with an increasing demand for the combustion of fossil fuels to produce energy for electricity and transportation (SAMI, 2002). The forest is within a day's drive of a large percentage of the United State's population. Within 120 miles, there are 27

urban areas and numerous towns near the forest. Three major cities–Atlanta, Charleston, and Charlotte–are among the urban areas about 120 miles from the forest.

The urban areas are where the largest numbers of vehicle miles are traveled, where many coal-fired power plants are located nearby to supply electricity, and where industrial facilities are located to manufacture goods (Figure 3-6). Within 120 miles of the forest, about 28% of the nitrogen oxide emissions are released from coal-fired power plants (especially during hot summer days when electricity is needed to cool homes and businesses) and about 38% of the nitrogen oxides released come from highway vehicles. Nitrogen oxides are an important contributor to the formation of ground-level ozone on hot sunny days (Chameides and Cowling, 1995). Current ozone concentrations near the forest are at levels that exceed the new ozone National Ambient Air Quality Standards (NAAQS), which means ozone levels on many areas of the forest are likely to be unhealthy for people (Figure 3-7). Also, ozone exposures are likely to be causing growth reductions in sensitive vegetation species on the forest, and may be causing the ozone sensitive species to be less abundant in the forest (SAMI, 2002). Currently, there are laws, rules, and regulations in place that will reduce nitrogen oxide emissions by 66% by 2040 (in comparison to 1990 emission) within 120 miles of the forest (Figure 3-8). The reductions in nitrogen oxides are most likely to reduce the highest concentrations of ozone, which may result in ozone having only minimal effects on growth by the year 2040. Further nitrogen oxides are also anticipated as state and local air pollution control agencies seek ways to attain the new ozone standard in urban areas like Atlanta, Augusta, Charlotte, Columbia, Greenville, and Spartanburg. The further reductions in nitrogen oxides will have a large benefit for the health of people.

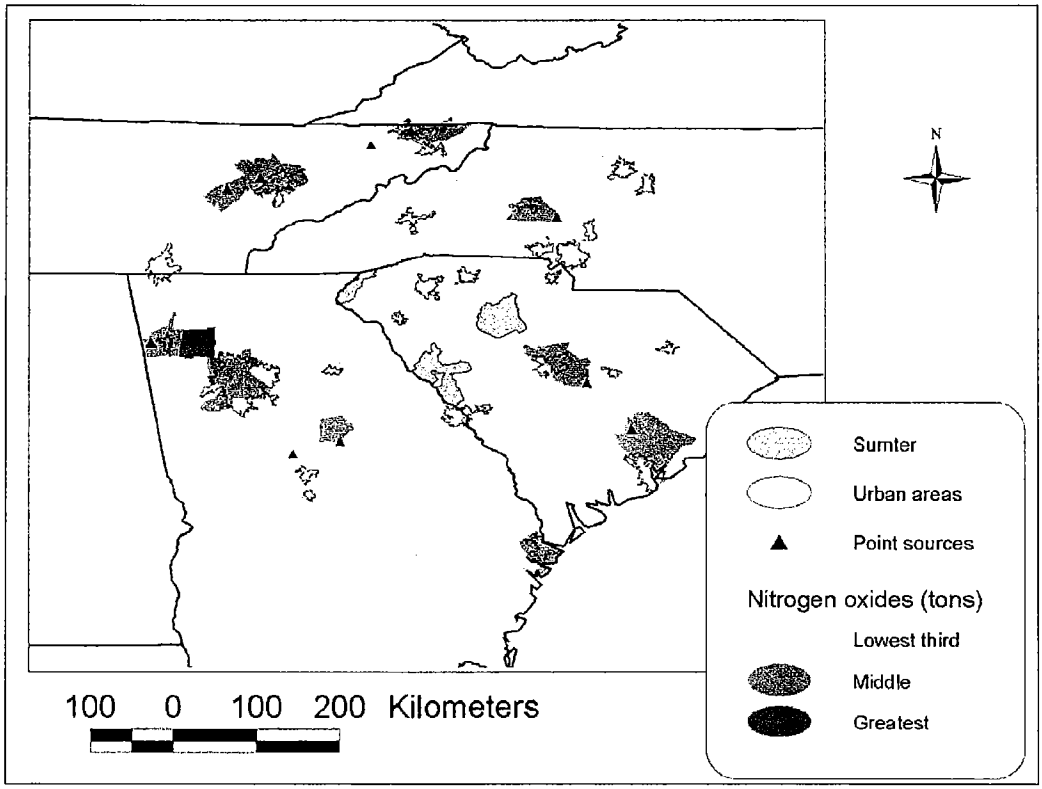


Figure 3-6. Total nitrogen oxide emission (tons) in 1990 and location of point sources of nitrogen oxides greater than or equal to 10,000 tons per year (SAMI, 2002).

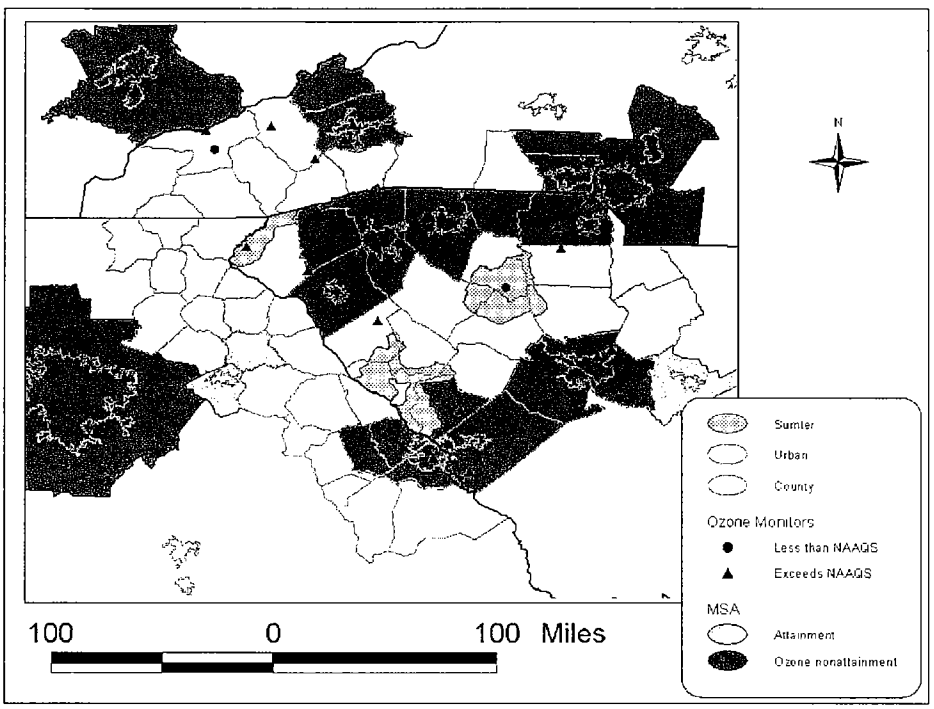


Figure 3-7. Area that could possibly be designated nonattainment for the 8-hour ozone standard based upon using 1998 through 2000 data.

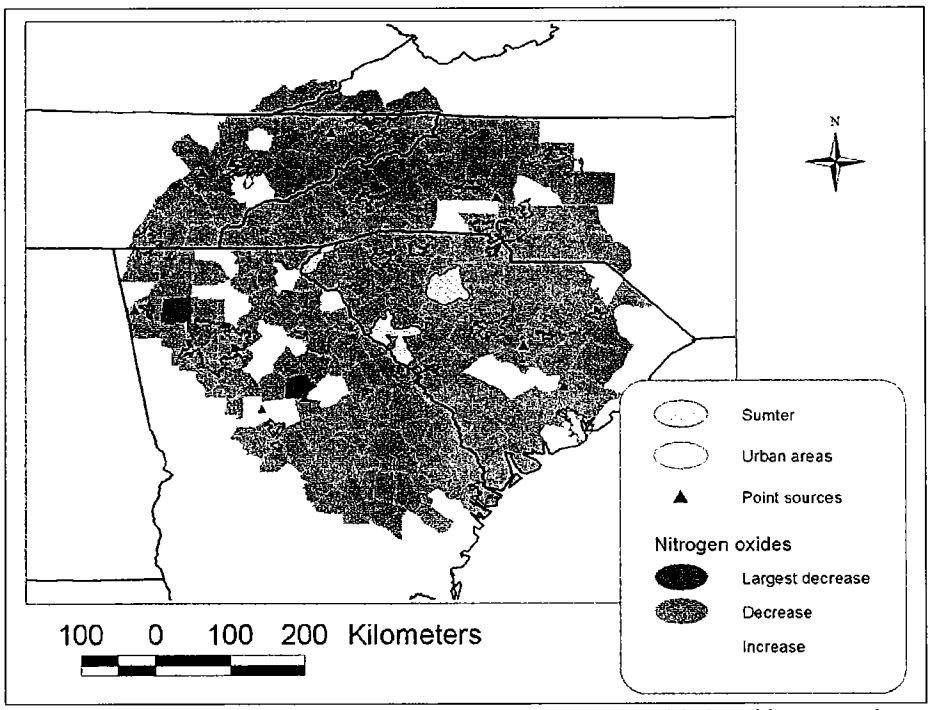


Figure 3-8. Changes in total nitrogen oxide emission (tons) in 2040 and location of point sources of nitrogen oxides greater than or equal to 10,000 tons in 1990 (SAMI,2002).

Acid compounds in clouds, fog, rain, and haze (dry deposition) are having an adverse impact on visibility and the ability of the soils and streams to buffer acid inputs (called acid neutralizing capacity, or ANC). Sulfur compounds, or sulfates, are the primary secondary compound causing these impacts and originally began as sulfur dioxide emissions. Seventy-five percent of the sulfur dioxide emissions within 120 miles of the forest are released from coal-fired power plants. Sulfur dioxide emissions are expected to decrease by 40%, or more, from sources within 120 miles of the forest by the year 2040. Currently, only the mountainous (elevations above 2,000 feet) portions of the Andrew Pickens Ranger District may be adversely impacted by acid deposition. Sampling of 10 randomly selected streams in the year 2000 had ANC values between 59.8 and 113.1 micro-equivalents per liter (mean 85.1$\pm$16.87), which is at a level that should allow for healthy aquatic stream communities. However, continued decreases in stream ANC is expected for some high elevation streams because the soils have been retaining sulfates for many decades. As the sulfates are released into soil water solution, then an equivalent amount of base cations, such as calcium, will be removed from the soils. In the future (by the year 2100) the potential does exist for a small number of streams to have ANC that are below a value of 50 microequivalents per liter, a value which may indicate potential impacts to the aquatic biota.

The regional haze and reduced visibility observed in the mountains is caused mostly by air pollution – primarily sulfates that originated from coal-fired power plants. The beautiful mountain scenery is one of the main reasons tourists visit the Andrew Pickens Ranger District and other areas in Appalachia (Appalachian Regional Commission,

1970). During the last four decades, the eastern United States has seen a significant, regional reduction in visibility (IMPROVE, 2001). The estimated natural background visibility for the eastern United States is 93±28 miles (NAAP, 1991). However, there has been a significant reduction in how far a person can see distant views, as well as how clearly a person can see the mountains. Secondary fine particles ($PM_{2.5}$) are primarily responsible for the visibility impairment. Secondary fine particles are formed when combustion gases are chemically transformed into particles. In the eastern United States it is sulfate particles (transformed sulfur dioxide) from coal-fired power plants that comprise most of the measured fine particle mass (IMPROVE, 2001).

The closest visibility monitoring is conducted near the Shining Rock Wilderness (Haywood County, North Carolina), a mandatory Class I area. On the days (with a relative humidity of 80%) classified as having the lowest fine particle mass (2.26 ug/m3), the estimated visibility is 90 miles, but on the highest mass (17.57 ug/m3) days the visibility is reduced significantly to 15 miles (Figure 3-9). The days with the poorest visibility are most likely to begin occurring in May and continue through September (Air Resource Specialists, 1995) during the time when most people are visiting the forest. Throughout the year, people are most likely to see a uniform haze – like a white or gray veil – obscure the beautiful mountains (Air Resource Specialists, 1995). Sulfates are the most important fine particles contributing to visibility impairment. On the low mass days they comprise 48% of the total mass while on the highest mass days the sulfates are 71% of the total. Seventy-five percent of the sulfur dioxide emissions within 120 miles of the forest are released from coal-fired power plants. Organics (released primarily from vegetation as volatile organic compounds) are the second most important fine particles measured and if organics were the most abundant fine particles, then there would be a bluish cast to the mountains – hence the name Blue Ridge Mountains.

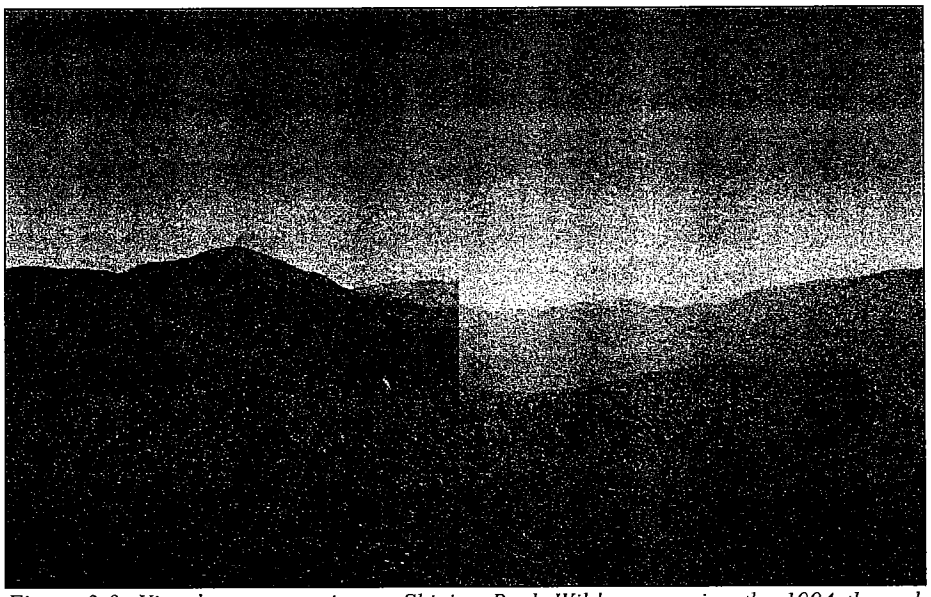


Figure 3-9. Visual representation at Shining Rock Wilderness using the 1994 through 1999 IMPROVE data. The image on the left shows visibility on a low fine particle mass day (90 miles), while the image on the right shows a high fine particle mass day (15 miles). Relative humidity was set at 80% when using the WinHaze model.

Sulfur dioxide is expected to decrease by at least 40% by the year 2040 in the counties within 120 miles of the forest. Further reductions by coal-fired power plants in North Carolina are likely to contribute to further reductions than SAMI (2002) estimated for the year 2040. SAMI did estimate what visibility may be like between the 1991 through 1995 average and the year 2040. For Shining Rock Wilderness, the annual average visibility was estimated to be 18.3 miles, but with the current laws, rules, and regulations in place, the average is expected to improve to 26.1 miles. Summertime visibility is worse, with an average of 10.9 miles. The SAMI (2002) estimates for summertime visibility are expected to improve by the year 2040 to 19.5 miles.

The fine particles that cause visibility impairment are also of concern because high concentrations can be unhealthy for people, since they are primarily associated with the aggravation of respiratory conditions such as asthma. Fine particles are closely associated with increased hospital admissions and emergency room visits for heart and lung disease, increased respiratory disease and symptoms such as asthma, decreased lung function, and even premature death. Sensitive groups are at greater risk and include the elderly; individuals with cardiopulmonary disease, such as asthma; and children. For this reason, fine particle levels are monitored, and the Environmental Protection Agency has established NAAQS for fine particles, also called $PM_{2.5}$. Table 3-5 presents results for monitors near the forest and these results indicate the 24-hour fine particulate standard (please note the maximum values are presented and not the 98th percentile) is unlikely to exceed the NAAQS when the data from the monitoring sites closest to the forest are averaged for three years. However, the annual average fine particle concentration is either close or has exceeded levels considered unhealthy for people (15 ug/m^3) near the

Long Cane Ranger District (currently Greenwood County and possibly Edgefield County in the future).

Table 3-5. Monitoring results for particulate matter 2.5 microns ($PM_{2.5}$) and smaller in size for the year 1999 through 2001.*

LOCATION (County)	Site ID	1999 Maximum 24-hour (ug/m^3)	1999 Annual Average (ug/m^3)	2000 Maximum 24-hour (ug/m^3)	2000 Annual Average (ug/m^3)	2001 Maximum 24-hour (ug/m^3)	2001 Annual Average (ug/m^3)
Edgefield	450370001	36.3	15.13	31.5	14.78	31.6	13.01
Greenwood	450470003	36.0	15.71	34.5	15.51	31.4	13.97
Oconee	450730001	33.9	13.42	32.7	12.63	42.7	11.82

* The National Ambient Air Quality Standard is violated if the average of 3-years of annual means is 15 ug/m3 or greater (multiple community oriented monitors can be averaged together), or the 3-year average of the 24-hour concentration for the 98th percentile (using the maximum population oriented monitor in an area) is the 65 ug/m3 or greater.

No portions of the forest are anticipated to be designated as nonattainment for the fine particle (and ozone) NAAQS. The Environmental Protection Agency determines whether any other portions of the forest will be designated as nonattainment for fine particles or ozone. It is of particular importance for fire managers to mitigate prescribed fire emissions, to the greatest extent practical, during those days characterized by existing or predicted high ambient air pollution. The $PM_{2.5}$ standard may require fire managers to be even more vigilant in protecting the health and welfare of citizens on and off forest lands from the effects of particulate matter emissions associated with prescribed fire.

Once an area is designated nonattainment, a State Implementation Plan is developed in attempt to bring the area back into attainment of the standard. This usually involves placing controls on various sources that contribute to the pollutant of concern in order to lessen or minimize the emissions. The forest will need to interact with the South Carolina Department of Health and Environmental Control and the South Carolina Forestry Commission to ensure that forest prescribed fire emissions (and perhaps other forest activities) are considered in the state implementation plan development, since 70% of the emissions from prescribed fires are fine particles, and nitrogen oxides and volatile organic compounds are also released.

Direct/Indirect and Cumulative Effects

Land management and recreational activities conducted on the forest do contribute to air quality degradation in combination with other air pollution emissions in the region. Most of the emission activities (such as highway vehicle use) from Forest Service activities are already accounted for in emissions inventories. However, the single most important Forest Service management activity that could deviate from the emissions inventory is for prescribed fires. Therefore, this analysis will be limited to evaluating how county level total emissions of fine particles will change with the alternatives.

The Southern Appalachian Mountain Initiatives (SAMI) database was used to estimate primary fine particulate matter ($PM_{2.5}$) emissions (SAMI, 2002) for the 10 counties that intersect the forest. Total fine particulate matter emissions in the year 1990 were estimated to be 13,666 tons and by the year 2040, the emissions are predicted to increase to 15,284 tons. The agriculture and forestry sector was estimated to have 674 tons of fine particles in 1990 and to have 1,023 tons by the year 2040. It should be noted that it can not be determined how much of the agriculture and forestry total are attributed to Forest Service prescribed fires.

Table 3-6 lists the estimated emissions of fine particulates for each of the alternatives and the emissions are directly related to the number of acres to receive prescribed fire treatment each year. Only Alternative G is below the agriculture and forestry 1990 totals obtained from the SAMI database, while all the other alternatives exceeded the 2040 levels predicted by SAMI. Most likely though, the SAMI emission inventory for fine particulates emissions has not anticipated all of the emissions for any of the Forest Service alternatives. Therefore, it is critical for the forest to work with the South Carolina Department of Health and Environmental Control and others to include Forest Service emissions in future emissions inventories.

Table 3-6. Estimated fine particulate emissions for each of the Alternatives using Environmental Protection Agency emission factors (U. S. EPA, 1996).

Alternative	Acres	Fuel Consumed (tons per acre)	$PM_{2.5}$ (pounds per ton of fuel consumed)	$PM_{2.5}$ Emissions (tons)
A	19,573	4	28	1,096
B	33,031	4	28	1,850
D	20,054	4	28	1,123
E	33,185	4	28	1,858
G	10,355	4	28	580
I	23,527	4	28	1,318
F-current	19,379	4	28	1,085

Sulfates are the primary fine particles measured at remote monitoring sites near the Class I areas (SAMI, 2002). Currently, the emissions from prescribed fires are not expected to be a large contributor to the total fine particulate matter mass and consequently to exceed the fine particle National Ambient Air Quality Standard (NAAQS). However, the forest will be expected to follow conformity determination rules and disclose any prescribed fire activities in nonattainment areas. Most likely, this will include any prescribed burn projects in Greenwood County.

Minerals

Affected Environment

The United States holds title to all of the minerals beneath 99.9% of the forest. Forest tract L-446, containing 358.4 acres, is the only tract on the forest where the United States does not own the mineral rights. The mineral rights under this tract are considered outstanding. Outstanding mineral rights are property rights that were established and separated from the surface estate prior to the Forest Service's acquisition of the surface estate. The Bureau of Land Management (BLM) manages the mineral estate where the United States holds title and the Forest Service administers the surface estate. There are no active mines on the national forest at this time. The Plan of Operations for a Preference Right Lease Application for Gold has been approved for 1100 acres on the Long Cane District. A Prospecting Permit Plan of Operations has been approved on the Long Cane District and a Prospecting Permit Application has been received for 200 acres on the Long Cane District.

Gold panning, as a recreational activity, has been occurring on the forest for many years. The Andrew Pickens Ranger District is where the majority of gold panning has occurred, with the Long Cane District close behind.

There are 362,850 acres on the Sumter National Forest. This acreage falls within three categories for mineral leasing purposes. The first category consists of lands not available for lease. These lands have either been withdrawn from mineral entry administratively, by law, or the forest has determined that a prescription goal cannot be accomplished if the lands were open to mineral entry. Only 2.7% of the forest falls within this category. The second category allows leasing, but there are No Surface Use or Controlled Surface Occupancy Stipulations attached to any lease issued on these lands; 4.4% of the forest falls within this category. The third category consists of lands that are available for lease with standard lease stipulations. Most lands on the forest, 92.9%, fall within this category.

Direct/Indirect Effects

The determination of effects for each alternative was measured by the percentage of the forest available for federal leasing under each alternative as shown in Table 3-7.

Alternative A (Goods and Services)**:** In this alternative, 71.4% of the forest would be available for lease with standard lease stipulations; 24.4% would be available with lease restrictions; and 4.2% would not be available for lease under any circumstances.

Alternative B (Biologically Driven)**:** This alternative emphasizes restoring the natural resources and creating and maintaining wildlife habitats. Available for leasing with standard lease stipulations would be 63.7% of the forest; 32.5% would be available with lease restrictions; and 3.8% would not be leased.

Alternative D (Balanced Age Class)**:** This alternative would allow the forest to reach and maintain a balanced age class. Available for mineral leasing with standard lease stipulations would be 74% of the forest; 23.4% would be available for mineral leasing but with restrictions; and 2.6% would not be available for leasing.

Alternative E (Recreation)**:** This alternative allows for most areas of the forest to maintain a forested canopy with large blocks of the forest being maintained in a roadless condition. Under this alternative, 59.9% of the forest would be available for mineral leasing; 36.6% would be available for lease with restrictions; and 2.7% not available for lease.

Alternative G (T&E species and watershed restoration)**:** This alternative provides for the inventory, monitoring, conservation, and recovery of proposed, threatened, endangered, sensitive, and locally rare species, with riparian areas maintained as old growth for habitat and connectivity. Under this alternative, 50.5% of the forest would be available for mineral leasing with standard lease stipulations; 45.7% would be available for lease with restrictions; and 2.7% would not be available for lease.

Alternative I (Preferred)**:** The preferred alternative allows for the leasing of 63.4% of the forest with standard lease stipulations; 33.6 % with restrictions (1.8% of the acreage in this category contains the No Surface Use restriction); and 3.0% where no leasing would be allowed.

The direct effect of each of the alternatives would be to increase the percentage of the forest available for lease with certain restrictions by 33.6 % and reduce the amount of acreage available for lease with standard stipulations by 33.1%. The total acreage available for lease will remain virtually the same. The acreage added to the restricted category will indirectly make mineral operations on the forest more expensive for companies or individuals, but allow for increased resource protection on the forest.

Table 3-7. Percentage of Forest Affected by Each Alternative

Alternatives	Not Available for Lease	No Surface Occupancy or Controlled Surface Use Stipulations	Available for Lease with Standard Stipulations
Alternative A	4.2	24.4	71.4
Alternative B	3.8	32.5	63.7
Alternative D	2.6	23.4	74.0
Alternative E	3.5	36.6	59.9
Alternative F	2.7	4.4	92.9
Alternative G	3.8	45.7	50.5
Alternative I	3.0	33.6	63.4

Cumulative Effects

Cumulative effects cannot be determined due to the uncertain nature of mineral exploration and development. Any lease issued will not have 100% surface disturbance.

BIOLOGICAL ELEMENTS

Major Forest Communities

The Forest Service maintains a continuous inventory of stand conditions (CISC), which includes forest types. To aid in analysis, major forest communities on the Sumter National Forest have been organized around forest community types described in *Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region*. The following table displays a crosswalk between the Southern Region's CISC forest types and old growth community types, as well as the relative distribution of these community types across the forest. The relationship between major forest communities discussed in this section to community types displayed in Table 3-8 is described in the affected environment section for each major forest community.

Table 3-8. Current composition of forest communities analyzed in the SPECTRUM model for the Sumter National Forest plan revision.

Piedmont (Enoree and Long Cane Districts)

Community Type (Spectrum Strata)	Site index	Forest Type (CISC Codes)	% Forested Acres
Dry - Mesic Oak (P21)	>65	Post oak – black oak (51) Chestnut oak (52) White oak – northern red oak – hickory (53) White oak (54) Northern red oak (55) Scrub oak (57) Scarlet oak (59) Chestnut oak – scarlet oak (60)	8.3
Dry – Xeric Oak (P22)	<=65 (hdwd) <60 (pine)	Eastern red cedar – hardwood (11) Shortleaf pine - oak (12) Loblolly pine - hardwood (13) Pitch pine – oak (15) Longleaf pine (21) Loblolly pine (31) Shortleaf pine (32) Virginia pine (33) Post oak – black oak (51) Chestnut oak (52) White oak – northern red oak – hickory (53) White oak (54) Northern red oak (55) Scrub oak (57) Scarlet oak (59) Chestnut oak – scarlet oak (60)	0.5
Dry, Dry – Mesic Oak and Oak-pine (P52)	>=50	Upland hardwoods – white pine (42) Oak – Eastern red cedar (43) Southern red oak – yellow pine (44)	0.6

		Chestnut oak – scarlet oak – yellow pine (45) White oak – black oak – yellow pine (47) Northern red oak – hickory – yellow pine (48) Bear oak – scrub oak – yellow pine (49)	
Dry, Dry – Mesic Pine and Pine-oak (P25x)	>=60	Eastern red cedar – hardwood (11) Shortleaf pine - oak (12) Loblolly pine - hardwood (13) Longleaf pine (21) Loblolly pine (31) Shortleaf pine (32) Virginia pine (33)	58.9
Mixed Mesophytic Forest (P05)	>=50	Cove hardwood – white pine – hemlock (41) Yellow poplar (50) Yellow poplar-white oak-northern red oak (56)	0.5
Bottomland, Riverfront Forest (P13)	>=50	Bottomland hardwood/yellow pine (46) Sweet gum/yellow poplar (58) Swamp chestnut oak – cherrybark oak (61) Sweet gum - nuttall oak - willow oak (62) Sugarberry – American elm – green ash (63) Laurel oak - willow oak (64) Overcup oak – water hickory (65) Sweet bay – swamp tupelo – red maple (68) Beech – magnolia (69) Black ash – American elm – red maple (71) River birch – sycamore (72) Cottonwood (73) Willow (74) Sycamore – pecan – American elm (75) Silver maple – American elm (76) Black walnut (82)	7.9

Mountains (Andrew Pickens District)

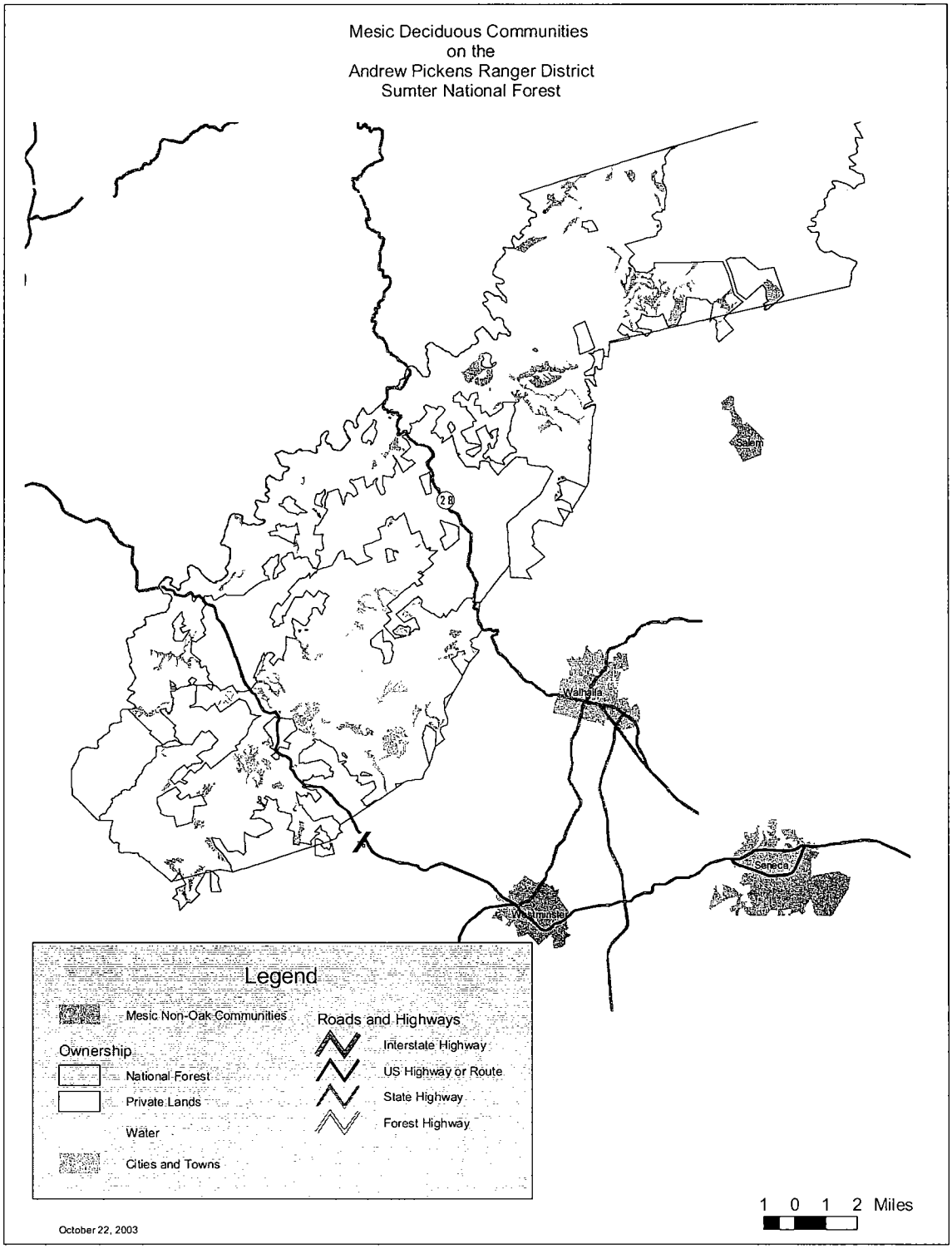
Community Type	Site index	Forest Type CISC Codes	% Forested Acres
Dry - Mesic Oak (M21)	>65	Post oak – black oak (51) Chestnut oak (52) White oak – northern red oak – hickory (53) White oak (54) Northern red oak (55) Scrub oak (57) Scarlet oak (59) Chestnut oak – scarlet oak (60)	4.4

Dry – Xeric Oak (M22)	<=65 (hdwd) <60 (pine)	White pine – upland hardwood (10) Shortleaf pine - oak (12) Pitch pine – oak (15) Virginia pine – oak (16) Shortleaf pine (32) Virginia pine (33) Pitch pine (38) Table Mountain pine (39) Post oak – black oak (51) Chestnut oak (52) White oak – northern red oak – hickory (53) White oak (54) Northern red oak (55) Scrub oak (57) Scarlet oak (59) Chestnut oak – scarlet oak (60)	0.5
Dry, Dry – Mesic Oak and Oak-pine (M52)	>=50	Upland hardwoods – white pine (42) Oak – Eastern red cedar (43) Southern red oak – yellow pine (44) Chestnut oak – scarlet oak – yellow pine (45) White oak – black oak – yellow pine (47) Northern red oak – hickory – yellow pine (48) Bear oak – scrub oak – yellow pine (49)	2.8
Dry, Dry – Mesic Pine and Pine-oak (M25)	>=60	White pine – upland hardwood (10) Shortleaf pine - oak (12) Pitch pine – oak (15) Virginia pine – oak (16) Shortleaf pine (32) Virginia pine (33) Pitch pine (38) Table Mountain pine (39)	7.9
Mixed Mesophytic Forest (M05)	>=50	White pine (3) White pine – hemlock (4) Hemlock (5) Hemlock – hardwood (8) White pine – cove hardwood (9) Red spruce – northern hardwood (17) Cove hardwood – white pine – hemlock (41) Bottomland hardwood – yellow pine (46) Yellow poplar (50) Yellow poplar-white oak-northern red oak (56) Swamp chestnut oak – cherrybark oak (61) Sweet gum - nuttall oak - willow oak (62) Sugarberry – American elm – green ash (63) Laurel oak - willow oak (64) Overcup oak – water hickory (65) Sweet bay – swamp tupelo – red maple (68) Beech – magnolia (69) Black ash – American elm – red maple (71)	5.7
Loblolly Pine (M53)	>=50	Loblolly pine - hardwood (13) Loblolly pine (31)	1.9

Mesic Deciduous Forests (non-oak)

Affected Environment

The mesic deciduous forests covered in this section include northern hardwood, mixed mesophytic, river floodplain hardwood, and eastern riverfront community types (USDA Forest Service, 1997). Mesic deciduous forest types are characterized by the presence of many shade tolerant tree species and relatively low levels of fire occurrences and are found predominantly on north and east facing slopes, in coves, or in bottomland situations. Soil and moisture conditions in these situations are conducive to rapid tree growth, well developed understory and midstory levels, and large diameter trees with cavities. The forest types included here are not fire adapted and contain a higher incidence of species that are fire intolerant than other major forest communities.


Mesic Deciduous Communities
on the
Andrew Pickens Ranger District
Sumter National Forest
28
Walhalla
Seneca
Westminster
Legend
Mesic Non-Oak Communities
Ownership
National Forest
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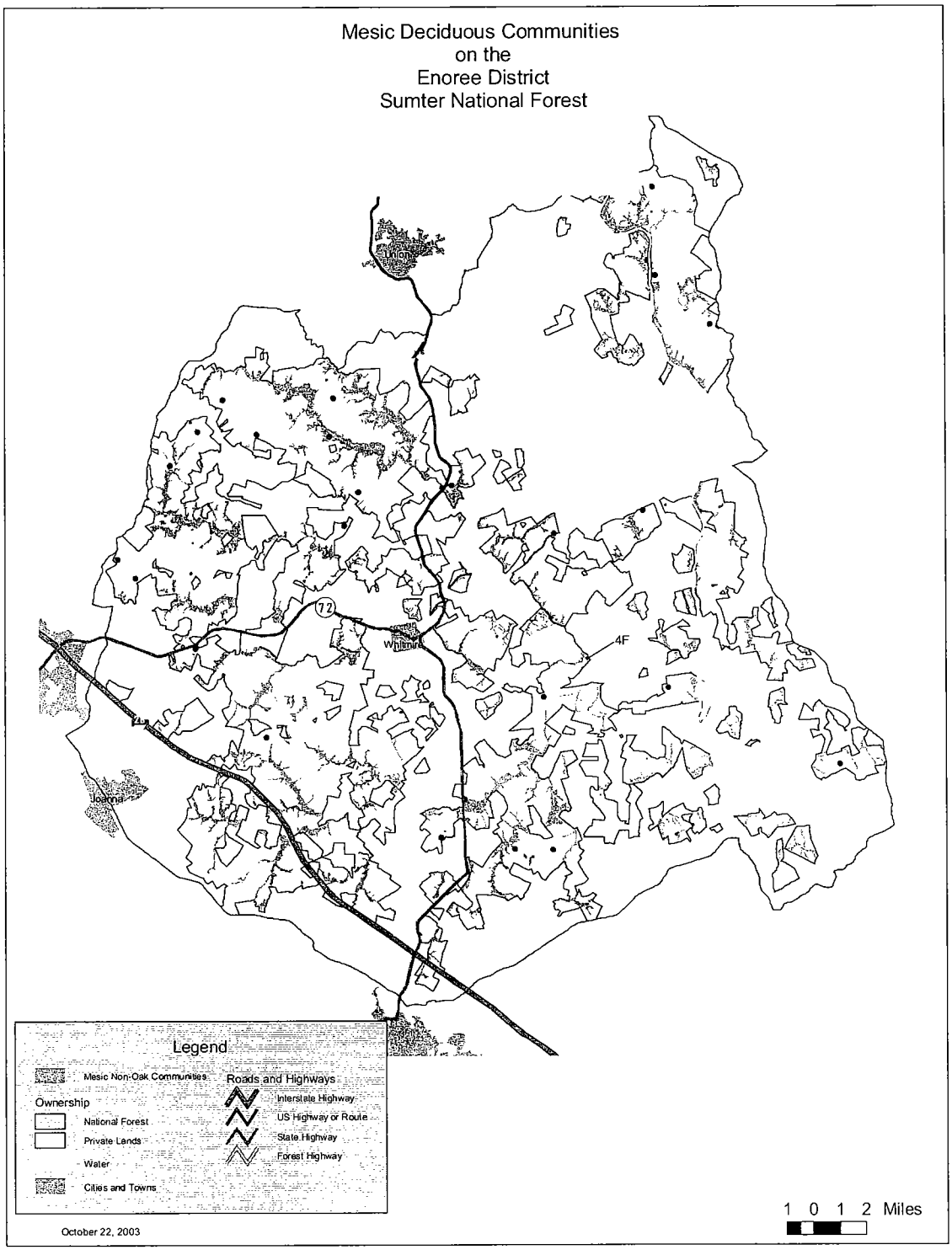
October 22, 2003


Mesic Deciduous Communities
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Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
1 0 1 2 Miles
October 22, 2003