CHAPTER 3

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

PURPOSE AND ORGANIZATION

The purpose of Chapter 3 is to present before and after views of the Forest environment. The environment is described as it is currently and as it would be if the alternatives were implemented.

The *Affected Environment* and *Environmental Consequences* disclosures are required by the National Environmental Policy Act (NEPA), which implements regulation under *40 CFR 1500*. Each resource is first described by its current condition. These descriptions are limited to the background information necessary for understanding how forest plan alternatives may affect the resource. The resources listed and their sub-headings are designed to address issues raised throughout the planning process.

After each discussion of the current condition of a resource, the potential effects (environmental consequences) associated with implementation of each alternative are discussed. All significant or potentially significant effects — including direct, indirect, and cumulative effects — are disclosed. Where possible, the effects are quantified. Where this is not possible, a qualitative discussion is presented. Environmental consequences related to the significant issues are discussed in the short and long term. Although a Forest Plan based on any alternative would guide management for 10 to 15 years, the longer term implications of implementing an alternative must be considered.

RELATIONSHIP BETWEEN THE SOUTHERN APPALACHIAN ASSESSMENT AND MANAGEMENT AREAS

The Southern Appalachian Assessment (SAA) is a collaborative effort among Federal agencies, state agencies, universities, special interest groups and private citizens. Due to the relationship of the national forests and other Federal lands to the biological, social, and economic conditions in the assessment area, more comprehensive and more scientifically credible data were needed for land management planning. The assessment supports individual forest plans at a regional level by determining how the lands, resources, people, and management of national forests interrelate within the larger context of the surrounding lands. This information serves as a baseline for some of the analysis documented in this chapter.

Management areas are defined as watersheds. The watershed management areas (WSMAs) are much smaller than the broader area included in the SAA. They are 5th level watershed designations, which on the Chattahoochee-Oconee National Forest, average about 25,000 acres each. Most represent the headwaters of larger streams that flow from the Forests into much larger streams in the Southern Appalachian region.

Relationship Between Watershed Management Areas and Management Prescriptions

The WSMAs do not have any unique direction that is not already available in the plan. They are being used strictly as areas that provide a "sense of place," as well as presenting additional information related to objectives and management prescription (MRx) allocation. They generally will be utilized as boundaries for project level cumulative effects analysis and activities. Management prescriptions are not limited to individual WSMAs; they generally apply to landscapes that cross numerous management areas. Some MRxs may actually fall entirely within a WSMA, but would not necessarily be tied directly to that WSMA.

Relationship Between Programmatic and Site-Specific Analysis

For estimating the effects of alternatives at the programmatic Forest Plan level, the assumption has been made that the kinds of resource management activities allowed under the prescriptions will, in fact, occur to the extent necessary to achieve the goals and objectives of each alternative. However, the actual location, design, and extent of such activities are generally not known at this time. Those will be site-specific (project-by-project) decisions. Thus, the discussions here refer to the potential for the effect to occur, realizing that in many cases, these are only estimates. The effects analysis is useful in comparing and evaluating alternatives on a Forestwide basis, but is not to be applied to specific locations on the Forests.

Types of Effects

Environmental consequences are the effects of implementing an alternative on the physical, social, and economic environment. *Direct environmental effects* are defined as those occurring at the same time and place as the initial action. *Indirect effects* are those that occur later than the action or are spatially removed from the activity, but would be significant in the foreseeable future. *Cumulative effects* result from the incremental effects of actions added to other past, present, and reasonably foreseeable actions, regardless of what agency (federal or non-federal) or person undertakes the other actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time.

PHYSICAL ELEMENTS

The physical environment is the non-living portion of the environment upon which the living organisms depend – air, soil, water, geology, and climate. This section begins with a description of the ecological classification of the Chattahoochee-Oconee National Forests. Ecological classification is a system which classifies land and water at various scales through integrating information about climate, geology, landform, soils, water, and vegetation. This classification is a tool to provide a more ecological and scientific basis in land and resource management planning.

Ecological classification is useful for:

- Evaluating the inherent capability of land and water resources.
- Predicting changes occurring over time.
- Evaluating effects of management.
- Allocating land to management areas.
- Selecting appropriate management indicators.
- Discussing and analyzing ecosystems and biodiversity at multiple scales.

DESCRIPTION OF ECOLOGICAL UNITS

In 1992, the Forest Service issued a commitment to using an ecological approach to managing the National Forests and Grasslands of the United States. This concept, termed ecosystem management, focuses on blending the needs of people with management that will sustain forest ecosystems (Robertson, 1992). A key point of this directive from the Chief of the Forest Service, Dale Robertson, was to use ecosystem management to better understand the complex ecosystems that occur on national forests.

A critical first step in planning the ecosystem management concept was the development of a consistent approach to ecosystem classification and mapping (McNab and Avers, 1994). As a result, the National Ecological Classification and Mapping Task Team (ECOMAP, 1993) were chartered to develop a consistent approach for classifying ecological units at multiple geographic scales.

Land classification is the process of arranging or ordering information about land units so one can better understand their similarities and relationships (Bailey et al. 1978). Ecological classification is a system by which land and water at various scales are classified and stratified through integrating information about geology, landform, soils, water, vegetation, and climate. These classifications represent homogenous units having similarities among their resource capabilities and relationships.

The National Hierarchical Framework of Ecological Units was developed and adopted in November 1993 by the Forest Service as a system to classify and map terrestrial ecological units at multiple geographic scales. Table 3- 1 displays the National Framework units.

Table 3- 1. Forest Service National Hierarchy of Ecological Units

Planning and Analysis Scale	Ecological Units	Purpose, Objectives, and General Use	General Size Range
Ecoregions Global Continental Regional	Domain -------------------- Division -------------------- Province	Broad application for modeling and sampling, strategic planning and assessment	Millions to tens of thousands of square miles
Subregions	Section ------------------- Subsection	Strategic, multi-forest, statewide, and multi-agency analysis and assessment	Thousands to tens of thousands of square miles
Landscape	Landtype Association	Forest, area wide planning and watershed analysis	Thousands to hundreds of acres
Land Unit	Landtype ------------------- Landtype Phase	Project and management area planning and analysis	Hundreds to less than 10 acres

Source: ECOMAP, 1993

ECOMAP (1993) briefly describes the framework: a regionalization, classification and mapping system for stratifying the Earth into progressively smaller areas of increasingly uniform ecological potentials. Ecological types are classified and ecological units are mapped based on associations of those biotic and environmental factors that directly affect and indirectly express energy, moisture, and nutrient gradients that regulate the structure and function of ecosystems. These factors include climate, physiography, water, soils, air, and potential natural communities.

The national hierarchy is comprised of four planning and analysis scales: ecoregions, subregions, landscape and land units. The scales are further divided into domains, divisions, provinces, sections, subsections, landtype associations, landtypes and landtype phases. A description of the ecological units from the Domain level through the Subsection level follows to provide a context for the Forests within the larger landscape of the United States and North America. Detailed information can be found in the references listed in the EIS. The lands of the Chattahoochee-Oconee National Forest occur in three Sections in Georgia. These are displayed in Table 3- 2.

Ecological Units of the Chattahoochee-Oconee National Forests

Domain: 200 Humid Temperate (8,669,924 square miles, 15 percent of world)
The Chattahoochee-Oconee National Forests are located in the Humid Temperate Domain (200), which is governed by both tropical and polar air masses, located in the mid latitudes (30^{o} to 60^{o}). Pronounced seasons are the rule, with strong annual cycles of temperature and precipitation. The regions of this Domain occur within climatic conditions where there is a winter cold season when plant growth ceases, and rain in summer is sufficient to support forest vegetation of broadleaf deciduous and needleleaf evergreen trees. Domains are also characterized by broad differences

in annual precipitation, evapotranspiration, potential natural communities, and biologically significant drainage systems

Division: subdivisions of a Domain determined by isolating areas of definite vegetation affinities (prairie or forest) that fall within the same regional climate. Divisions are delineated according to the amount of water deficit and winter temperatures, which have an influence on biological and physical processes and the duration of any snow cover. The mountainous portion of the Chattahoochee occurs in Hot Continental regime mountains (M220), which is characterized by hot summers and cool winters. This Division is approximately 187,259 square miles in area. The remaining portions of the Chattahoochee and the Oconee in the Piedmont and Ridge and Valley are included in Subtropical Division (230). This ecological unit is characterized by high humidity and the absence of cold winters.

Province – subdivisions of a Division that correspond to broad vegetation regions, which conform to climatic subzones controlled primarily by continental weather patterns such as length of dry season and duration of cold temperatures. Similar soil orders or soil types also characterize provinces. Again the mountainous portion of the Chattahoochee is delineated in the Central Appalachian Broadleaf Forest – Coniferous Forest – Meadow Province (M221), distinguished by subdued low mountains and open low mountains with valleys. The M prefix in the symbol defines mountainous terrain.

The lands in the Piedmont and Ridge and Valley occur in the Southeastern Mixed Forest Province (231). This Province is characterized by 50 to 80 percent of the area sloping gently toward the sea.

Subregion Units of the Chattahoochee-Oconee National Forests

Sections

The primary scale used in land management planning, to provide an ecological approach to analysis and implementation, is at the Section level of the Framework. Combinations of climate, geomorphic process, topography, and stratigraphy characterize ecological units at this scale. These processes or properties influence moisture availability, and exposure to radiant solar energy. The results are control of hydrologic function, soil-forming processes, and potential plant community distributions. Sections and Subsections are the two ecological units mapped at this scale.

Sections are defined as broad areas of similar geomorphic process, stratigraphy, geologic origin, drainage networks, topography, and regional climate. Such areas are often inferred by relating geologic maps to potential natural vegetation series groupings by Kuchler (1964). Boundaries of some Sections approximate geomorphic provinces (for example Blue Ridge) as recognized by geologists. Section names generally describe the predominant physiographic feature upon which the ecological unit delineation is based, e.g. Appalachian Piedmont. The sections of the Forests are listed in Table 3- 2 and described in detail following the Table.

Table 3- 2. Sections on the Chattahoochee-Oconee National Forest

I. Domain (highest level, identifies separations on the North American continent)
Humid Temperate (200) - generally the United States east of the 100th Meridian; climate governed by both tropical and polar air masses, contains forests of broadleaf deciduous and needleleaf trees.

II. Divisions (2nd level, primarily differentiated by climatic differences, especially winter frost)

A. **Hot Continental** (220) - further described as **Hot Continental Regime Mountains** (M220), characterized by hot summers and cool winters, includes the Appalachian Mountains from Pennsylvania to north Alabama.

B. **Subtropical** (230) - marked by high humidity (especially in summer) and the absence of cold winters, includes the Piedmont and Southern Ridge and Valley.

III. Provinces (broad vegetation regions and climate subzones)

A. **Central Appalachian Broadleaf Forest - Coniferous Forest - Meadow Province** (M221) - subdued low mountains and open low mountains with valleys, includes the Southern Appalachian Mountains.

B. **Southeastern Mixed Forest** (231) - characterized by gentle slopes, includes the Piedmont and Ridge and Valley.

IV. Sections (broad areas of similar topography, regional climate, and potential natural vegetation)

A. **Blue Ridge Mountains** (M221D) - includes the southern portion of the Appalachian Mountains in Georgia, North Carolina, and Virginia. Occurs only on the Chattahoochee NF, does not include the Armuchee RD, and the portion of the Chattooga RD east and northeast of Clarkesville, Georgia.

B. **Southern Appalachian Piedmont** (231A) - includes the Oconee RD and the Chattooga RD east and northeast of Clarkesville, Georgia. Represented by irregular plains, plains with high hills, open low hills, and tablelands of moderate relief.

C. **Southern Ridge and Valley** (231D) - located only on the Armuchee RD of the Chattahoochee NF and is characterized by parallel ridges and valleys.

Source: USDA Forest Service, 1994

Description of Sections adapted from McNab, W.H. and Avers, P.E. 1994. Ecological Subregions of the United States: Section Descriptions.

Province M221 – Central Appalachian Broadleaf Forest – Coniferous Forest – Meadow (Appalachian Highlands, 68,100 $mi^{2)}$

This province is composed of subdued low mountains of crystalline rocks and open low mountains with valleys underlain by folded strong and weak strata. The relief is high, up to 3,000 feet. Elevations range from 300 to 6,000 feet. Climate is temperate with distinct summer and winter, and all areas are subject to frost. The valleys of the southern Appalachian Mountains support a mixed oak-pine forest, dominated by a dozen species each in the white and black oak groups. Chestnut was once abundant, but a fungus has eliminated it as a canopy tree. Mixed Mesophytic forest extends into narrow valleys and coves of the southern Appalachians, where oak vegetation predominates. The pattern of vegetation is complicated by topography and geology.

Section M221D – Blue Ridge Mountains
Total Area in U.S. – 21,000 square miles, 0.6 percent of U.S.
Area of Chattahoochee-Oconee NF: 640,448 acres, 73 percent of Forests

Geomorphology: This section is in the Blue Ridge geomorphic province. Tectonic faulting and uplift of resistant, crystalline bedrock into a relatively narrow band of highly metamorphosed, parallel mountain ranges formed the Section. The northern part of this section (north of Roanoke Gap in Virginia) is characterized by a single, broad (5 to 10 mi) ridge that extends into southern Pennsylvania. The southern half of the Section is broader, higher, more mountainous, and displays little or no structural grain. Though high (46 peaks are over 6,000 feet in elevation), the mountains are rounded and generally lack prominent angularity. Drainage is structurally controlled, dominantly trellis in the north; dendritic patterns dominate the southern half. Landforms on about 80 percent of the Section are low mountains. The remainder of the Section is open, low mountains. Elevation ranges from 1,000 to over 6,000 ft. Local relief ranges from 500 to 1,000 ft. Mt. Mitchell, the highest point in eastern North America (6,684 ft) occurs here. Brasstown Bald (4,784 ft) in Georgia is in this Section.

Lithology and Stratigraphy: Bedrock is overlain by a veneer of residuum on the ridges and mountaintops, colluvium on the slopes, and alluvial materials on the valleys. Although structural grain is not evident in the south half, the whole Section is bounded on the eastern and western margins by southwest to northeast trending thrust faults, between more faults and tight folds.

Bedrock is composed primarily of Proterozoic metasediments (quartzite, schist and gneiss) and meta-igneous rocks (granite, rhyolite, basalt, and gabbro). Smaller areas underlain by Paleozoic granite occur along the eastern edge of the Section, with lower Cambrian sandstone, shale and dolomite, and broad zones of intensely sheared and altered rock. The Lower Cambrian rocks occur intermittently along the western edge as well.

Soil Taxa: Soils are dominated by the suborders Ochrepts and Udults. Dystrochrepts are on steep slopes of lower elevation mountains. Hapludults are on the low foothills, and Haplumbrepts have formed on foot slopes and in valleys. Haplumbrepts are also common at higher elevations, while Hapludults are dominant in broad valleys. Rhodudults have formed over rocks with a high content of mafic minerals. Soils are generally moderately deep and medium textured. Boulders and bedrock outcrops are common on upper slopes, but are not extensive. These soils have a mesic temperature regime, an udic moisture regime, and mixed mineralolgy. Similar soils with a frigid temperature regime are typically present at elevations above 4,800 feet. Soils receive adequate moisture for growth of vegetation throughout the year.

Potential Natural Vegetation: Kuchler (1964) classified vegetation in this Section as Appalachian oak forest, southeastern spruce-fir forest, and northern hardwoods. The predominant vegetation is montane cold-deciduous broad-leaved forest dominated by the genus Quercus. The oak forest type consists of black, white, and chestnut oaks that dominate dry mountain slopes; pitch Pine is often a component along ridge tops. Mesophytic species such as yellow poplar, red maple, northern red oak, and sweet birch dominate the valleys and moist slopes. Smaller areas of cold-deciduous broad-leaved forest with evergreen needle–leaved trees are present in the intermontane basins, with the hardwood-Pine cover type of scarlet, white, blackjack, and post oaks and shortleaf and Virginia Pines. Table Mountain Pine, a fire-dependent species with serotinous cones, occurs on xeric ridge tops where fire was historically more common. Eastern white Pine dominates small areas of coarse-textured soils and parts of the Blue Ridge escarpment joining the Southern Appalachian Piedmont Section. Mesic sites at higher elevations (4,500 ft, 1,360 m) are occupied by northern hardwoods (e.g. sugar maple, basswood, and buckeye); drier sites are dominated by northern red oak. The broad-leaved forest changes to evergreen needle-leaved forest with conical crowns (e.g. red spruce, Fraser fir) above altitudes of about 5,000 to 6,000 ft (1,800 m).

Fauna: Many species of small mammals and birds with northern or boreal affinities reach their southernmost range in eastern North America in the Blue Ridge Section. These include the New England cottontail rabbit, northern water shrew, rock vole, northern flying squirrel, blackburnian warbler, and saw-whet owl. This Section supports the largest diversity of salamanders in North America. At least 12 species of the genus {\it Plethodon} and 6 species of the genus {\itDesmognathus} are endemic to the Blue Ridge Section. Most endemic species are found in the central and southern subsections, where topographic relief is greater, peaks are more isolated, and higher rainfall occurs. Disjunct and isolated populations of the green salamander and bog turtle are found in the southernmost subsections.

Climate: Average precipitation is 40 to 50 in., but ranges up to 60 in. on the highest peaks. Only 35 to 40 in. fall in the Asheville Basin (North Carolina), an area surrounded by higher mountains. Along parts of the southern Blue Ridge escarpment bordering Southern Appalachian Piedmont Section, rainfall averages over 80 in.; the highest in the eastern United States. Precipitation is about equally distributed throughout the year and relatively little occurs as snow. Mean annual temperature is 50 to 62^{o} F (10 to 15^{o} C) and ranges from 38^{o} F (3^{o} C) in January to 76^{o} F (24^{o} C) in July. The growing season lasts 150 to 220 days, but varies according to elevation and the influence of local topography.

Surface Water Characteristics: There is a high density of small to medium size perennial streams and associated rivers; those in intermountain basins have moderate rates of flow. Some streams on mountainous areas in zones of high rainfall are characterized by high rates of flow and velocity. A dendritic drainage pattern has developed on deeply dissected surfaces, with some control from the underlying bedrock. Isolated areas in some locations are wet all year because of seepages. The largest river drainages are the French Broad and Little Tennessee. In Georgia, the Chattahoochee, Tallulah, Ellijay, Coosawattee, Toccoa, Conasauga, Little

Tennessee, Hiwassee, Nottely, Chattooga, and Chestatee Rivers form their headwaters within this Section. The Tennessee Valley Authority, Georgia Power Company and U.S. Army Corps of Engineers own and manage a combined total of eight (8) reservoirs within the boundaries of the Chattahoochee National Forest for power generation and recreation.

Disturbance Regimes: Fire, wind, ice and precipitation are the principal causes of natural disturbance. It is believed that Native Americans used fire where drier conditions prevail. Fire caused by lightning is more prevalent in some areas, especially near Grandfather Mountain, North Carolina. Tornadoes are uncommon, but more prevalent are localized “micro-bursts” of intense winds, which cause small patches of trees to be up-rooted, especially on mountain slopes. Winter ice storms are not uncommon at mid-to-high elevations, and intense precipitation cause localized scouring and erosion of drainage channels, followed by sedimentation and flooding. An introduced pathogen, the chestnut blight, caused considerable disturbance to composition of most forest stands from 1920 to 1940 by top-killing all American chestnut trees. Gypsy moth has not affected forests in the central and southern subsections, but has the potential to cause a major impact on forest vegetation because of the dominance by oaks.

Land use: Natural vegetation has been cleared for agriculture and urban development on about 35 percent of the area, mostly in broad valleys between major mountain ranges.

Location on the Forests: generally situated between the South Carolina state line (eastern boundary) and U.S Highway 411 near Chatsworth (western boundary). The southern extent of this Section in Georgia coincides with the border of the Chattahoochee National Forest. Districts in the Section include the entire Tallulah, Brasstown, and Toccoa, the Cohutta portion of the Armuchee-Cohutta, and the mountainous portion of the Chattooga Ranger District north and west of Clarkesville.

Province 231 – Southeastern Mixed Forest
(Southeastern United States, 193,000 mi^2, 5.4 percent of the United States)

Seven sections comprise this Province with two, the Southern Ridge and Valley and Southern Appalachian Piedmont found on the Chattahoochee-Oconee National Forests in Georgia. The Province extends from Virginia in a “crescent” shape on the eastern edge of the Appalachian Mountains west to the coastal plains of east Texas. Relief is from 300 to 2,000 feet. Climate is roughly uniform throughout the region with mild winters and hot, humid summers. Growing season is long. Medium-tall forests of broadleaf deciduous and needleleaf evergreen trees provide climax vegetation. At least 50 percent of the stands are made up of loblolly, shortleaf, and other southern yellow pine species, singularly or in combination.

Section 231D – Southern Ridge and Valley
Total Area in the U.S.: 6,700 square miles, 0.2 percent of U.S.
Area of Chattahoochee-Oconee NF – 64,656 acres, 8 percent of Forests

Geomorphology: This Section is in the Southeastern Mixed Forest Province. The area is a folded, faulted and uplifted belt of parallel valleys and ridges, strongly dissected by differential erosion, mass wasting, fluvial erosion, and transport and deposition. About 60 percent of this Section consists of plains with hills and 40 percent consists of open high hills. Elevation ranges from 650 to 2,000 ft. Local relief ranges from 300 to 500 ft. in areas of plains, with elevation ranging from 500 to 1,000 ft. in areas of high hills.

Lithology and Stratigraphy: Rock units formed during the Paleozoic Era. Strata consist of a mosaic of marine deposits of Lower Cambrian clastic rocks (granites), and mixture of marine deposits of Cambrian (carbonates and shales), Lower Ordovician (carbonates), and Mississippian (shales, limestone, and chert) ages.

Soil Taxa: Soils are mostly soil orders Udults with some Ochrepts. Paledults dominate upland areas underlain by limestone. Hapludults are in valleys underlain by shale. Dystrochrepts are common on side slopes of ridges. Hapludolls and Eutrochrepts are on bottomlands. Soils have an udic moisture regime and thermic or mesic temperature regime. Almost all soils are well drained. Soils range from shallow on sandstone and shales to very deep on limestone formations.

Potential Natural Vegetation: Kuchler (1964) mapped vegetation as oak-hickory-Pine forest and southern mixed forest. The predominant vegetation form is needle-leaved, evergreen trees with cold deciduous, broad-leaved forest. The principal cover type is oak-hickory, which includes southern red oak, white oak, post oak, red maple, winged elm, flowering dogwood, pignut hickory and loblolly Pine. In some areas, loblolly and shortleaf pines dominate.

Fauna: Among the fauna in this Section are white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, Eastern chipmunk, white-footed mouse, pine vole, short-tailed shrew, and cotton mouse. The turkey, bobwhite, and mourning dove are game birds discussed in various parts of this Section. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake, and timber rattlesnake.

Climate: Precipitation averages 36 to 55 in. annually. Mean annual temperature is from 55 to 61^{o} F (13 to 16^{o} C). The growing season lasts about 170 to 210 days.

Surface Water Characteristics: This Section has a moderate density of small to medium size perennial streams and associated rivers, mostly with low to moderate rates of flow and moderate velocity. Trellis drainage pattern has developed with bedrock structural control. One of the major rivers draining this Section is the Coosa. The Conasauga, Oostanaula, and Chattooga Rivers have tributaries on National Forest lands in this narrow Section.

Disturbance Regimes: Fire has probably been the principal historical disturbance, previously burning over small areas between natural barriers with moderate frequency and low intensity. Insect related disturbances have resulted from southern Pine beetles. Climatic related influences include occasional droughts and ice storms.

Land Use: Natural vegetation has been cleared for agriculture on over 60 percent of the area, primarily on the productive limestone-derived soils of the valley floors.

Location on the Forests: located only on the Armuchee portion of the Armuchee-Cohutta Ranger District.

<u>Section 231A – Southern Appalachian Piedmont</u>
Total Area in the U.S.: 73,200 square miles, 2.0 percent of the U.S.
Area on the Chattahoochee-Oconee NF: 161,375 acres, 19 percent

Geomorphology: This Section is in the Appalachian Piedmont geomorphic province. It consists of an intensely metamorphosed, moderately dissected plain consisting of thick saprolite, continental sediments, and accreted terranes. Differential erosion has produced some isolated mountains called monadnocks, which rise above the general land surface, characterized by bare granite exposures. Yonah Mountain on the Chattooga Ranger District is one example, along with Stone Mountain some 80 miles to the southeast in Atlanta. Landforms on about 70 percent of the Section are irregular plains. Landforms on the remaining area are about equally divided; plains with high hills; open low hills, and tablelands of moderate relief. Elevation ranges from 330 to 1,300 ft (100 to 440 m). Local relief ranges from 100 to 300 feet (30 to 90 m).

Lithology and Stratigraphy: Rock units formed during the Precambrian (60 percent), Paleozoic (30 percent) and Mesozoic (10 percent) Eras. Precambrian strata consist of metamorphic complexes with compositions of schist and phyllite, and mafic Para gneiss. Paleozoic strata consist of about equal amounts of Cambrian eugeosynclinal and volcanic rocks. Mesozoic strata consist of Triassic marine deposits (sandstone, siltstone, and shale).

Soil Taxa: Udults are the predominant soils. Paledults and Hapludults are on gently sloping uplands. Hapludults, Rhodudults, Dystrochrepts, and Hapudalfs dominate steeper slopes. Dystrochrepts, Udifluvents, And Fluvaquests are on alluvium. Soils have a thermic temperature regime, and kaolinitic, mixed, or oxidic mineralogy. Soils are generally deep, with clayey or loamy subsoil. In many areas, soils are severely eroded because of past intensive agricultural practices, especially for cotton production.

Potential Natural Vegetation: Kuchler (1964) mapped this area as oak-hickory-Pine forest and southern mixed forest. Predominant vegetation form is evergreen forest with rounded crowns, and about equal areas of cold-deciduous broad-leaved forest with evergreen needle-leaved trees. The oak-hickory forest cover type consists of white, post, and southern red oaks, and hickories of pignut and mockernut. The loblolly-shortleaf Pine cover type is common on disturbed sites and usually has an understory component of dogwood and sourwood.

Fauna: Among the fauna in this Section are white-tailed deer, black bear, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, fox squirrel, eastern chipmunk, white-footed mouse, Pine vole, short-tailed shrew, and cotton mouse. The turkey, bobwhite, and mourning dove are game birds in various parts of this Section. Songbirds include the red-eyed vireo, cardinal, tufted titmouse, wood thrush, summer tanager, blue-gray gnatcatcher, hooded warbler, and Carolina wren. The herpetofauna include the box turtle, common garter snake, and timber rattlesnake.

Climate: Average annual precipitation ranges from 45 to 55 in (1120 to 1,400 mm) annually. Mean annual temperature averages from 55 to 61^{o} F (14 to 18^{o} C). The growing season lasts about 205 to 235 days.

Surface Water Characteristics: There is a moderate density of small to medium size perennial streams and associated rivers, mostly with low to moderate rates of flow and moderate velocity. A dendritic drainage pattern has developed on moderately dissected surface, with some influence from the underlying bedrock. Many rivers drain this Section, including the Chattahoochee, Ocmulgee, Savannah, Saluda, and Yadkin. The Broad River, Ocmulgee, and Oconee Rivers flow within this Section on National Forest lands. Georgia Power Company manages two large reservoirs on the Oconee River for power generation and recreation.

Disturbance Regimes: Fire has probably been the principal historical disturbance, previously burning over small to moderate size areas between natural barriers with low frequency and low intensity. Insect related disturbances have resulted from southern Pine beetles. Climatic influences include occasional summer droughts and winter ice storms, and infrequent tornadoes. Significant anthropogenic disturbances occurred in the 1800s with much of the land area being cleared for intensive cotton production. Lack of soil conservation practices resulted in severe erosion (as much as 2 feet) and soil loss. The Federal government established conservation practices in the 1930s using extensive planting of yellow Pine species to reestablish vegetation cover.

Land: Natural vegetation has been cleared for agriculture on most of the area, especially for cotton production in the 1800s. Much of the landscape has been damaged by accelerated sheet erosion due to abandonment of cropland in the mid-1800s to early twentieth century.

Location on the Forests: the entire Oconee Ranger District, and the portion of the Chattooga Ranger District southeast of Clarkesville, often described as the “upper” Piedmont.

<u>Subsections</u>

Subsections are smaller areas of Sections with similar surficial geology, lithology, geomorphic process, soil groups, subregional climate and potential natural communities. Names of Subsections are usually derived from geologic features. Table 3- 3 displays the Subsections found on the Chattahoochee-Oconee National Forests.

Table 3- 3. Ecological Subsections on the Chattahoochee-Oconee National Forest

V. **Subsections** (smaller areas of sections, similar surface geology features, soil types, and climate)

A. **Metasedimentary Mountains** (M221Dd) - defined by low mountains (2,000 to 5,000 feet elevation), underlain by metasedimentary rocks, occurs on the Brasstown, Cohutta, and Toccoa RDs. Acres on Forest: 126,742

B. **Southern Blue Ridge Mountains** (M221 Dc) - defined by low mountains (2000 to 5,000 feet elevation) underlain by crystalline rocks, occurs on the Brasstown, Chattooga, Tallulah, and Toccoa RDs. Acres on Forest: 513,706

C. **Midland Plateau Central Uplands** (231Aa) - composed of irregular plains underlain by crystalline rocks, and occurs only on the Oconee RD. Acres on Forest: 115,353

D. **Piedmont Ridge** (231Ab) - a long, narrow subsection generally following the Brevard Fault in Georgia and called the Gainesville Ridges, extending from the South Carolina line through Atlanta west into Alabama. The subsection is typified by tablelands of moderate relief (300 to 500 feet) and occurs only on the southeastern portion of the Chattooga RD. Acres on Forest: 9,013

E. **Schist Plains** (231Ac) - defined by tablelands of moderate relief (300 to 500 feet) joining the Southern Blue Ridge Mountains Subsection at its northeastern boundary near the Rabun-Habersham county line, found only on the Chattooga RD. Acres on Forest: 5,778

F. **Lower Foot Hill**s (231Ad) - a relatively small unit characterized by open high hills, is south of and adjacent to the Piedmont Ridge Subsection, occurs only on the Chattooga RD in Georgia but extends into South Carolina to the east on the Sumter NF. Acres on Forest: 30,183

G. **Schist Hills** (231Ag) has open hills (500 to 1000 feet) and is south of and adjacent to the Southern Blue Ridge Mountains Subsection along its southern boundary, also creating a transition area, occurs on the Toccoa and Chattooga RDs. Acres on Forest: 1,048

H. **Sandstone Ridge** (231Dc) has parallel ridges and valleys and occurs only on the Armuchee RD. Acres on Forest: 64,656

Source: Keys, et. al, , 1995

Landscape Ecological Units on the Chattahoochee-Oconee National Forests

Landtype Associations

At the landscape scale, ecological units are defined by general topography, geomorphic process, surficial geology, soil and potential natural community patterns and local climate. These factors affect biotic distributions, hydrologic function, natural disturbance regimes, and general land use. Local landform patterns become apparent at this level in the hierarchy, and differences among units are usually obvious to on-the-ground observers. At this level, terrestrial features and processes may also have a strong influence on ecological characteristics of aquatic habitats. Landtype Association ecological units represent this scale in the hierarchy.

Landtype Associations are groupings of landtypes or subdivisions of Subsections based on similarities in geomorphic process, geologic rock types, soil complexes, stream types, lakes, wetlands, and series, subseries, or plant association vegetation communities. Repeatable patterns of soil complexes and plant communities are useful in delineating map units at this level. Names of Landtype Associations are often derived from geomorphic history, vegetation community or local landscape features.

The Chattahoochee-Oconee National Forest has completed a first approximation of Landtype Associations (Rightmyer and Stephens, 1996). Currently forty-two (42) Landtype Associations (LTAs) have been identified on the Chattahoochee, and six (6) LTAs on the Oconee National Forest. These ecological units fit, or nest, within the higher levels of the Hierarchical Framework of Ecological Units. The primary use of these units will be for watershed analysis and project level planning. Maps, descriptions and supporting data for the LTAs are on file in the Forest Supervisors office in Gainesville.

Two additional levels of ecological units are described below LTAs, the landtypes and landtype phases. These units are designed and mapped in the field or through GIS analysis based on local topography, rock types, soils, and vegetation. These factors influence the structure and composition of plant communities, hydrologic function, and basic land capability. To date (2003) landtypes or landtype phases have been drafted only for the Armuchee portion of the Armuchee-Cohutta Ranger District.

Geology of the Chattahoochee-Oconee National Forests

Geology section adapted from Nolder (1982) report prepared for the Forests.

The Chattahoochee National Forest is underlain by Paleozoic (570 to 280 million years before present) sedimentary rocks to the west, and Precambrian to Triassic (570 to 225 million years before present) metamorphic and igneous rocks in central and eastern areas, roughly from Murray County east to the South Carolina border. Rock units generally strike northeast and dip regionally to the southeast, although local structure is far more complex. The crystalline (igneous and metamorphic) rocks in the area are known to have undergone at least two and in some areas as many as four episodes of folding, and at least two periods of metamorphism, the last accompanied by intense regional faulting. The faults serve to divide the rocks into belts that exhibit somewhat different characteristics.

Rocks of the Ridge and Valley – northwestern Georgia is underlain by a sequence of sedimentary rocks consisting of limestone and dolomite, shale, chert, and sandstone. Rocks of the western Blue Ridge – from the Ridge and Valley and Great Smoky Fault east to the Hayesville Fault are rocks of metasedimentary origin including phyllite, metagraywacke, and metaconglomerates. These rocks overlie gneisses, and schists moving to the east. The Murphy group of rocks is found from Ellijay through Cherry Log north to Mineral Bluff including schists, quartzites, and marble.

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Rocks of the eastern Blue Ridge – east of the Hayesville fault are crystalline rocks including schists, gneisses, and intrusive igneous rocks. The igneous rock intrusions include mafic and ultra-mafic rocks. Gneiss rocks predominate over schist in the eastern portion of the Chattahoochee.

A domal structure underlain by quartzite, surrounded by a ring of aluminous schists and granite gneiss is dominant in the Tallulah Falls Dome area near Tallulah Falls. The Brevard Zone, a linear feature stretching from Alabama north through Georgia, North Carolina and into Virginia, also is evident in the eastern edge of the Forest. The Brevard is composed geologically of crushed, powered, and recrystallized slices of marble, and highly deformed igneous bodies.

Rocks of the Upper Piedmont – South and east of the Brevard zone, rocks of highly metamorphic grade and gneissic rocks similar to those to the west are intruded by granites and granite gneisses; little of the area is forest land.

The Oconee National Forest is underlain by gneisses, granite gneisses, gabbros, diabase and amphibolite rocks of Precambrian to Triassic age (570 million to 225 million years before present). On the northern end of the Forest, rock types include hornblende and granite gneiss, amphibolites, and schists. Two large gabbro bodies occur, surrounded by metamorphic halos. Geologic structure is dominated by two northeast trending faults of regional extent, the Towaliga to the north and the Goat Rock to the south. The northern fault dips to the northwest, and the southern to the southeast.

The southern portion of the Oconee National Forest is underlain by granites, granite gneisses, biotite gneisses, and highly metamorphosed mafic and felsic intrusive bodies. Feldspar is produced from the pematite swarms in the western and central areas of this portion of the Oconee near Monticello.

Summary of the geologic history of the Southern Appalachian Mountains from “Birth of the Mountains – The Geologic Story of the Southern Appalachian Mountains, S.H.B Clark, U.S. Geologic Survey, 2001). The geologic history of surface features in the southeastern United States is long and diverse. Some rocks exposed in the Appalachian Mountains date back one billion years old. A deep basin, known as the Ocoee basin, formed on the margin of the super continent in what is now the western Carolinas, eastern Tennessee and northern Georgia. The sediments of the Ocoee Basin now form the bedrock of the Great Smoky, Unicoi, and Plott Balsam Mountains. The rocks that formed from coarse sediments are very hard and resistant to weathering and erosion. These form the ridges and peaks of today. Rocks of finer grained sediments, clay and silt, are softer and break down more easily, today found in lower areas. Erosion of the alternating layers of hard and soft rocks makes many of the landforms that we see today. As rivers cut their way through the layers, hard rocks form ledges that make waterfalls, and alternating layers of hard and soft rock make the riverbeds that produce whitewater rapids.

Molten rocks below the Earth’s surface may erupt to form volcanoes or quiet lava flows. When molten rock remains deep below ground, it cools and crystallizes to form bodies of rock that are called igneous plutons. Plutons are scattered throughout the Southern Appalachians like plums in a pudding. Some plutons are now exposed at the land surface due to the erosion of overlying rock. These structures are composed of granite and similar rocks; they weather to form unusual, smooth-sided domes. Mount Yonah, near Helen, Georgia, is an example of this geology.

Faults act as channels for migration of fluids and were a key in localizing gold in certain zones. Although the date that white settlers discovered gold in the Southern Appalachians is uncertain, there is no doubt that gold caused profound changes in the human history of the area. The Cherokees living in the region knew about the gold, but it did not have the same significance for them as it did the new settlers. In the 1820s, newspaper articles described vast riches of gold in Cherokee lands of North Georgia. Thousands of miners flocked quickly to the area with dreams of quick riches. They washed gravel from banks of the streams to search for gold. The frenzy caused by the discovery of gold hastened the removal of the Cherokee Indians during the winter of 1837-38.

The collision of continents hundreds of millions of years ago also set the stage for patterns of human settlement, travel, and transportation routes in the region. When the continents collided, folds and faults formed with northeast-southwest alignments. These structures are the framework that controls the ridges and valleys of today. The northeast – southwest trending ridges and valleys were both the main routes of travel for people and ideas and, at the same time, barriers for travel.

A less obvious result of the collision was a telescoping of contrasting rock types. The juxtaposition of rocks that formed in diverse environments set the stage for the diversity of landscape, habitat, and life forms that characterize the Southern Appalachians today. Differences in underlying rocks also influenced profoundly the patterns of regional development. Some land and soils were better suited for farming, mining, or timber than others were. The location of industry, and subsequently, the location of population centers, was based on availability of raw materials and transportation routes.

Sand, clay, and interlayered limey ooze that formed the floor of the shallow, inland sea became the bedrock of the Ridge and Valley province. The resistant sandstone layers now cap ridges and form cliffs. Limestone, on the other hand, erodes more readily, forming valleys. Limestone provides nutrients for crops and is conducive to forming caves and sinkholes, which contain unique living communities. The occurrence of iron ore, which was deposited in the inland sea along with limestone and nearby coal deposits in the Ridge and Valley province and the Appalachian Plateaus, formed a basis for early economic development.

The pebbles, sand, and clay that were deposited in the deep Ocoee basin became the bedrock of the Great Smoky Mountains. The hard, metamorphosed sandstone forms outcrops and cliffs that are habitats for scattered communities of plants and animals. Metal-rich layers produce the acidic soils that some species, such as red spruce, need to flourish.

SOILS

Affected Environment

Soil is a primary natural resource from which many other resources and the most valued commodities flow. One such resource is the forest. The better the soil, the more productive and healthy is the forest that rises from it. Soil and forest have developed together, each nurturing changes in the other. However, while forests mature in a few decades, their soils often need millennia to reach peak productivity (Powers, 1990).

All renewable resources of the Chattahoochee-Oconee National Forests are dependent on soil. Soil is a non-renewable resource, considered so because of the length of time required for its formation. The soils of the Forests today have experienced past episodes of use, abuse and recovery. Congress initially established the Chattahoochee NF under the authority of the 1911 Weeks Act. This law authorized the Secretary of Agriculture to “locate and purchase forested, cut over or denuded lands within the watersheds of navigable streams…necessary to the regulation of the flow of navigable streams or for the production of timber” (P.L. 61-435, March 1, 1911). Thus began a slow process of restoration of the forestlands left idle, eroding and often without protective cover.

The Oconee National Forest has a history of over-use and abandonment, severe accelerated sheet and gully erosion, followed by successful restoration to productivity. Gentle topography, combined with deep, fertile soils, and favorable climate created ideal conditions for the intensive cultivation of cotton throughout much of the American Piedmont in the 1700s and 1800s. Land was continuously cleared, then farmed with few conservation measures until perceived as “exhausted,” and then abandoned (Trimble, 1974). Moving on to the next available tract of land was the only option, abandoning the land leaving the soil exposed to nature’s forces of erosion. Deeply weathered clayey soils, combined with lack of ground cover, created conditions of accelerated erosion. Deep gullies formed between the streams, which soon filled with sediment from the adjacent eroding slopes. Trimble (1974) estimated an average loss of 7.5 inches of topsoil in the Georgia Piedmont, some areas losing as much as 16 inches. The Federal government began the process of restoration by purchasing the worn-out farms and fields in the 1930s. Conservation practices and revegetation with forest species began a restoration to healthy watershed conditions.

Conceptually, the quality or health of a soil can be viewed as “its capacity to function.” More explicitly, the Soil Science Society of America defines soil quality as “The capacity of a soil to function within ecosystem boundaries to sustain biological productivity, maintain environmental quality, and promote plant and animal health” (SSSA 1997). To protect and enhance soil quality, everyone must recognize that the soil resource affects the health, functioning, and total productivity of all ecosystems.

Soil scientists of the Forest Service and Soil Conservation Service began producing intensive soil surveys on the Chattahoochee-Oconee National Forests in the early 1960s. This data is now available for the entire Forest in both soil surveys and GIS databases. It is useful in the revision of the land management plan and the development of site-specific management projects. Use of this information provides opportunities to blend management activities with the ecological capabilities and potentials of the land.

Diverse geology, topography and climate have, over time, resulted in a spatially complex pattern of landforms and associated soils of different physical and biological properties and processes. These soils and landforms respond differently to management activities. Most management activities and natural disturbance processes – such as wildfires – stress soil resources to various extents. Impacts or indicators of stress include: erosion, compaction, and nutrient loss through removal of coarse woody debris, severe burning, flooding, and landslides. These effects may be of concern onsite within the watershed uplands or offsite to aquatic resources within streams. They may also increase the post-wildfire risk to life and property associated with potential floods and landslides. Soil effects or stresses are not always detrimental or long lasting. In order to maintain and, where necessary, restore the long-term quality and productivity of the soil, detrimental impacts to the soil resource must be managed within tolerable limits.

Soil Types

Soil scientists have classified about 86 soil series on the lands of the Chattahoochee-Oconee. These soil series are mapped and classified into 350 mapping unit delineations, each representing one or more soil type. Soil series are the lowest category in a hierarchy system of classification used in the United States called Soil Taxonomy (USDA, 1999). More than 19,000 series have been recognized in the U.S. These series describe the properties and characteristics of soils that can be evaluated for use and management

Soil formation is dependent on five basic factors: parent material, topography, climate, organisms, and time. Many different soil types are found on the Forests because of several factors. A wide range of parent material, more than 100 geologic formations, occurs across the Forests. These rock types, in combination with topography, climate and time have created significant variations in soils. Elevation is lowest on the Oconee at 300 feet above sea level, and highest at 4,784 feet at Brasstown Bald, also the highest point in Georgia. Over 40 mountain peaks exist on the Forest above 4,000 feet elevation. Annual precipitation ranges from 50 inches on the Oconee to 70 inches or more in the northeast corner (Rabun County) of the Chattahoochee near Ellicott Rock Wilderness.

Dominant Soil Types on the Chattahoochee (landform and extent):

1. Deep, fine-loamy and loamy-skeletal soils occurring on alluvial bottoms and terraces, about 3 percent of the Forests;

2. Moderately deep to deep, fine-loamy, coarse-loamy and loamy skeletal soils occurring on gently sloping to steep side slopes, and deep, fine-loamy soils in coves, about 65 percent of the Forest;
3. Moderately deep to deep, fine-loamy, fine and clayey textured residual soils occurring on ridge tops and upper side slopes, about 30 percent of the Forest.
4. Shallow, loamy-skeletal and areas dominated by rocks, occurring on ridges and upper side slopes, less than 2 percent.

Dominant Soil Types of the Oconee (landform and extent):

1. Deep, fine loamy soils occurring on alluvial bottoms and terraces, about 15 percent of the Forest;
2. Deep, fine loamy and clayey soils occurring on gently sloping to moderately steep rolling hills and sideslope, about 80 percent;
3. Moderately deep, fine loamy and sandy soils occurring on moderately steep sideslopes and shallow, sandy soils on sideslopes, about 10 percent.

As previously mentioned, some portions of the Oconee National Forest have been altered by past anthropogenic disturbances, primarily due to severe accelerated erosion and displacement. Upland soils generally have lost from 25 to 75 percent of the original soil surface or topsoil horizon. Soil mapping and classification reflects these conditions of the soils.

Soils occurring in riparian landforms such as wetlands, floodplains and stream terraces are associated with streams and rivers. These soils developed from alluvial sediments transported from upland sources. Soil textures are typically gravelly loams, fine sandy and sandy loams. The soils are highly productive and generally altered by cultivation, land clearing, and restoration. Recreation uses and travel ways are often the primary impacts today. These soils have periodic episodes of high water tables and flooding. Soils occurring in areas identified as wetlands are classified as hydric, characterized by saturation or flooding for periods during the year to develop conditions of low oxygen in the soils. These sites also have vegetation communities adapted to the unique growing conditions.

Soils on upland or side slopes are formed in place from materials of mixed geology derived from a variety of rock types. In coves, more common on north facing slopes, soils are deep, well drained and offer highly productive growing sites. Soils on the steep upper slopes range from moderately deep to shallow. Risk for severe erosion and unstable slope conditions are more common in these areas. Soils found on ridge top are typically shallow to moderately deep with occurrences of rock outcrops and exposed boulders.

Effects Analysis

The primary goal of soil management is to maintain or enhance long-term productivity. The National Forest Management Act (NFMA) of 1976, Section 6 (3)(E)(i), restricts timber harvest from National Forest System lands to locations where "soil, slope or other watershed conditions, will not be irreversibly damaged." Likewise, Forest Service regulations (36 CFR 219.14) limit timber production to lands where soil productivity and watershed conditions won't be irreversibly damaged. The timber must be harvested "in a manner consistent with the protection of soil, watershed, fish, wildlife, recreation, and aesthetic resources, and the regeneration of the timber resource."

In order to maintain long-term soil productivity, soil disturbance needs to be minimized and adequate control measures implemented to protect soil productivity. Mitigation measures have been developed to protect soils. Technical guidance can be found in the Forest Plan standards, Forest Service handbooks, contract specifications, Georgia's Best Management Practices for Forestry, and the Manual for Erosion and Sediment Control in Georgia. Resource protection measures apply to all alternatives. Monitoring is also a part of project planning and implementation. A key part of monitoring is to determine if the mitigations are working and protecting the intended resources.

Soil's most important physical functions are: 1) water storage, 2) air and water circulation, and 3) root support (Powers, 1990). Soil is fundamentally important for vegetation growth. One-fourth or more of a tree's mass is located in the soil, which provides both the water and mineral nutrients needed for survival and growth. Soil properties affecting the supply of air, nutrients, and water to plant roots include structure, texture, stone content, strength, density, porosity, organic matter content, mineralogy, reaction (pH), microorganisms, and temperature.

Soil productivity varies widely due to characteristics such as soil depth, available water holding capacity, nutrient status, and site characteristics, including elevation, slope, and aspect. The most productive soils are found in valley bottoms, toe slopes and coves. The concept of productivity is the inherent capacity of a soil to support the growth of plants, plant communities, and soil biota. In some areas, such as on the Oconee, past practices have reduced growth potential due to soil loss and compaction. Soil productivity depends upon climate, inherent soil characteristics, and current soil conditions.

The effects of management practices will influence the future of soil productivity and resource uses. The demand for many forest resources, which are dependent on soil productivity, is expected to increase in the future. Vegetation management practices, especially road building, invariably have the potential to degrade soil quality and health, impairing the soil's capacity to perform its functions of sustaining productivity of flora and fauna. Poor and/or damaged soils increase moisture stress and nutrient deficiencies, which in turn, contribute to susceptibility to disease and pest problems.

Some factors affecting productivity include surface or sheet erosion, soil displacement, soil compaction, nutrient loss, poor aeration and decreased infiltration. Researchers recognize soil loss or erosion, and soil compaction as the two most troublesome physical hazards associated with forest management and use (Bengtson 1978).

This Environmental Impact Statement (EIS) presents an overview of alternatives and general effects on the soil resource. When projects are proposed, site-specific analysis occurs, and mitigation is based on the potential, capability, and limitation of the soils in the project area. For this EIS, the categories affecting productivity discussed include compaction, soil displacement, and erosion. Region Eight Soil Quality Standards identify conditions where soil impairment is not occurring as retaining “at least 85 percent of an activity area is left in a condition of acceptable potential soil productivity” (USDA, 2002).

Table 3- 4 shows the soil limitations for the Forests. This information is based on the Forest’s soil resource inventory. Low fertility is correlated with nutrient-poor bedrock on the Chattahoochee and past historic erosion on the Oconee. Landslide hazard is correlated with slope steepness. Steep slopes and soil textures characterize erosion hazard. Compaction hazard is more common on soils of high clay texture.

Table 3- 4. Soil Limitations as Percent of Total Forest Area

Limitation	Chattahoochee	Oconee
	Percent	Percent
Low Fertility	60	98
Severely Eroded	2	50
Steeper than 60percent	35	0
Severe Landslide Hazard	10	0
Severe Erosion Hazard	56	77
Severe Compaction Hazard	15	25

Source: USDA Forest Service, 1985

General Effects

Soil erosion

Soil erosion, or soil loss, is the removal of surface soil through mechanical means (e.g. equipment use) or erosion. It is the origin of most of the sediment delivered to streams. Soil loss affects productivity primarily through reductions in the supply of nutrients and water. The primary cause of soil erosion is overland flow from runoff or high intensity storms. Without overland flow, there is very little erosion. An undisturbed soil with soil layers intact and growing vegetation cover has a low susceptibility to erosion. When soils are disturbed to expose bare mineral soil (A-horizon), then soils on slopes become susceptible to raindrop impact, displacement and overland flow of water. These forces combine to move soil down slope, sometimes into stream channels where it becomes sediment and impacts water quality.

In Georgia, forests cover 21,714,200 acres, or about 57.6 percent of the total of the state’s land area. The average annual rate of soil loss in Georgia is 5.1 tons per acre, which represents the estimated amount of soil that moves off of a particular slope as a result of sheet and rill erosion (GSWCC, 1993). One inch of soil over one acre weighs approximately 160 tons. A loss of 10 tons per acre would be 1/16 inch over the entire acre. Statewide, the major concern for loss of long-term productivity due to erosion is on croplands in agricultural cultivation and conversion to urban uses.

Timber harvest, site preparation, fuels treatment, road and trail construction and use, and recreation uses remove or rearrange surface cover which changes erosion rates. Forest management objectives for soil erosion include controlling soil loss rates and minimizing delivery of sedimentation to streams. This helps protect aquatic habitats and sustain soil productivity. To achieve this, a Forest-wide standard to maintain the organic layers, topsoil and root mat on all soils dedicated to growing vegetation to at least 85percent of a project area was put in place. Surface erosion rates depend on such factors as soil erodibility, steepness of slope, and amount of bare ground. Erosion rates can be calculated at project levels, but not at the forest scale.

Vegetation plays a major role in the complex interactions of slope stability and the control of erosion. It acts to intercept and store significant amounts of precipitation, thereby buffering the effects of storm events. The roots of vegetation physically bind soil particles together; the strength of roots adds strength to the soil; and the roots may grow to bedrock, forming an effective anchor system. Once precipitation enters the soil, it becomes available for the vegetation to remove it through evapo-transpiration, which decreases the amount of destabilizing groundwater.

Soil Compaction

Soil compaction can significantly reduce long-term soil productivity; therefore, it is important to prevent unnecessary compaction. Compaction alters the physical arrangement of the soil matrix, compresses the soil mass, breaks down surface aggregates and decreases the macropore volume (Pritchett 1979). Increase in soil density also describes and quantifies compaction. Bulk density, the quantifying parameter, is defined as the ratio of dry weight of a given volume of undisturbed soil to the weight of an equal volume of water (Pritchett 1979). It is greatly influenced by soil structure and texture and relates to the porosity of a soil. Soils that are loose and porous have bulk densities whereas compacted soils have high values of density. An upper limit, or threshold, bulk density value has been described where resistance to root penetration is so high that plant growth is essentially stopped (Daddow and Warrington 1983). This level is referred to as growth limiting bulk density (GLBD) and appears to be determined by soil texture due to its effect on soil pore size and mechanical resistance. Compaction often occurs because of management activities, thus it is important to stay within acceptable standards to minimize the overall effect. Detrimental compaction is characterized as conditions that adversely affect hydrologic function and site productivity. A 15 percent increase in the average undisturbed soil bulk density is considered detrimental and results in a loss of soil productivity. These conditions result in impacts to soil porosity, air exchange, root penetration, infiltration and permeability.

Some soils are more easily compacted than others, and most soils are more easily compacted when moist than when dry. Compaction in forestry operations most often occurs during the use of ground-based equipment such as skidders or tractors. Use of all-terrain vehicles and even horses can also result in compaction of soils when conditions such as wetness exist during use. Each trip across the same location will cause some compaction. The effects are cumulative, with each succeeding trip increasing the compaction. Compaction is not desirable for the Forest in general, because it reduces soil productivity in terms of the amount of vegetation the land can produce.

Soil Displacement

Soil displacement is the horizontal movement of topsoil, i.e. the organic rich surface soil layers, from one place to another. Mechanical forces, such as equipment operations or dragging logs, can cause this movement. Human activities, i.e. recreation trails, also cause displacement, as can accelerated or natural erosion. Visible displacement can be readily observed in removal of the topsoil.

Displacement most readily affects organic matter content, an important component of soil productivity. Soil organic matter affects both water and nutrient holding capacity and reduces the erosion hazard. As organic matter (leaves, needles and twigs) decomposes, it releases nutrients. This layer also acts as mulch and reduces soil erosion due to rainfall impact. Fine root mats in the topsoil bind the soil together. Soil displacement can directly impair short- and long-term productivity because soil is a non-renewable resource. Many years are needed for the soil to recover its original productivity when the upper layers are lost. Soil formation typically occurs at a rate of one inch per 200 to 1,000 years, and depends on many environmental factors.

Displacement occurs most often in the construction and use of roads, trails, campsites, log landings or other areas where soils are excavated. Limiting the area disturbed for equipment operations, and maintaining or restoring surface cover if displacement occurs, can minimize these conditions. The degree of displacement may increase as slope gradient increases. Wildfires that burn at high intensity can also result in loss of the protective organic layer and have potential for accelerated erosion. These conditions are mitigated by post-fire rehabilitation.

Conclusion

Standards set forth in the Forest Land Management Plan have been found effective in minimizing impacts to soil resources. Localized impacts discussed in the following section can occur. Site-specific analysis evaluates the potential effects of proposed management actions and considers the limitations of soils.

Direct and Indirect Effects

The following discussion provides some background information regarding the direct or indirect environmental effects common to soil resources from forest management and uses of forest resources. Any activity that disturbs the land surface, decreases vegetation cover, or alters vegetation communities can affect soils. The primary management or resource activities that could affect the soil resource are:

- **Recreation:** Recreation activities directly affect soils by exposing and compacting soils, increasing the potential for erosion and sedimentation.
- **Roads and Trails:** Roads and trails expose and compact soils, and alter surface water flow. When left open, they will contribute to higher erosion rates than closed roads and trails with proper water controls and surface cover.
- **Vegetation Management:** Vegetation management activities that may affect soils include timber harvesting, site preparation, timber stand improvement,

prescribed fire, skid trail construction, and wildlife habitat improvements. Loss of the protective soil cover (litter) from ground disturbance can increase erosion while decreasing soil productivity.

- **Fire Management:** Prescribed burning directly affects soils by removing a portion of the vegetation cover, which exposes soil to erosion. Control lines also expose mineral soil. These factors can reduce soil productivity. The significance of this varies widely depending on the soils, topography and the intensity of the burn.
- **Minerals Management:** Extraction of locatable or leasable minerals directly affects soils by removing vegetation, and often the entire soil material overlying the minerals. Possible effects include erosion and loss of soil productivity. Mineral sites are restored when use ends.

Effects of Recreation on Soils

Overuse of campsites, can result in soil compaction and deterioration of the vegetation. These effects can lead to increased surface-water runoff and possibly gully formation. This situation presently occurs in some developed recreation sites or at frequently used, dispersed recreation sites, such as campsites near trout streams. These effects are expected to be similar under all Alternatives. There are numerous dispersed sites throughout the Forest and, where these sites are used in moderation, impacts are localized. In heavily used areas, vegetation destruction, soil compaction, and displacement can occur. All alternatives contain Forest-wide standards limiting dispersed camping and the construction of recreation facilities near streams and within riparian areas.

All alternatives contain the same number of developed recreation areas (approximately 116 sites for a total 5,445 acres or 0.6 percent of the Forest). An estimated 10 percent of these areas have impacted soils (compacted by foot and vehicle traffic, surfaced for roads or camping pads, etc.) Considering this, soils on an estimated 550 acres of the Forest are detrimentally impacted by developed recreation uses.

Recreation trails (e.g. trails and trailheads) and and other recreation uses are widely dispersed. Use is causing the same impacts described above on many areas associated with trails across the Forest. There are currently 680 miles of non-motorized trails on the system (hiking, mountain biking, horseback, canoeing), and 133.5 miles of multiple-use motorized trails (ATV, motorcycle, 4-WD vehicles).

All alternatives limit off-road vehicle use to designated roads and trails. This exception has resulted in some soil erosion, compaction and puddling. Although many of these impacts are caused by illegal activity, many impacts also occur during hunting seasons when soils are often wet and highly susceptible to damage. The extent of this impact has not been determined. Regardless, significant localized impacts exist throughout the Forest. Managers consider illegal off-road use to be the “biggest” soil productivity problem on the Forests. The control of illegal use would reduce damage to soil resources, and allow law enforcement to be more effective in addressing this activity and impact. One factor in mitigating effects of trail use is to maintain trails on a regular basis to keep erosion and drainage run-off under control.

Trails are similar to roads in impacts but the impacts may be less as trails are narrower and generally do not provide access for heavy vehicles. However, trails are often steeper and many are not designed as well for drainage as are roads. The type and intensity of trail use can affect erosion and compaction. Lightly used trails are usually narrower and may have some protective vegetation. Tires, hooves, or feet can loosen soil. Foot and horse trails are sometimes steeper than motorized trails but are usually not as wide do not tend to involve as many cut slopes. There are currently about 813 miles of designated/classified trails occupying approximately 591 acres, or less than 0.01 percent of the Chattahoochee-Oconee National Forests.

Trails cause indirect impacts to the soil resource such as erosion, and off-trail sedimentation. Increases in access typically result in increased off-trail hiking and biking on previously undisturbed areas. However, this is generally limited to localized areas. Although localized effects do exist, from a forest-wide perspective, the impacts of trails on the soil resource are not significantly different from one alternative to another, and the total impact of trails is well within acceptable limits.

Overall, recreational use is expected to increase on the Forest, and is similar between Alternatives. The direct impact to soil productivity, from soil erosion and compaction, is expected to be proportional to use rather than variable by alternative. The magnitude and extent of motorized recreation trends have a greater effect on soils than non-motorized recreation. Therefore, recreation impacts on soils are assumed proportional to the amount of Forest area available for motorized recreation. The proportion of direct impact would vary at the local use level. Table 3-5 displays the acreage and percentage of the Forest available for motorized recreation opportunities.

Table 3- 5. Relative Impacts on Soils Between Alternatives for Recreation

	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Acres in Management Prescriptions Open to Motorized Recreation (includes Further Analysis areas)	585,883	641,734	602,575	398,666	594,781	412,564	578,004
Percentage of Forest Open to Motorized Recreation Opportunities	67	74	70	46	69	48	65

Source: Chattahoochee-Oconee NFs, GIS Data, 2003

Although Table 3- 5 indicates 65 percent of the Forest is available for motorized recreation this does not automatically mean that all 578,004 acres will be impacted by these uses. Trail use, other than foot travel, is limited to designated trails and open roads only under Alternative I, therefore the acreage of potential impact is a much smaller percentage of the total Forest area. Use in developed and dispersed recreation sites is also a percentage of the total area delineated, thus these uses will also impact a small percentage of the total Forest acreage base. Confining these uses to designated sites on soils suitable and appropriate for the specific use will maintain soil productivity and forest health at optimum conditions.

Alternatives A and E are projected to have high (+25 percent) levels of use in general forest recreation use, and wilderness use above current levels or Alternative F. Alternatives D and I are projected to have moderate (+10 percent) increases in these use categories. With the growth in population within the Forest planning area, nearly all types of recreation use are increasing, and experience has shown that recreation use shifts elsewhere rather than being eliminated if insufficient recreation opportunities are available. The short travel distance to major population centers such as Atlanta, Chattanooga, and Greenville creates the potential for continuous growth in recreation use. Concurrently it also poses a challenge to maintain desirable recreation experiences while minimizing impacts to natural resources.

Effects from Timber Management

Activities associated with harvest of timber can cause erosion, soil compaction, soil displacement, and loss of organic matter. In general the actions requiring removal of ground cover and displacement of soil material are most responsible for potential impacts. Use of logging equipment such as skidders to bring trees to a central location, and the routes used by trucks to remove logs from the harvest area can cause compaction, especially if the soils are wet and fine textured or clayey. Standard provisions in timber sale contracts allow the Forest Service to suspend logging operations during wet periods to minimize the risk of compaction. Sale preparation and administration procedures, along with direction in Georgia's Best Management Practices for Forestry (Georgia Forestry Commission 1999), are to designate skid trails, landings and temporary roads, allowing sensitive sites to be avoided and minimizing the area repeatedly traversed by logging equipment. Log landings normally occupy a small amount of timber harvest area, i.e. average one-third acre per 20 acres or less than 1 percent of a harvest area. Skid trails and skid roads used for equipment movement within the harvest area also range in area extent from less than 1 percent to 10 percent. On the Chattahoochee-Oconee National Forests, the construction of these areas normally involves only minor excavation, grading and soil displacement.

When logging is completed, heavily compacted areas (e.g. skid trails and landings) are ripped to break up compaction and revegetated to provide cover. Direction limiting the area impacted by detrimental compaction applies equally to all alternatives. Ground-based harvesting techniques, such as those historically and currently employed on the Forests, may result in compaction and erosion affecting 5 to 10 percent of a treatment area. However, since past and anticipated future timber harvest affects only a very small portion of the landscape, the overall area impacted by compaction is very small. Under all alternatives, soil compaction and erosion would be kept to acceptable levels by adhering to this direction.

In all alternatives, where soil displacement does occur, timber sale contracts require log landings be drained, scarified and revegetated to mitigate effects. The harvest treatments commonly practiced on the Forests (shelterwood, seed tree, thinning, clearcut, and salvage) generally require piling only unmerchantable material near landings. This practice minimizes the amount of soil pushed into the pile. The amount of detrimental soil loss due to landing construction and piling on the Forests is negligible under all alternatives.

Erosion is largely a function of inherent soil erosiveness, slope and ground cover. Logging can reduce ground cover and skid trails can channel runoff. The Forest Plan limits ground-based skidding to slopes below 40 percent and this applies to all alternatives, except Alternative F, which allows ground systems up to 45 percent slope gradient. Retention of soil organic matter, including large woody debris, also helps reduce the likelihood of erosion. In addition, the types of harvest predominantly employed retain considerable live vegetative cover to protect the soil and live roots to hold the soil. Combined, these measures should prevent detrimental soil loss or decline in long-term site productivity under any alternative.

Timber harvest can cause loss of organic matter important to long-term site productivity. Timber harvest may disturb but generally does not remove duff and surface litter. Some types of logging slash disposal, and reforestation activities can remove organic matter, but usually leave additional woody debris (i.e. logging slash) on the site. This woody debris includes the portions of the trees richest in nutrients – leaves, twigs and small branches, and roots. Large woody debris is a nutrient sink, is home to fungi and other soil organisms, slows down surface runoff, and is a catch for sediment.

All of these potential detrimental effects (compaction, puddling, soil displacement, and loss of organic matter) can be mitigated through the implementation of soil and water conservation practices and Best Management Practices. These practices include the use of designated skid trails, sub soiling, seeding for erosion control, water barring, avoidance of unstable slopes, and equipment limitations. The soil and water conservation practices and BMPs apply to all alternatives. Under any of the alternatives, only a small fraction (0.4 percent to 1.4 percent) of the lands suited for timber management, and a very small fraction (0.1 percent to 1.0 percent) of the Forest, would be disturbed through timber harvest in any year. Under Alternative I, about 446,200 acres (52 percent) of the Forest would be considered suited for timber management with a projected 4,085 acres prescribed for timber harvest from this total.

From a forest-wide perspective, impacts of timber harvest on soils differ between the alternatives. Table 3- 6 displays the projected acres of harvest by alternative and the percent of soil disturbance. In all alternatives and for timber harvest on both suited and non-suited lands, site specific analyses would be completed prior to any activity to determine if and under what conditions timber could be harvested while maintaining soil quality.

Table 3- 6. Estimated Effects of Timber Harvest on Soils – Acres of Harvest by Alternative for the Chattahoochee-Oconee NFs in Decade 1

Harvest Method	A	B	D	E	F	G	I
Thin	3,331	4,061	2,614	675	3,705	417	2,563
Un-Even Aged	444	964	483	407	2,588	410	459
Shelterwood-Seed Cut	0	0	0	0	820	0	0
Shelterwood-Removal Cut	0	0	0	0	0	0	0
Clearcut with Reserves	1,506	2,553	3,849	660	3,984	36	1,382
Total All Harvest	5,261	7,578	6,946	1,742	11,097	863	4,404
Soil Disturbance – 10 percent of Total Area Harvested	526	757	694	174	1,109	86	440

Source: Chattahoochee-Oconee NFs, GIS Data, 2003

The percentage of the Forests classified as suitable for timber harvest is an indication of the acres that may have harvest activities that could create impacts on soils. Table 3- 7 displays the acres suitable for timber harvest on the Forest by alternative.

Table 3- 7. Acres Suitable for Timber Harvest on the Chattahoochee-Oconee NF by Alternative

	A	B	D	E	F	G	I
Chattahoochee	388,007	489,985	484,070	126,771	535,466	146,830	367,196
Percent of Forest	52%	65%	65%	17%	71%	20%	49%
Oconee	91,472	90,150	91,885	81,084	97,759	76,112	93,902
Percent of Forest	79%	78%	80%	70%	85%	66%	81%
Total Percent of Total	479,479 55%	580,136 67%	579,955 67%	207,855 24%	633,226 73%	222,942 26%	461,098 53%

Source: Chattahoochee-Oconee NFs, GIS Data, 2003

In Alternative I, the acres modeled as suitable for timber harvest did not include slopes over 45 percent gradient, estimated to be about 45 percent of the total Forest land area. Harvesting on this portion of the land base requires the use of cable or skyline systems. These systems generally result in lower amounts of surface disturbance due to a reduced need for skid trails to bring trees to log landings, resulting in a smaller amount of soil disturbance. However, access roads for trucks to remove logs from the landings are needed. Often these roads must cross steep side slopes that risk causing unstable slope conditions, along with erosion and sedimentation. One outcome of modeling outputs from slopes under 45 percent is assigning timber management activities to terrain with lower hazard for erosion and slope stability problems resulting in sustainable productivity of soils.

Effects of Roads on Soils

Access routes are associated with most management activities on the Forests including recreation, timber, prescribed fire, and wildlife management. Road construction and reconstruction require vegetation removal, soil disturbance, and slope re-contouring. Soils must be compacted, hardened and generally surfaced with stone. Roads often become impervious surfaces, collect surface runoff, concentrate overland flow, and divert or reroute water from paths it would otherwise take if the road prism were not present. Roads can disrupt normal flow patterns and create new connections for sediment or other pollutants to enter the stream system. Forest roads can significantly affect site productivity by removing and displacing topsoil, altering soil properties, changing microclimate, and accelerating erosion. The direct effect of roads on soil productivity is estimated to range from 1 to 30 percent of the landscape area in managed forestlands. Losses of productivity associated with road-caused accelerated erosion are site specific and highly variable in extent.

Since the permanent or classified roads on the Forests have been dedicated to a non-productive use, from a soil productivity standpoint, this erosion, except where it extends off-site, has little effect on soil productivity. Sediment from this erosion, however, will often affect water quality and aquatic habitat. Road cuts can also undermine unstable slopes and lead to landslides, especially in steep terrain.

Road designs consider these potential effects. Proper design and maintenance can mitigate these impacts; however, some localized impacts still occur, particularly when maintenance is not kept current. Today, roads are located and constructed either to avoid or, if this is not feasible, mitigate problems associated with unstable or highly erodible soils, steep slopes, and wet areas. A well-designed transportation and trail system can reduce damage to the soil that would have occurred, or was occurring, without the facilities. If user needs are satisfied, there is less likelihood of off-road use, which can seriously degrade soils.

<u>All alternatives contain direction allowing closure of unnecessary roads to prevent resource damage</u>. Road closures range from barriers (gates) to obliteration and decommissioning. Barriers reduce traffic use impacts that cause eroding and unstable roads, but do not restore soil productivity. Restoring stable grades, natural drainages, and ground cover are critical to restoring and protecting soil productivity.

The current Forest-wide system of classified roads under Forest Service jurisdiction totals 1,635.85 miles, with 1,352.38 miles on the Chattahoochee and 283.47 miles on the Oconee. The width of the “disturbance area” (edge-to-edge clearing limits and the travel surface or roadbed) varies by road design, terrain conditions and management classification, but generally ranges from 24 to 66 feet wide. Assuming an average width of 24 feet for the disturbance area, there is about 2.9 acres per mile of road. Therefore, approximately 4,740 acres (3,930 on Chattahoochee & 820 on Oconee) of the Forests is in disturbance area or travel surface for existing classified roads, less than 0.05 percent of the total land area. These soils are considered removed from productive use for vegetation production, and are a portion of the Forest area that may contribute to erosion and sediment.

Classified roads in areas allocated to Recommended Wilderness Study and some Wild and Scenic River prescriptions would be closed to motorized use and removed from the road system. These roads would be converted to non-motorized trail use or obliterated. This change in total miles of classified roads would occur in all alternatives except Alternative F.

During the period 1986 to 1997, 99 miles of new construction and 302 miles of reconstruction of the Forest arterial, collector, and local road system were completed. Years 1986 and 1987 were the highest in new construction, 21 and 23 miles respectively. The lowest activity occurred in 1996 and 1997 with only 0 and 0.8 miles constructed. Approximately 68 percent of the mileage was built to support the timber harvest program. The remaining road mileage was constructed under the general forest roads program to provide access for the forest user and multiple resource needs, such as recreation and wildlife.

New road construction is expected to be low for the upcoming planning period under Alternative I. Approximately 10 percent of the total road system will be evaluated annually for possible reconstruction to maintain the road system at a level providing safe access and minimal resource impacts. By 2015, classified roads are projected to occupy between 4,474 and 5,100 acres, or less than 0.05 percent of the total Forest land area. Localized differences in effects would exist, but from a forest-wide perspective, the impacts of classified roads on the soil resource are not significantly different among the alternatives.

In addition to the system roads discussed above, there are “unclassified” roads on the Chattahoochee-Oconee National Forests. Except for temporary roads, forest users typically create these roads as repeated travel over an area exposes a route. The next visitor follows the path of least resistance. Unfortunately these routes are often on poor locations that result in resource damage to streams and soils. Annually, about 30 to 40 acres of these unauthorized roads are obliterated and restored through watershed improvement projects. Not all obliterated roads are successfully eliminated, however, as some are inappropriately “reopened” by Forest users. Because they are unapproved and user-developed, the amount and location of unclassified roads is constantly changing. These roads affect soil resources similarly to other roads. In some cases, impacts of unclassified roads may be worse because they are often poorly located and lack erosion control measures. They are, however, generally narrower in width. The Chattahoochee-Oconee National Forests do not have a complete inventory of unclassified roads.

<u>Effects of Range Management on Soils on the Oconee National Forest</u>

The main potential impacts of livestock grazing on soil productivity are compaction and accelerated erosion, generally from over-grazing or poor maintenance. Range management occurs on approximately 1,120 acres on the Oconee National Forest within nineteen (19) permanent improved pasture allotments. These allotments are managed as early successional grass pasture for temporary grazing of cattle or horses. Use of the allotments is under permit with permit holders required to maintain fences and perform liming and fertilization as needed.

Erosion is largely a function of inherent soil erosiveness, slope and soil cover. Controlling where livestock graze and managing grazing to retain effective vegetation cover can mitigate livestock-induced erosion.

Livestock grazing within standards has minimal impact on soils. In localized areas such as livestock paths, soils can be compacted and vegetation damaged or removed. Livestock paths tend to collect runoff and can cause erosion. These instances, however, are localized. Concentrated livestock use in localized areas such as sometimes occurs with cattle in riparian areas can result in soil compaction and puddling. Compaction in wetlands or riparian areas can directly affect the ability of soils to support plant communities. Because livestock range across allotments, minor compaction can occur over broader areas, but the weight of the individual animals is not sufficient to cause long-term degradation.

Under Alternative I an allotment vacant or not under permit for more than 1 year will be converted to the surrounding management prescription and be utilized as a wildlife opening.

Effects of Fire on Soils

The effects of prescribed fire and wild land fire on soils are summarized here, but are more fully described in *Vegetation Management in the Appalachian Mountains, Volume II, Appendix B – Effects of Fire on Soil and Water in Southern National Forests* (USDA Forest Service, Southern Region, 1989). Fire affects soil through transfer of heat into the duff layer and underlying soil. These effects vary considerably depending upon fire intensity, duration and soil conditions. The direct impacts to soil include charring of the ground surface, possible development of water repellent conditions, and acceleration of erosion for about one to three years. Burned areas can experience a loss in plant nutrient reserves and a reduction of microbial populations. Soil productivity may be slightly diminished. In some instances, the burned area benefits from increased availability of nitrogen, phosphorus, calcium, magnesium, potassium, and sulfur.

A major factor relative to the impact of fire on soil is the extent to which fire kills vegetation and burns the organic layers on the soil surface. When fire consumes all the surface litter and vegetation canopy, soils are exposed to erosive effects of precipitation and any subsequent runoff. Severe fire can increase the rate of erosion; however the effects of severe fire are typically isolated and short-term. Wild land fires tend to accelerate surface erosion more than prescribed burns, because the potential for higher severity burns is greater, and the placement of control lines are more indiscriminate than planned containment lines for prescribed fire. Over time, much of the vegetative cover can be re-established on disturbed sites through succession. Eventually, burned soils will stabilize and the hydrologic function of the soils will return to normal condition.

Severe wildfires often destroy vegetation and detrimentally burn soils. A high intensity fire could adversely affect site productivity by impacting the physical, chemical and biological properties of the soil. The physical effects could include loss of structure, reduction in porosity, and change in color. Reduced infiltration can affect the hydrology, which can in turn affect stream channel morphology and cause a resulting shift in stream aquatic habitat.

With low- to moderate-intensity fires, soil productivity would be maintained. Some areas may see a short-term increase in nutrient availability. Lethal temperatures for soil organisms would typically be confined to the upper inch or two of the soil. Sufficient ground cover typically remains in place to protect the soil surface from accelerated erosion.

The effects of fires on soil are usually short-lived and not significant except when fire intensities are high or the underlying soil resource is fragile. Soils on the Oconee classified as severely eroded are protected during prescribed fire by assessing the depth of the soil surface layer and postponing burning if the surface layer is too thin. Detrimental burning reduces soil productivity and can cause gully erosion, slumping and reduced microbial activity. Fire lines constructed to control wildfires are susceptible to erosion; however, installation of water bars and revegetation is implemented shortly after the fire is suppressed. These measures are normally successful in containing erosion on these disturbances; however, occasional problems do occur such as water bars failing or vegetation failing to establish and provide a root mat. Many vegetation types on the Forests sprout and quickly reestablish naturally following fire. Some, however, do not, and the amount of protective cover declines. These areas can experience erosion until protective vegetative cover is reestablished. Areas severely burned in wildfires can receive emergency rehabilitation to reduce or minimize soil degradation.

Since 1985, the Chattahoochee National Forest has averaged 105 wildfires per year with an average size of 11.4 acres. The Oconee National Forest has averaged 11 per year with an average size of 11 acres.

The acreage likely to be burned by wildfire would vary among the alternatives. Alternatives with the largest amounts of wilderness are expected to experience the largest and most severe wildfires due to limited access and options to control fires.

Prescribed fires can potentially result in the same types of impacts on soils as wildfires; however, these burns are generally planned for smaller acreages and to avoid fragile soils and burn at low to moderate intensities, limiting adverse impacts. These fires are often designed to reduce fuel loadings, and by doing so, reduce the likelihood of detrimental impacts from subsequent wildfires. Because these fires are planned, there is usually less fire line on steep slopes to potentially erode. Rehabilitation is initiated when severe impacts do occur. Most impacts to soil from prescribed fire are short-term. Approximately 7,000 acres have been burned annually with prescribed fire. With implementation of the National Fire Plan, this is expected to increase. Table 3- 8 and Table 3- 9 describe the estimated prescribed burning program by Ecological Section.

Table 3- 8. Projected Annual Prescribed Burning Program Acres by Alternative for the Blue Ridge and Ridge and Valley Sections

Alternative	Weighted Average FWRBE Option Value	Rank	Blue Ridge Estimated Rx Burn Program Acres	Ridge & Valley Estimated RX Burn Program Acres
G	1.52	2	1820	780
E	1.78	3	2730	1170
I	2.09	4	3815	1635
A	2.16	5	4060	1740
B	2.34	7	4690	2010
D	2.58	8	5530	2370

Source: Chattahoochee-Oconee NFs, GIS Data, 2003

Table 3- 9. Projected Annual Prescribed Burning Program Acres by Alternative for the Southern Appalachian Piedmont Section

Alternative	Weighted Average FWRBE Option Value	Rank	Piedmont Estimated Rx Burn Program Acres
G	2.45	2	14,500
I	2.70	4	17,000
E	2.74	5	17,400
B	2.76	6	17,600
D	2.85	7	18,500
A	2.90	8	19,000

Source: Chattahoochee-Oconee NFs, GIS Data, 2003

The regional soil quality standards (USDA 2002) protect against detrimentally burned soils caused by direct management actions, and apply to all alternatives. The impacts of prescribed fire on soils would not differ greatly among the alternatives, and these impacts are expected to stay within established limits.

<u>Effects of Mineral Activities on Soils</u>
Mineral exploration and extraction potentially can have minor to major impacts to soil productivity. Recreational gold panning, rock collecting and similar recreational use are low to moderate on the Forests. Soil erosion is the primary concern. Primarily individuals, on an irregular basis, generally disperse this type of activity with use levels low.

Several small borrow pits have been developed as sources of earth material for road improvements. These sites are typically located on ridges and upper side slopes away from streams. Best Management Practices are observed to minimize off-site impacts. Borrow pits are reclaimed when use ends. There are currently no other mineral exploration activities occurring on the Forests.

Cumulative Effects

Soil Productivity: The forest management activities with the greatest long-term potential to impact soils are associated with road and trail construction, timber harvesting and associated operations, and construction of control lines for fire management. Management standards (mitigation measures) presented in Forest-wide Standards, Chapter 2, can conserve long-term soil productivity.

In the short term, the alternatives disturbing the greater area of soils will potentially generate the larger short-term reduction in productivity and disruption of the hydrologic balance. In ascending order, from least to greatest potential within the first decade would be Alternatives G, E, I, A, B, D and F. However, with implementation of prescribed management measures (i.e. revegetation and protection of bare soil areas), the long-term cumulative effects from erosion would be within tolerable soil loss rates, and thus, sustain productivity.

Soil compaction: Much of the affects on soils occur in areas allocated or otherwise designated for future use (e.g. log landings, primary bladed skid roads) in support of future management objectives such as timber harvest or wildlife habitat improvement. Compaction will likely be present in the foreseeable future and cause residual, long-term effects on sites: (1) where compaction is more than four inches in depth above the projected growth-limiting bulk density for a particular soil; (2) where there is a 20 percent or greater reduction in macro-pore space; or (3) where there is a 15 percent increase in bulk density. This is unless mechanically ripping and subsoiling compacted soils, and then revegetating them, restore the impacted area. Therefore, where affected areas are not adequately restored following compaction, some incremental and/or cumulative effects will result until a threshold is reached which balances soil density levels with the compaction effect generated by future similar activities on the same sites.

Cumulatively, environmental consequences to soils from past, present and foreseeable actions associated with use and management of different kinds of soils on the Forests and related to management activities, can be made minimal through careful planning and use of appropriate mitigation measures (Best Management Practices).

WATERSHEDS

The following statements, quoted from Water & The Forest Service (USDA Forest Service, 2000), state the interrelationship of water and the forests. Water is an essential physical resource, the lifeblood for human consumption, habitat for water dependent species of plants, animals and other aquatic life.

> *Throughout human history, water has played a central, defining role. It has sculpted the biological and physical landscape through erosion and disturbance. The amount, place, and timing of water are reflected in the vegetative mosaic across the landscape. Water has also played a key role in shaping the pattern and type of human occupancy; routes of travel and transportation, patterns of settlement, and the nature and scope of human land-use all owe their characteristics largely to water regimes.*
>
> *Conversely, social demands on the water resource system have produced major effects on virtually every aspect of that system including quality, quantity, distribution, and form (for example, white water vs. impoundments).*

These statements readily apply to the water found on the Chattahoochee-Oconee National Forests in Georgia, and the system of streams, rivers, lakes and watersheds through which it flows. Georgia is experiencing increased demands for water supply, along with a desire for it to be clean and free of pollutants. Forests are key to clean water. About 66 percent of the Nation's scarce freshwater resources originate on forests, which cover about one-third of the Nation's land area. The forested land absorbs rain, refills underground aquifers, cools and cleanses water, slows storm runoff, reduces flooding, sustains watershed stability and resilience, and provides critical habitat for fish and wildlife (USDA, 2000).

The Federal government originally acquired the lands within the boundaries of the Chattahoochee National Forest under the authority of the 1911 Weeks Act. The Weeks Act authorized the Secretary of Agriculture to purchase lands within the watersheds of navigable streams to restore the watersheds and their normal stream flows, and to provide a supply of timber. These purchases began on the Forest in the 1920s. The lands of the Oconee National Forest were purchased to restore abandoned, eroding agriculture lands to a protected watershed condition. Conservation measures were installed to stop the loss of valuable topsoil, and stabilize sediment choked stream channels.

One of the primary missions of the Forest Service is to provide high-quality water in sufficient quantities to meet all needs of natural resource and human requirements. Because many of the streams and river systems within north and middle Georgia originate within National Forest boundaries, it is imperative that the Forests emphasize proper watershed management to ensure that good, clean water is provided to meet these needs. Water bodies within Georgia currently vary from relatively undisturbed conditions to heavily polluted from human activities—including recreation, road construction, timber harvesting, agriculture, and urban development, as well as disturbances associated with natural processes, such as wildfire.

This Environmental Impact Statement (EIS) presents an overview of alternatives and general effects on the water resource for the Forest Land Management Plan. When projects are proposed, more site-specific hydrological and watershed analysis occurs, and mitigation is based on the potential, capability, and limitation of the water resource at the site level.

Water stresses documented for Georgia that are important indicators of future trends or potential issues within the boundaries of the National Forests include:

Growth in North Georgia:. The northern portion of the state must meet the water supply needs of a rapidly growing population in an area with relatively low stream flow rates and limited groundwater reserves. Also this growth has increased the amount of treated wastewater released into waterways, along with an increasing amount of non-point source pollution related to development.

Interstate conflicts among the States of Georgia, Alabama, and Florida over water management in the Coosa, Tallapoosa, Flint and Chattahoochee River Basins: These states have been in negotiation for several years over the water quantity and quality management of the Alabama-Coosa-Tallapoosa and Apalachicola-Chattahoochee-Flint river basins. These basins comprise 38 percent of Georgia's total land area; provide domestic water supplies to over 60 percent of Georgia's population; and supply water for more than 35 percent of Georgia's irrigated agriculture industry.

Droughts of 1998-2002: This period of extended drought has caused profound negative impacts on agricultural and municipal water systems. During the summer of 2000, twenty-three cities and five counties in north Georgia faced critical water supply shortages. The Secretary of the U.S. Department of Agriculture declared all 159 counties of Georgia as federal disaster areas due to drought conditions.

Loss of healthy aquatic habitat and reduction in water quality due to land developments: Land development impacts include increased wastewater discharges and runoff from non-point pollution sources. Determination of total maximum daily load (TMDLs) of pollutants and new water management practices will be required to sustain water quality and protect aquatic habitat.

Old water and wastewater infrastructure in many communities: Leaking or overflowing sewer lines and inadequate wastewater treatment facilities can cause water quality problems.
(State of Georgia, 2001)

Affected Environment

An estimated 44,056 miles of perennial rivers and streams and 23,906 miles of intermittent streams occur within the fourteen (14) major river basins of the state of Georgia. (Georgia DNR, 1997) The State has a total surface area of 59,441 square miles, or 37,702,100 acres. Approximately 2,763 miles of perennial streams occur on the Chattahoochee National Forest, all classified as cold water streams. The Oconee National Forest has about 393 miles of perennial streams, classified as warm water. The miles of perennial streams, combined with an additional 10,800 miles of non-perennial streams, makes ensuring water quality a critical task for the Forest Service.

The National Forest System lands of the Chattahoochee-Oconee National Forests occur within six of the fourteen major river basins of Georgia. Collectively these six basins drain 31,159 square miles or 52 percent of the state's land area. Watersheds are the natural hydrologic boundaries for surface-water runoff. Since they are definable features on the landscape, they are broadly used as spatial boundaries for investigations of surface-water resources (Maxwell, et. al. 1995). Watersheds throughout the United States have been defined by the United States Department of Interior Geological Survey (USGS) and are used by the U.S. Water Resources Council and other agencies for comprehensive planning and investigations. Larger watersheds contain smaller watersheds nested within the larger area. Smaller watersheds can, in turn, be subdivided into progressively smaller areas. Normally, five to fifteen smaller watersheds are nested into a larger watershed. The USGS maintains a standardized system of boundaries of watersheds throughout the United States. This system, using maps, names and codes, is currently in use by multiple agencies to organize and catalog hydrologic data and related resource information for hydrologic units at specific scales or sizes. A hydrologic unit code (HUC), consisting of two digits for each level in the hierarchical unit system, is used to identify any hydrologic area of interest (USGS, 1987). Table 3-10 gives examples of these levels.

Table 3- 10. Hydrologic Unit Code Levels as Defined by the U.S. Geologic Survey

Level (HUC)	Subdivision Name	Description of Watershed
1 (1st)	Region	Major Geographic Areas or Regions (i.e. South Atlantic Gulf Region
2 (2nd)	Subregions	Area drained by a river system and its tributaries in that reach, or a closed basin (i.e. Middle Tennessee-Hiwassee)
3 (3rd)	Accounting Units	Further divides larger river systems (i.e. Savannah, Coosa-Tallapoosa)
4 (4th)	Cataloging Units	Part or all of a surface drainage basin, a combination of drainage basins, or a distinct hydrologic feature (i.e. Broad, Conasauga, Upper Chattahoochee
5 (5th)		Large Watershed Delineation (i.e. Etowah River, Upper Conasauga)

Source: USDI Geological Survey, 1987.

The Chattahoochee-Oconee National Forests lies within two Hydrologic Regions (1st Level HUC):

South Atlantic-Gulf
Tennessee

Water in the South Atlantic-Gulf ultimately flows into the Atlantic Ocean within and between the states of Virginia and Florida, or the Gulf of Mexico within and between the states of Florida and Louisiana. Water from the Tennessee Region flows into the Tennessee River to the Ohio River, then into the Mississippi River and ultimately into the Gulf of Mexico.

There are six subregions, six accounting regions, and thirteen cataloging units with National Forest lands in Georgia. A cataloging level unit is also referred to as a 4th level HUC for its 8 digit identifying code. These units have been further subdivided and mapped at the next lower level, identified as 5th level HUCs. For the Forest, Plan these 5th level HUCs are also being designated as Watershed Management Areas. Forty-three 5th level HUCs have been mapped on the Chattahoochee-Oconee. Thirty-two 5th level HUC/watershed management areas occur on the Chattahoochee ranging in size from 28,477 acres to 178,704 acres. The remaining eleven HUCs are found on the Oconee, ranging in size from 50,559 to 139,815 acres. Table 3- 11 lists the Hydrologic Units to the fourth level.

Table 3- 11. Fourth Level Hydrologic Units of the Chattahoochee-Oconee National Forests

South Atlantic–Gulf Region	Ranger District
Ogeechee-Savannah Subregion	
Savannah River Basin	
Tugaloo Subbasin	Tallulah
Broad Subbasin	Chattooga
Altamaha Subregion	
Altamaha River Basin	
Upper Oconee Subbasin	Oconee
Upper Ocmulgee Subbasin	Oconee
Apalachicola Subregion	
Apalachicola River Basin	
Upper Chattahoochee Subbasin	Chattooga
Alabama Subregion	
Coosa-Tallapoosa River Basin	
Conasauga Subbasin	Cohutta
Coosawattee Subbasin	Cohutta
Oostanula Subbasin	Armuchee
Etowah Subbasin	Toccoa
Upper Coosa Subbasin	Armuchee
Tennessee Region	**Ranger District**
Upper Tennessee Subregion	
Upper Tennessee River Basin	
Upper Little Tennessee Subbasin	Tallulah
Middle Tennessee–Hiwassee Subregion	
Middle Tennessee–Hiwassee River Basin	
Middle Tennessee–Chickamauga Subbasin	Armuchee
Hiwassee Subbasin	Brasstown
Ocoee Subbasin	Toccoa

Source: USDI Geological Survey, 1987.

Figure 3-1 displays the location of the Chattahoochee NF and the Oconee NF, with the boundaries of the fifth level HUCs or watersheds in the state of Georgia. Table 3-12 lists the 5^{th} level HUCs/WMAs with the percent public and private ownership. The National Forest acres in each 5^{th} level HUC can be found in the Forest Plan, chapter 4, Watershed Management Areas. Corresponding with Table 3- 12, Figure 3 - 2 through Figure 3 - 5 display the relationship of HUCs to National Forest ownership.

Table 3- 12. Fifth Level HUCS/Watershed Management Areas

Forest	Name	5th Level HUC No.	% FS Land	% Private Land
Chattahoochee	Chattooga River, North and West Forks	0306010201	70	30
	Tallulah River	0306010207	60	40
	Tugaloo River-Panther Creek	0306010206	36	64
	Broad River-North and Middle Forks	0306010401	12	88
	Chattahoochee River-Chickamauga Creek	0313000101	40	60
	Soque River	0313000102	17	83
	Chestatee River-Dicks Creek	0313000105	32	68
	Chestatee River-Yahoola Creek	0313000106	19	81
	Conasauga River-Upper	0315010101	53	47
	Conasauga River-Middle	0315010102	20	80
	Coahulla Creek	0315010103	2	98
	Holly Creek	0315010104	27	73
	Conasauga River-Lower	0315010105	7	93
	Cartecay River	0315010201	18	82
	Ellijay River	0315010202	22	78
	Mountaintown Creek	0315010203	29	71
	Coosawattee River-Carters Lake	0315010204	2	98
	Oostanaula River - Upper	0315010301	11	89
	Johns Creek	0315010303	38	62
	Little Armuchee Creek	0315010304	15	85
	Armuchee Creek	0315010305	24	76
	Etowah River-Upper	0315010401	23	77
	Amicalola Creek	0315010402	7	93
	Chattooga River-Upper	0315010504	1	99
	Chattooga River-Lower	0315010505	3	97
	Little Tennessee River	0601020201	39	61
	Little Chickamauga Creek-East Chickamauga Creek	0602000109	4	96
	Hiawassee River-Chatuge Lake	0602000201	51	49
	Brasstown Creek	0602000204	19	81
	Nottely River-Nottely Lake	0602000208	36	64
	Toccoa River-Upper	0602000301	69	31
	Toccoa River-Middle	0602000302	18	82
Oconee	Oconee River-Big Creek	0307010106	5	95
	Oconee River-Greenbriar Creek	0307010107	21	79
	Appalachee River-Lower	0307010109	5	95
	Richland Creek	0307010111	1	99
	Oconee River-Sugar Creek	0307010110	<1	99
	Little River-Upper	0307010114	1	99
	Little River-Lower	0307010115	28	72
	Murder Creek	0307010116	11	89
	Big Cedar Creek	0307010117	16	84
	Ocmulgee River-Big Sandy Creek	0307010310	12	88
	Ocmulgee River-Rum Creek	0307010313	12	88

Source: USDI Geological Survey, 1987.

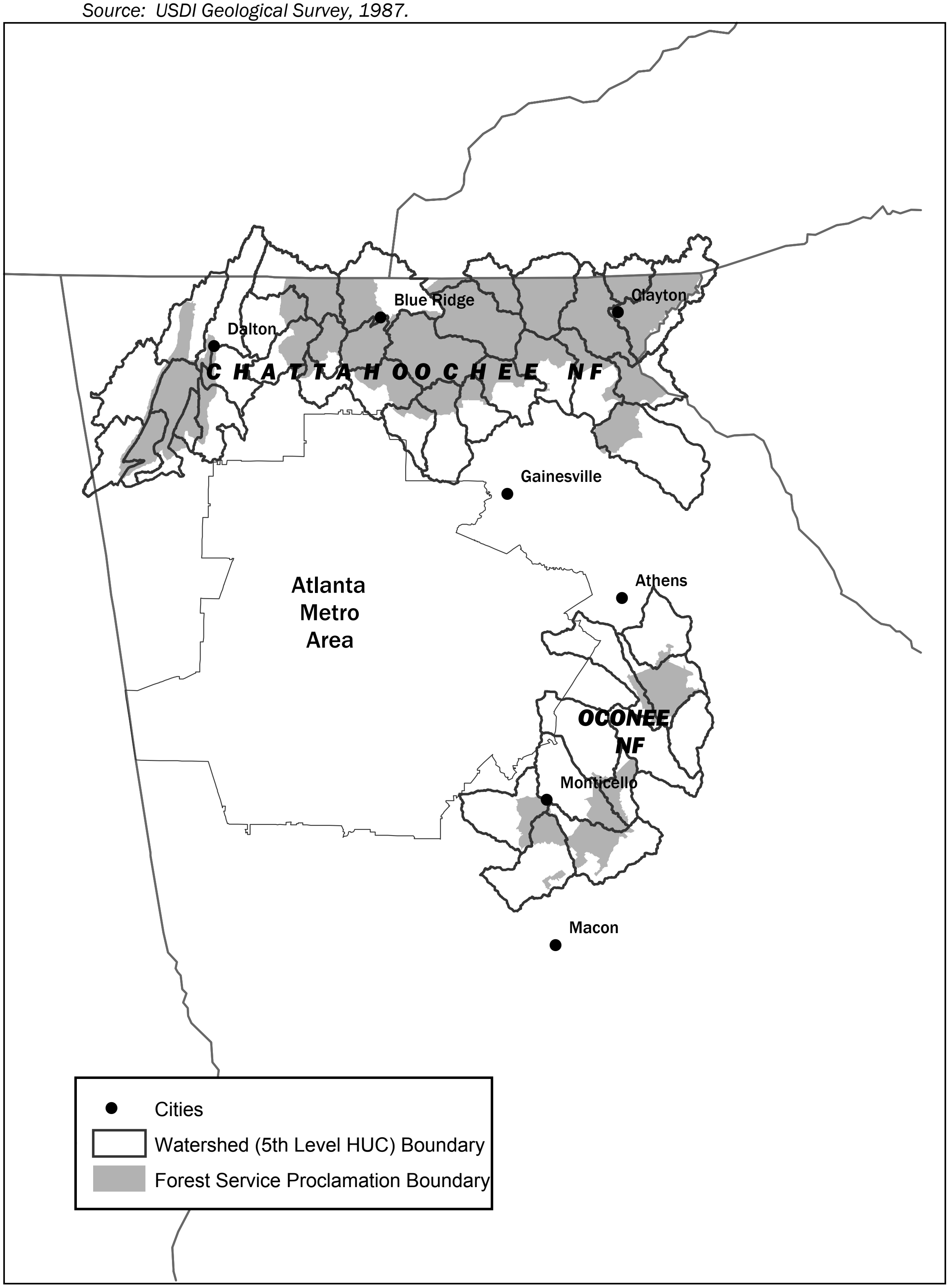


Figure 3 - 1. Location of HUCs and National Forests in North Georgia

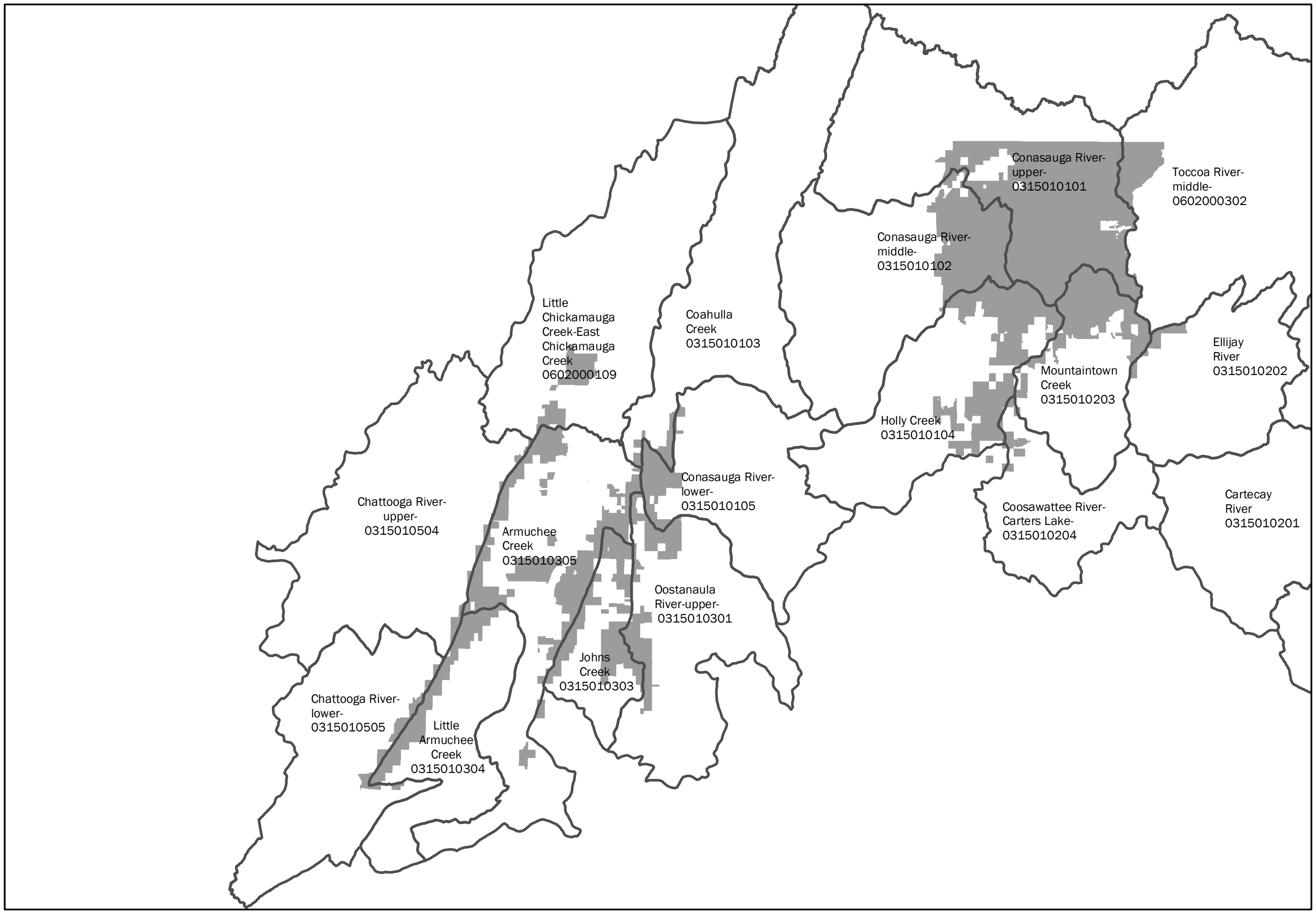


Figure 3 - 2. Westside Watershed Management Areas with Chattahoochee National Forest Ownership

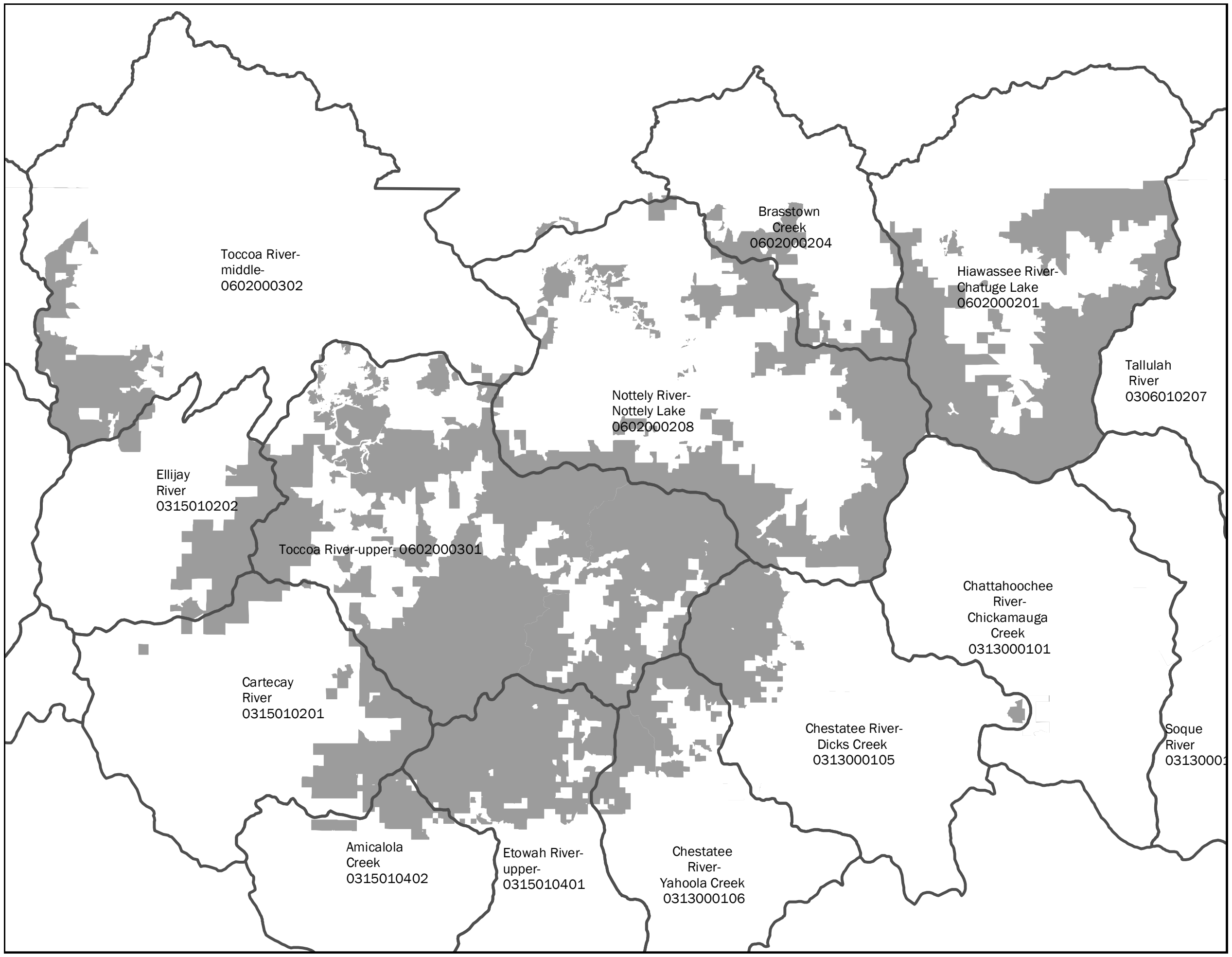


Figure 3 - 3. Central Watershed Management with Chattahoochee National Forest Ownership

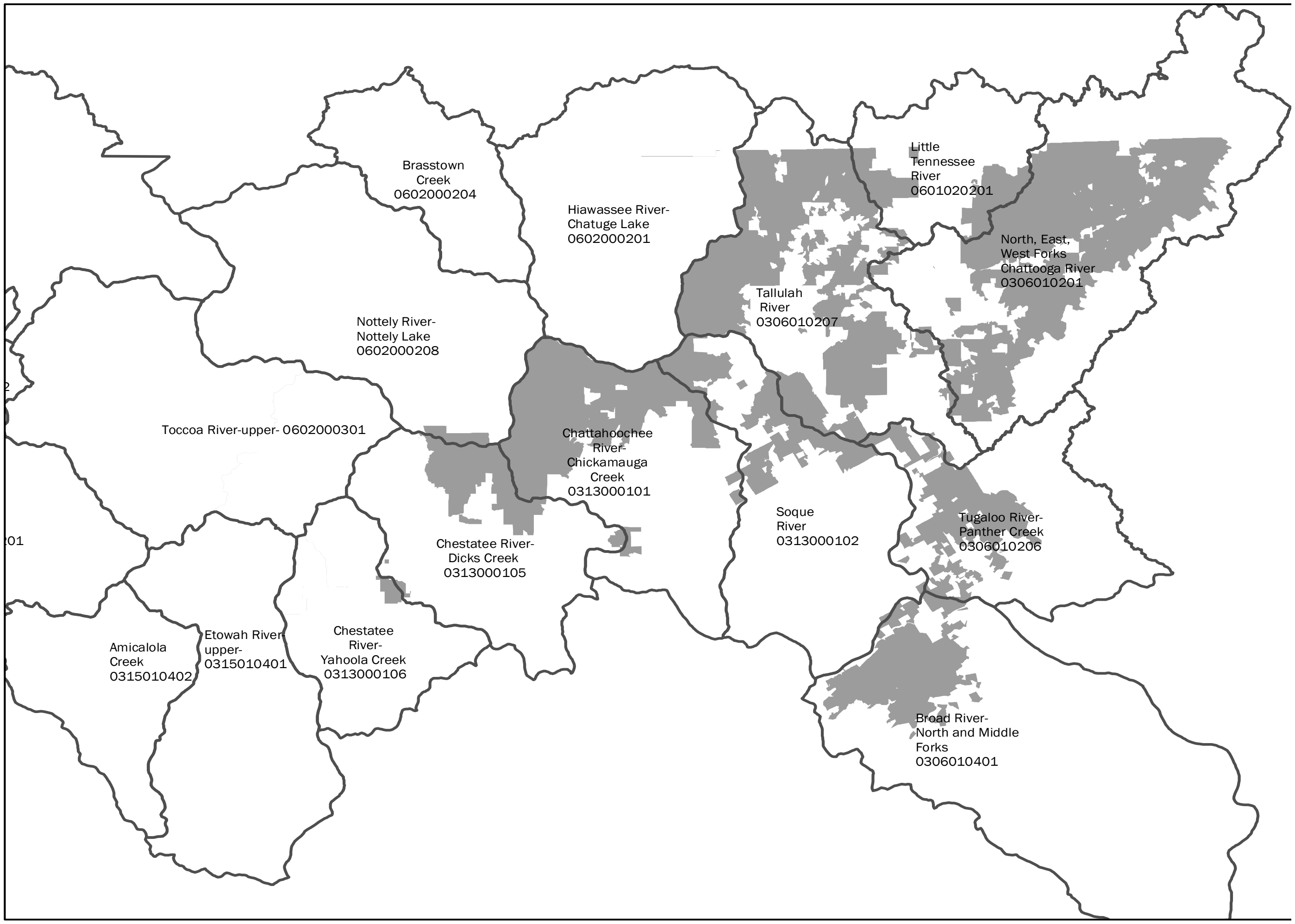


Figure 3 - 4. Eastside Watershed Management Areas with Chattahoochee National Forest Ownership

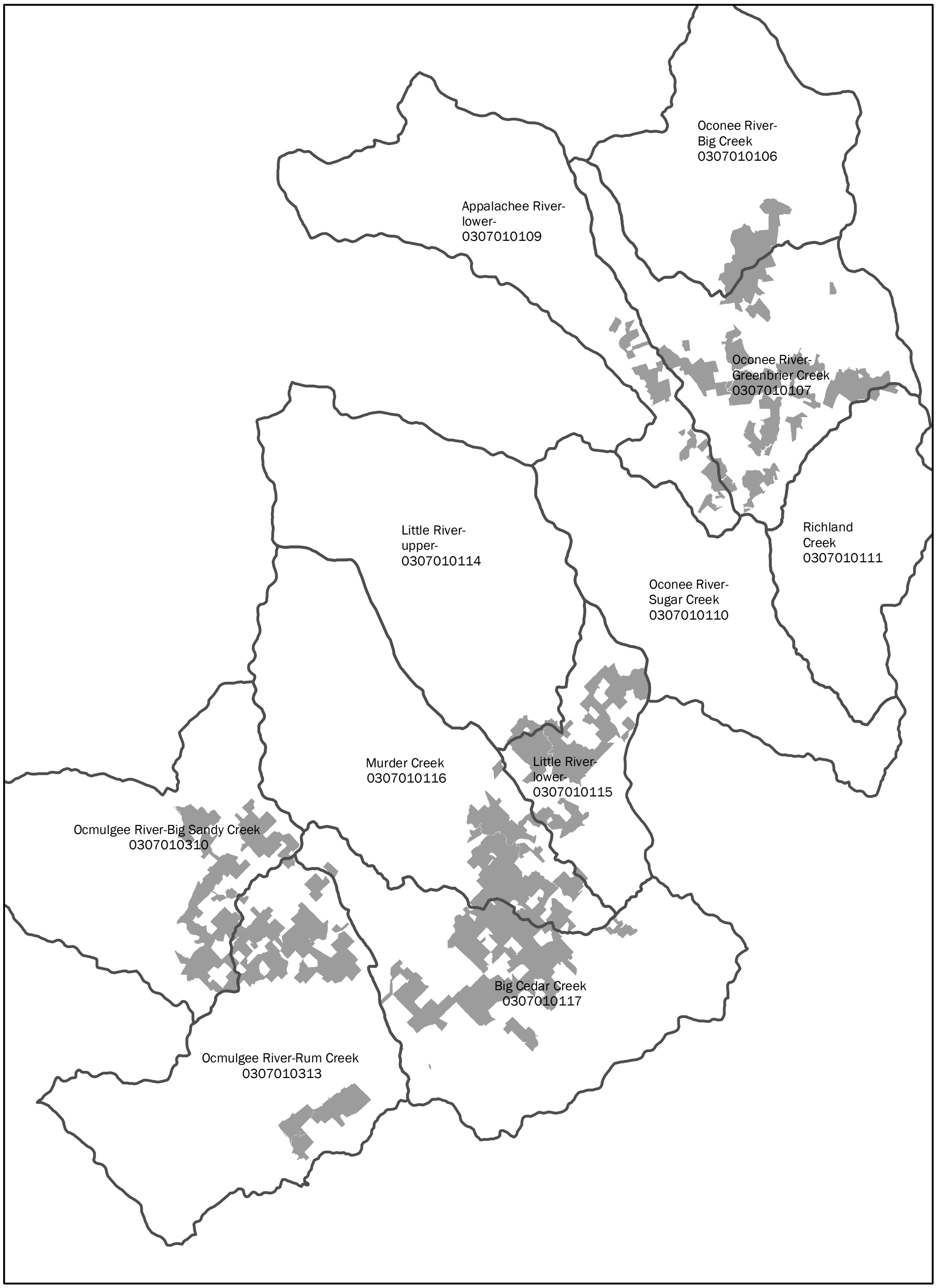


Figure 3 - 5. Oconee Watershed Management Areas with National Forest Ownership

Water Quantity/Yield

A statewide average annual precipitation of 50 inches ranks Georgia sixth among the contiguous 48 states in annual precipitation. However, occasional droughts serve as a reminder of the limitations of water resources and the priority to maintain acceptable stream water quality (USGS, 1992). The Chattahoochee has an average annual rainfall range of 55 inches (in the Ridge and Valley Section) to 80 inches (Blue Ridge Mountains Section, near the point where North Carolina, South Carolina, and Georgia meet). Oconee NF has an average annual rainfall of about 50 inches (Southern Appalachian Piedmont Section).

Together the two forests are estimated to yield an average water runoff of 2,296,000 acre-feet of water per year from their 865,043 acres. This is approximately 2.7 acre-feet of water from each acre of national forest land. Runoff fluctuates by season and yearly conditions.

On the forests, this water in-stream sustains plant and animal life in many different habitats. Water is also used by humans in their recreational activities, such as fishing, swimming, canoeing, rafting, and hiking, or simply viewing waterfalls and streams. Off-stream uses of water on the National Forests include fish hatcheries, self-served domestic water supplies, and two municipal water supplies.

Watersheds that begin in the mountains of the Chattahoochee NF have high-velocity flows, which leave the forest to provide water supplies through both on-stream and off-stream withdrawals for a variety of uses. Surface water was withdrawn from Georgia's streams, rivers, and reservoirs at a rate of 890 million gallons per day (Mgal/day) in 1995 (USGS, 1996). This represented 77 percent of the water withdrawn in the state, with groundwater withdrawal accounting for the remainder. Thermoelectric power generation accounted for 3,280 Mgal/day of the total withdrawal amount. Public water was second (629 Mgal/day) with self-supplied industrial, mining, and agricultural activities, and self-supplied domestic and commercial use following in order of withdrawal. Surface water use is greatest in the northern part of the state, where urban areas and industry rely almost entirely on surface water supplies. Downstream uses in-stream include hydroelectric power generation and dilution of municipal and industrial treated wastewater discharge. Off-stream uses downstream include municipal and industrial water supply, commercial water supply, and cooling for power generation.

Almost 71 percent of the state's population of 6 million residents in 1995 relied on surface water for supply. Water usage on National Forest System lands in the South ranges from 1,700 gallons per day in Alabama to 1,315,000 gallons per day in Virginia. The Chattahoochee NF uses approximately 81,000 gallons per day, and North Carolina uses 172,000 gallons per day (USDA, 1996)

Water Quality

The quality of the water found throughout the Forests has been monitored by a variety of agencies and organizations for a number of years. The Georgia Environmental Protection Division (EPD) has conducted an extensive analysis of surface water quality throughout the State of Georgia in association with Section 303(d) of the Clean Water Act. This section of the Act requires all states to assess surface water within their borders to determine if designated beneficial uses of the water bodies are being met. If it is determined that the quality of the waters is not sufficient to meet designated beneficial uses, then the states are required to develop Total Maximum Daily Loads (TMDLs) to improve and protect the quality of the water to support designated uses. The GA TMDL lawsuit (Consent Decree signed in 1996) has also resulted in additional assessment across the State. The first assessment of forestry and forestry-related activities as a result of this lawsuit occurred in the Chattooga River Watershed (0306010201). This assessment resulted in some of the first sediment impaired stream listings in the State. These sediment-related impaired streams for the Chattooga River Watershed are listed in Table 3- 13. Many pollutants are monitored throughout the state, including chemical, physical or biological parameters. Sediment-related listings of not supporting or partially supporting stream segments are listed below because sediment is the primary pollutant resulting from land disturbing activities on NF lands. Sediment-related impairment includes streams listed with any of the following pollutants: sediment, habitat or biota listings.

Another group of watersheds near the Oconee NF have been assessed for sediment-related impairment using an Index of Biological Integrity (IBI) based on fish species. This resulted in a group of streams listed for biological impairment. Most of these streams are in the following HUCs: Ocmulgee River-Big Sandy Creek (0307010310) and Ocmulgee River–Rum Creek (0307010313). The Georgia EPD is completing TMDL analyses for these streams as they complete their River Basin Management Plans. The Ocmulgee River Basin Management Plan is scheduled to be available in 2003. The Georgia EPD and the U.S. EPA continue to work under the GA TMDL consent decree and associated timelines monitored by the court. Assessment methods, TMDL analysis models, and overall TMDL implementation guidance for Georgia are frequently modified or adjusted. The Forest Service continues to coordinate with GA EPD, U.S. EPA, GA Forestry Commission and other agencies to address TMDL issues for the Forest. The State of Georgia has concluded the majority of the streams within the Forest are meeting minimum requirements to support designated beneficial uses; however, several within and adjacent to the Forest have been determined as not supporting or partially supporting designated uses (GA DNR, 2002). These are listed in the following table:

Table 3- 13. Sediment Impaired Stream Segments Within Forest Plan Revision 5th Level HUCs, With Their Stream Mileage On NF Land

Stream Name	5th Level HUC Number	Sediment Impaired Segment	Miles on NF	% of NF Miles Within Each HUC
Chattahoochee National Forest				
Chattooga River - North and West Forks	0306010201	Chechero Creek	0	0
		Law Ground Creek	2.2	0.85
		Pool Creek	0.1	0.06
		Roach Mill Creek	1.2	0.49
		Saddle Gap Creek	0.4	0.14
		Scott Creek	0.7	0.28
		She Creek	0	0
		Stekoa Creek	2.5	0.97
		Warwoman Creek	1.2	0.48
Tugaloo River-Panther Creek	0306010206	Toccoa Creek	1.0	1.03
Broad River-North and Middle Forks	0306010401	Broad River	0	0
		Lower North Fork – Broad River	0	0
		Middle Fork – Broad River	9.0	2.17
		North Fork – Broad River	0	0
Soque River	0313000102	Hazel Creek	0	0
Oostanaula River – Upper	0315010301	Oothklooga Creek	0	0
Little Chickamauga Creek-East Chickamauga Creek	0602000109	Dry Creek	0	0
Hiawassee River-Chatuge Lake	0602000201	Bearmeat Creek	0.6	0.35
Nottely River-Nottely Lake	0602000208	Butternut Creek	0	0
		Lower Youngcane Creek	0	0
Toccoa River-Middle	0602000302	Weaver Creek	0	0

Table continued next page.

Stream Name	5th Level HUC Number	Sediment Impaired Segment	Miles on NF	% of NF Miles Within Each HUC
Oconee National Forest				
Little River-Upper	0307010114	Little River	0.8	23.61
Little River-Lower	0307010115	Little River	2.1	5.14
Ocmulgee River-Big Sandy Creek	0307010310	Big Sandy Creek	0	0
		Harmon Pye Branch	1.2	2.19
		Herds Creek	0	0
		Long Branch	1.4	2.44
		Rocky Creek	0	0
		Town Branch	0	0
		Wise Creek	3.8	6.79
Ocmulgee River-Rum Creek	0307010313	Gladesville Creek	3.5	5.51
		Little Dear Creek	0	0
		Rum Creek	0	0
		Scoggins Creek	0	0

Source: Spatial data sets representing the 2002 GA 305b Report and supplemental listings by U.S. EPA.

Percent impaired streams were calculated using spatial data from other agencies (for impaired streams) and using USFS 1:24,000 base stream layer or spatial data set. The final column represents percent of streams on NF land in each HUC that are impaired with a sediment-related listing on the GA 303d report or a sediment-related listing contained in the EPA supplemental data set. These are not supporting or partially supporting stream segments with listings due to “sediment, habitat, or biota” pollutants of concern. There are stream segments listed in these 5th level HUCs due to other pollutants of concern, but sediment is the primary pollutant resulting from FS land management activities. A complete list of all impaired streams can be obtained from the GA Department of Natural Resources, Environmental Protection Division and the U.S. Environmental Protection Agency.

Departures in Water Quality

The quality of water flowing in streams on the Forests has been impacted by a variety of means. On the Chattahoochee, roads, trails, recreation uses, and logging have probably had the greatest impact on water quality. The ownership pattern of the Oconee National Forest lands downstream of private land uses, adds the impacts of agriculture, industrial and urban development as stressors to water quality.

Public Drinking Water Supply on the Chattahoochee-Oconee

A public supply watershed is defined as the area where rainfall runoff drains into a river, stream or reservoir and is used as a source of public drinking water supply.

Withdrawal typically occurs directly from a stream, river or storage reservoir. Most of the 185 surface source drinking water intakes in the State of Georgia are located above the Fall Line in the northern half of the state, with supplies in south Georgia mainly from ground water or aquifer sources.

In 1995, public water supply ranked second in volume of water withdrawal in Georgia at 1153 million gallons per day, a 307 percent increase over the volume in 1960 (USGS, 1998). All public water supply systems in Georgia operate under permits regulated by the Georgia Department of Natural Resources, Environmental Protection Division. Regulations address the volume of water permitted for withdrawal, water quality standards, and the delivery to customers.

Laws and Regulations on Drinking Water

The Federal law most directly designed to protect both surface and ground water used for drinking water purposes is the Safe Drinking Water Act (SDWA), enacted by Congress on December 16, 1974 to protect public drinking water systems in the United States from harmful contaminants. The Safe Drinking Water Act directed the US Environmental Protection Agency (USEPA) to develop national primary drinking water regulations. The Act was amended in 1986 to set drinking water regulations for contaminants and guidance for treatment and delivery systems. In 1996, Congress amended the SDWA again to place greater emphasis on protecting surface and ground water sources used for drinking water supply. One such requirement is the development of source water assessments. The assessments are a three-part effort:

- Delineation of the land area that contributes the raw water used for drinking water which becomes the source water assessment and protection area;
- Inventory of potential contamination sources to drinking water supplies; and
- Provide an understanding of the susceptibility of the public water supply to those identified potential contaminant sources.

Source water assessments for forest watersheds are not likely to be fundamentally different from those in areas with other land uses. Scientific information will need to be applied locally on a case-by-case basis to consider what natural and human activities have a reasonable potential to introduce contaminants that are likely to reach a drinking water intake. (Dissmeyer et. al. 2000). The purpose of the source water assessments is to help those who provide drinking water the means to identify potential threats to their source(s) of water so protective measures can be taken. The Georgia Environmental Protection Division (EPD) approves source water assessments of the watersheds that drain to intakes or reservoirs, with results made available to the public. Status of public source water assessments may be reviewed by visiting the EPD website at http://www.ganet.org/dnr/environ/.

Potential contaminant sources are in two categories:

- point (from an identifiable location) such as airports, fuel facilities, wastewater treatment facilities, landfills, and electric substations

- non-point (diffuse sources, location not readily identifiable) such as stream crossings by roads, railroads, or utilities, and impervious surfaces such as parking lots, buildings, roads and streets.

Impervious surface area is identified as a potential pollution source because these areas do not allow water to infiltrate into the ground, but accelerate the runoff, along with any contaminants contained in the water. Areas classified higher than 20 percent of total area in impervious surfaces are rated as high for potential pollution. Watersheds in the state with significant urban land use typically have high percentages of impervious surface, thus rating high for pollution potential. As an example, the Chattahoochee River water supply watershed serving the Cobb County – Marietta Water Authority has 18.9 percent impervious surface area, along with 591 sewer lines crossing the streams above the intake, and a total of 898 identified potential source facilities.

Contaminants move into the public water supply watershed from releases or spills into receiving streams, or through overland storm-water runoff during and following storm events. Control of point source pollutants is primarily at the source by controlling outlets and releases. More challenging is the control of non-point sources of contaminants as the source is not often readily identifiable. The technique most often applied is to provide buffers of streams to serve as filters between potential sources and the stream system.

Current Georgia environmental planning direction identifies the following delineation criteria of public supply watersheds:

A) <u>Large water supply watershed</u> – has 100 square miles (64,000 acres), or more, of land within the drainage basin upstream of a governmentally-owned public drinking water supply intake. Assessments will be done within a 100-foot buffer zone within a 7-mile radius of all water supply reservoirs or intakes upstream of public water intakes.

   Corridors of all perennial streams within a large water supply watershed that contribute to a water supply reservoir within a seven mile radius of the reservoir boundary or intake are protected by (a) a buffer for a distance of 100 feet on both sides of the stream, (b) no impervious surface shall be constructed within a 150 foot setback on both sides of the stream, and (c) septic tanks and septic tank drain fields are prohibited in the 150 foot setback.

B) <u>Small water supply watershed</u> – has less than 100 square miles of land within the drainage basin upstream of a governmentally-owned public drinking water supply intake. In addition to the requirements above, assessments will be done within 50-foot buffers and 75- foot setbacks for water supply intakes or reservoirs.

   The perennial stream corridors of a small water supply watershed within a seven mile radius upstream of a governmentally-owned public drinking water supply intake or water supply reservoir are protected by: (a) A buffer shall be maintained of a distance of 100 feet on both sides of the stream, (b) No impervious surface shall be constructed within a 150 foot setback area on both sides of the stream, and (c) Septic tanks and septic tank drain fields are prohibited in the 150 foot setback.

Forestry activities have been identified for exemptions by local governments from the stream corridor setback provisions, if activities are consistent with the Best Management Practices for Forestry and the activity will not impair the quality of the drinking water stream.

Public Water Systems in the Forest Planning Area

Sixteen public water supply systems occur within the Forest planning area of the Chattahoochee-Oconee National Forests in Georgia. These community systems serve small cities, towns, and other public facilities. Table 3- 14 identifies the community public water supplies by name, watershed management area, and intake stream location and permitted daily withdrawal. Two of the systems have intakes or reservoirs located on National Forest system lands under special use permits. A third system has a small watershed with tributary streams within the headwaters on National Forest. These three systems have been allocated to management prescription 9.A.1 to recognize their function as public water supply source areas. The remaining thirteen public water supply systems occur within the Forest planning area, however the withdrawal intakes or reservoirs are not located on National Forest. The source intakes and reservoirs are located downstream, with intakes typically on larger perennial streams or reservoirs that have smaller tributaries extending back upstream into the National Forests. The Chattahoochee-Oconee plans to participate in the source water assessment process for these systems as they are developed.

Allocation to Management Prescriptions

Management Prescription 9.A.1 (Source Water Protection Watersheds) was developed by the Southern Appalachian National Forests planning process to identify portions of the national forests contributing directly to public drinking water supply watersheds. These areas identify systems with withdrawal intakes from surface sources under special use permit. These are Camp Frank D. Merrill on the Etowah River in Lumpkin County and the Davidson Creek reservoir serving the city of Toccoa in Stephens County. A third system, Yahoola Creek Reservoir, located near Dahlonega in Lumpkin County is in 9.A.1. This 150-acre reservoir, filled in 2003, has a small watershed (36 square miles) with about 4600 acres in the headwaters of Yahoola Creek on National Forest, or about one-fifth of the public supply watershed.

Table 3- 14. Community Water Systems with Intakes within the Chattahoochee-Oconee National Forest Planning Area

Community Public Water System[1]	Management Area Watershed	Withdrawal Stream/Reservoir	Permitted Withdrawal (MGD)[2]
City of Blairsville	Nottely River-Nottely Lake	Nottely River	1.0
City of Blue Ridge	Toccoa River – Upper	Lake Blue Ridge	1.1
City of Chatsworth	Holly Creek	Holly Creek	1.1
City of Clarkesville	Soque River	Soque River	1.5
City of Clayton	Tallulah River	Lake Rabun	1.0
City of Cleveland	Chestatee River-Dicks Creek	Turner Creek	2.5
City of Dahlonega	Chestatee River-Yahoola Creek	Yahoola Creek Reservoir	2.0
City of Eatonton	Little River-Upper	Little River	1.1
City of Helen	Chattahoochee River	Chattahoochee River	1.5
City of Ellijay	Ellijay River	Ellijay River	3.5
City of Greensboro	Oconee River-Greenbrier Creek	Lake Oconee	1.5
City of Hiawassee	Hiawassee River-Chatuge Lake	Lake Chatuge	2.0
City of McCaysville	Toccoa River-Middle	Toccoa River	1.0
Camp Frank D. Merrill[3]	Etowah River-Upper	Etowah River	0.5
City of Toccoa[3]	Tugalo River-Panther Creek	Davidson Creek Reservoir, Cedar Creek/Toccoa Reservoir	7.0
Unicoi State Park	Chattahoochee River-Chickamauga Creek	Smith Creek/Lake Unicoi	0.5

1 – Community Water System – public water systems that serve people year-round.
2 - MGD- million gallons per day
3 - Intake or Reservoir is located on National Forest land, under special use permit.
(Source – Georgia EPD, Forest data, 2003)

Impacts of Land Management on Public Water Supplies

The importance of safe public drinking water, as evidenced by Congressional amendments to the Safe Drinking Water Act in 1996, has received increased management emphasis from the EPA, state water quality agencies, and the Forest Service. As an agency, the Forest Service prepared Drinking Water from Forests and Grasslands: A Synthesis of the Scientific Literature, (Dissmeyer et al. 2000). This report provides a comprehensive reference for forest managers to plan, implement and react to public concerns related to source water assessments. The following material is based on this report.

> Water from forests and grasslands is usually cleaner than water from urban and agricultural areas. Nevertheless, some common practices on forests and grasslands can contaminate drinking water sources. Forests have long been relied upon as sources of clean drinking water for two reasons: (1) forests mainly grow under conditions that produce relatively reliable water runoff, and (2) properly managed forests can yield water relatively low in contaminants when compared with many urban and agricultural land uses. The Forest Service estimates that at least 3,400 towns and cities nationwide currently depend on National Forest System watersheds for their public water supplies. In addition, the national forests have over 3,000 public water supplies for campgrounds, administrative centers and similar facilities. Communities that draw source water from national forests provide a public water supply to 60 million plus people, or one-fourth of the people served by public water supplies nationwide. Since 70 percent of the forest area in the United States is outside of the National Forest System, the number of people served by all forests is far greater.
>
> Urbanization has been identified as a major factor in contaminating surface and ground water and modifying hydrologic processes. Urbanization replaces natural vegetation cover with impervious surfaces, decreasing natural infiltration of water, increasing peak flows, and decreasing ground water discharge. Increased peak flows can negatively affect drinking water quality by causing bank destabilization and streambed scouring, which increase turbidity and sedimentation. During the past 20 years, private tracts in and adjacent to public land have been developed rapidly for residential, commercial, and recreational use. This development poses a significant threat to drinking water quality through surface and ground water contamination. Development occurs near the headwaters of streams where water quality is generally the highest and is easily degraded because of stream size. Urban land, whether within city limits or situated among rural settings, is also a source of wastewater and other contaminants contained in runoff.
>
> Recreation uses of National Forests, both concentrated and dispersed, are increasing in demand as population increases and shifts around the country. Pollutants associated with concentrated uses are typically from campsites, service facilities, wastewater treatment, fuel residues and construction or maintenance runoff. These potential sources are often at the water's edge and in some areas lack adequate vegetation buffer to filter contaminants. Pollutants from dispersed uses are often near trails, stream crossings and off-travel ways. Visitors and their animals can contaminate water supplies by carrying and depositing feces containing microorganisms that cause human diseases. Contamination comes from fecal deposition and from direct contact with water during water related activities such as swimming. Similar effects occur from dispersed recreation uses, however, these sites typically are located and used with few controls of impacts. Dispersed recreation activities

that attract people to spend time near water bodies, but lack developed sanitary facilities, can introduce fecal organisms, presumably including pathogens, into surface waters. However, few studies have been done to determine thresholds above which dispersed use contaminate source water excessively.

In heavily used watersheds it is important to institute management of use levels to address contamination of water supplies. Reducing use levels, adding adequate toilet facilities, and providing visitor education in appropriate waste disposal are often needed to deal with contamination problems. Dispersed recreation activities that attract people to spend time near water bodies, but lack developed sanitary facilities, can introduce fecal organisms, presumably including pathogens, into surface waters. However, few studies have been done to determine thresholds above which dispersed use contaminate source water excessively. Many other potential effects of dispersed recreation on drinking water sources, such as risks associated with pets and off-road vehicles, are poorly understood and need further research.

Roads and other utility corridors pose risks of contamination because they concentrate many human activities. Roadside recreation facilities are often centers of dispersed recreation. Roads also support transport of materials, some of them toxic. Some materials may be spilled during accidents; the highest risk of water contamination is where roads cross-streams. Utility corridors present similar risks due to incidents such as pipeline failures or transformer fires that may spill hazardous materials. Road and corridor construction, maintenance, and use have been shown to contribute sediments to streams because they have elevated erosion rates and can increase the risk of landslides on unstable terrain. Proper engineering design, construction and maintenance of roads and utility corridors, as well as emergency preparedness can reduce but not entirely eliminate these risks to source waters.

Many researchers have studied the impacts on water quality from manipulating forest vegetation for purposes such as timber and fiber production, including growing trees, harvesting them, and reestablishing forest vegetation. The primary contaminant to source water from these activities is sediment associated with soil disturbance during harvesting and regeneration and erosion from roads. Most modern pesticides and herbicides that are currently used on forests are immobilized and degraded in soils to the extent that they pose little contamination risk to source water if required application precautions are followed.

Prescribed fire is normally conducted under conditions when fire severity is low, and impact on source water quality under these conditions also is low. Wildfires, however, can be severe. When they occur on steep or erodible terrain and are followed by intense rainfall, they can produce large sediment loads that pose problems for source waters.

Soil disturbing activities such as road construction and maintenance, forest harvesting, and intermixed urban and wildland uses can introduce sediment into drinking water sources. Disease organisms may enter source waters from: (1) recreation and other human activities that lack developed sanitary facilities, (2) malfunctioning sewage facilities, and (3) wild and domestic animals concentrated near source waters. Nutrients may enter source water from fertilizer and from atmospheric deposition of nitrogen compounds. Toxic chemicals may reach source waters from pest control; from extraction of minerals, oil and gas; from accidental chemical spills along highways and utility corridors; and from leaking underground storage tanks.

Mitigation of Impacts on Public Water Systems

Two primary objectives can be identified for managing National Forest watersheds that contribute to public water systems: (1) Maintain 60-75 percent or higher ground cover in plants and litter to maintain surface runoff at low levels and minimize soil loss, and (2) Reduce the movement of potential contaminants from National Forests into the stream system that eventually is withdrawn for public water supplies. This will be accomplished by implementing Forestwide standards that address water quality and mitigate direct impacts to public water systems. Prescription-specific standards will also provide implementation direction to maintain stream buffers along perennial and intermittent streams within the tributaries above public water systems. This direction will be in Management Prescription 9.A.1 (Source Water Protection Watersheds) and Management Prescription 11 (Riparian Corridor). Objectives in the plan to complete watershed assessments on the National Forests at the fifth and sixth level HUCs will be important to identify watershed conditions, potential contaminants, and cooperate with managers of public water systems in completing the mandated Source Water Assessments.

General Effects – Water Resources

Any activity that disturbs the stream channel or alters surrounding vegetation communities can affect the water resource. The most likely properties to be affected are stream channel morphology and surface water quality. These in turn can affect beneficial uses of water, such as fisheries and aquatic macroinvertebrates. Management effects can be categorized as direct, indirect or cumulative effects. Cumulative effects and associated analysis were completed on a watershed basis. Fifth level Hydrologic Unit Codes (HUCs) were used for analysis at the Forest scale. Fifth level HUC numbers and complete names are listed in Table 3- 15. Please refer to this list for future tables where only the HUC number is listed.

Table 3- 15. List of 5th Level Hydrologic Unit Codes (HUCs) and Names

HUC Number	5th Level HUC Name
0306010201	North, East, West Forks Chattooga River
0306010207	Tallulah River
0306010206	Tugaloo River-Panther Creek
0306010401	Broad River-North and Middle Forks
0307010106	Oconee River-Big Creek
0307010107	Oconee River-Greenbrier Creek
0307010109	Appalachee River-lower-
0307010111	Richland Creek
0307010110	Oconee River-Sugar Creek
0307010114	Little River-upper-
0307010115	Little River-lower-
0307010116	Murder Creek
0307010117	Big Cedar Creek
0307010310	Ocmulgee River-Big Sandy Creek
0307010313	Ocmulgee River-Rum Creek
0313000101	Chattahoochee River-Chickamauga Creek
0313000102	Soque River
0313000105	Chestatee River-Dicks Creek
0313000106	Chestatee River-Yahoola Creek
0315010101	Conasauga River-upper-
0315010102	Conasauga River-middle-
0315010103	Coahulla Creek
0315010104	Holly Creek
0315010105	Conasauga River-lower-
0315010201	Cartecay River
0315010202	Ellijay River
0315010203	Mountaintown Creek
0315010204	Coosawattee River-Carters Lake-
0315010301	Oostanaula River-upper-
0315010303	Johns Creek
0315010304	Little Armuchee Creek
0315010305	Armuchee Creek
0315010401	Etowah River-upper-
0315010402	Amicalola Creek
0315010504	Chattooga River-upper-
0315010505	Chattooga River-lower-
0601020201	Little Tennessee River
0602000109	Little Chickamauga Creek-East Chickamauga Creek
0602000201	Hiawassee River-Chatuge Lake
0602000204	Brasstown Creek
0602000208	Nottely River-Nottely Lake
0602000301	Toccoa River-upper-
0602000302	Toccoa River-middle-

Direct and Indirect Effects

Direct effects are those that occur at the same time and place as the *action (40 CFR 1508.8)*. Vegetation and wildlife management can have direct and indirect effects on the water resource. Vegetation removal through harvesting results in a corresponding decrease in evapotranspiration and reduced raindrop interception, which may result in measurable, increased water yield. Alternative F has the most potential to affect water yield, followed by alternatives B, D, A, I, E and G. Streamside vegetation removal may also result in increased water temperature. However, this effect is mitigated through the use of Best Management Practices (BMPs) and the riparian corridor management prescription.

Soil erosion is a direct effect from land management activities. Erosion can occur from management activities such as skid trail construction, log landings, and road construction or reconstruction. Recreation activity, including trail construction or maintenance, can result in soil erosion. Fire control lines (wildland and prescribed) also expose mineral soil.

Indirect effects are caused by an action and are later in time or farther removed in distance, but are still reasonably foreseeable *(40 CFR 1508.8)*. Indirect effects from typical land management activities include sedimentation, which can alter channel morphology, reduce aquatic habitats, and impair water quality. Increased water yield is an indirect effect of vegetation removal or harvest.

Environmental stressors have the ability to impair or threaten water quality and degrade watershed conditions. These stressors are defined as point and nonpoint sources of pollution. Point sources of pollution are sources from outflow points such as pipes. Point sources of pollution are generally located off the NF, and they are often associated with urban areas or development.

Nonpoint sources of pollution are diffuse in nature. They can generally be defined as the pollution caused by rainfall moving over and through the ground. As water moves over or through the soil, it picks up and carries away natural pollutants and pollutants resulting from human activities. Road sediment is the principal nonpoint source of pollution from forestry activities (Swift, 1988). Other sediment sources include recreation trails (OHV, horse, hiking etc.), skid trails, log landings, and constructed fire control lines.

Sediment is a natural pollutant that moves through aquatic systems. However, excessive sedimentation results in water body impairment. The State of Georgia lists impaired water body segments on a list according to section 303d of the Clean Water Act. This “303d list” or “list of impaired water bodies” has been supplemented by the U.S. Environmental Protection Agency for Georgia. A list of sediment-related impaired stream segments on NF can be found in Table 3- 13. This list is based on annual monitoring by State and Federal agencies. It will be updated as new data becomes available.

Sediment is the product of erosion, whether the erosion occurred as surface, gully, or mass soil erosion. Only a portion of the soil eroded is passed through and out of a watershed during a storm event. Most sediment is deposited at the base of slopes, in flood plains following high flows or flood events, and within river channels. (Brooks, et al.) Sedimentation is an indirect effect from ground or soil disturbing activities. It can also enter a watercourse directly through road/trail crossings and on-site disturbance. Table 3- 16 lists the modeled increases in sedimentation for period 1 (first decade) of all alternatives. These are predicted percent increases in sedimentation due to FS management activities, above the current land use/cover inputs. This model is more fully described in Cumulative Effects, but the FS activities modeled include harvest activities with temporary road construction and prescribed fire acres with miles of constructed fire lines. These values do not reflect mitigation measures, which will substantially reduce any sediment delivered to a water body. These results serve as a mathematical index, which should only be used to compare alternatives.

These results should be used to compare management alternatives. This approach utilizes the best available tools and information, and the numbers are subject to change in the future as better data or improved methods become available.

Table 3- 16. Percent Increase In Sedimentation (Modeled) Over Current Land Use/Cover For Each HUC And Period 1 Of Each Alternative, Without Mitigation Measures

Percent Increase in Sedimentation							
5th HUC	A1	B1	D1	E1	F1	G1	I1
0306010201	2.46	5.49	5.49	1.09	9.43	0.38	4.30
0306010207	6.13	11.37	9.95	2.44	15.50	0.66	6.90
0306010206	1.21	2.22	1.30	0.29	2.20	0.46	1.18
0306010401	0.28	0.18	0.28	0.08	0.33	0.09	0.20
0307010106	0.05	0.05	0.06	0.03	0.02	0.03	0.04
0307010107	0.53	0.39	1.47	0.26	0.26	0.19	0.28
0307010109	0.06	0.04	0.16	0.03	0.03	0.02	0.03
0307010111	0.00	0.00	0.01	0.00	0.00	0.00	0.00
0307010110	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0307010114	0.01	0.01	0.01	0.00	0.00	0.00	0.01
0307010115	0.37	0.38	0.38	0.22	0.26	0.17	0.28
0307010116	0.13	0.13	0.13	0.08	0.10	0.06	0.11
0307010117	0.31	0.32	0.33	0.19	0.23	0.14	0.25
0307010310	0.24	0.25	0.24	0.29	0.24	0.10	0.19
0307010313	0.25	0.26	0.26	0.17	0.29	0.11	0.19
0313000101	2.89	6.65	5.07	0.76	9.13	0.47	2.74
0313000102	1.07	1.79	1.47	0.23	2.46	0.12	0.96
0313000105	2.47	4.87	3.71	0.54	6.04	0.28	2.02
0313000106	1.13	2.17	1.62	0.27	3.15	0.15	1.32
0315010101	3.43	6.99	6.17	1.37	10.11	0.61	4.33
0315010102	3.31	3.31	3.17	2.60	4.26	0.28	2.32

Percent Increase in Sedimentation							
5th HUC	A1	B1	D1	E1	F1	G1	I1
0315010103	0.01	0.09	0.20	0.01	0.28	0.04	0.04
0315010104	2.85	3.39	3.41	1.22	4.48	0.62	2.44
0315010105	0.15	0.44	0.32	0.04	1.53	0.16	0.43
0315010201	1.05	2.14	1.89	0.29	3.06	0.16	1.41
0315010202	0.98	2.49	2.13	0.34	2.73	0.18	1.07
0315010203	2.73	4.80	3.99	1.12	6.43	1.08	4.02
0315010204	0.31	0.33	0.34	0.03	0.43	0.15	0.24
0315010301	0.73	1.00	0.87	0.07	1.62	0.16	0.81
0315010303	3.68	7.13	6.15	0.39	10.35	1.24	3.06
0315010304	1.35	1.81	1.19	2.90	2.19	0.28	1.35
0315010305	1.34	2.13	2.28	1.55	2.72	0.36	1.03
0315010401	2.37	4.59	3.96	0.60	6.12	0.33	3.27
0315010402	0.58	1.05	0.81	0.18	1.40	0.10	0.68
0315010504	0.03	0.04	0.11	0.07	0.32	0.01	0.02
0315010505	0.05	0.07	0.17	0.06	0.57	0.01	0.06
0601020201	0.86	1.55	1.54	0.21	2.53	0.10	1.37
0602000109	0.36	0.11	0.19	0.38	0.42	0.02	0.10
0602000201	3.26	5.42	5.09	0.67	8.41	0.39	2.71
0602000204	1.67	2.42	2.28	0.28	3.28	0.14	0.93
0602000208	2.26	3.75	3.47	0.50	5.36	0.26	2.32
0602000301	7.54	16.56	13.50	1.99	20.49	1.03	9.36
0602000302	0.30	0.52	0.50	0.08	0.71	0.03	0.40

Source: Cumulative effects model outputs December, 2002 for Alternatives A thru G; and September, 2003 for Alt. I.

These data are further summarized in Table 3- 17.

Table 3- 17. Average Percent Increase in Sedimentation Due to Planned FS Activities in Period 1 Across All 43 Watersheds, without Mitigation Measures.

Alternative	Average Increase	Rank of Alternatives*
A	1.4	5
B	2.5	2
D	2.2	3
E	0.6	6
F	3.5	1
G	0.3	7
I	1.5	4

*Rank 1 = highest average increase

Source: Cumulative effects model outputs December, 2002 for Alternatives A thru G; and September, 2003 for Alt I.

Few new roads are expected to be constructed in the future for all alternatives. The use of temporary roads is expected to continue in all alternatives. Temporary roads are authorized by contract, permit or lease. They are not necessary for long-term resource management and are not intended to be part of the forest transportation system. Effects from temporary roads used for timber harvest are short in duration and minimized through use of best management practices. Permanent roads (system roads) continue to be improved across the Forest as funding permits. Most new, permanent road construction will be for recreation purposes. The condition of the existing road system varies widely across the Forest. Relocating road segments to minimize soil-water effects and road reconstruction are expected activities. The level of road treatment activity does not vary greatly by alternative. Table 3- 18, below, lists the expected annual harvest by alternative. Most future temporary road construction would correspond with timber harvests. Existing roads are also used for timber harvests, and they are often treated to improve their condition. This data indicates that more roads would receive treatment or temporary roads would be utilized in alternative F. Table 3- 17 indicates this alternative also has the highest modeled increase in sedimentation from planned FS activities.

Table 3- 18. Average Annual Harvest Acres in the First Decade by Type of Harvest and Alternative for the Chattahoochee and Oconee National Forests

Harvest Method	A	B	D	E	F	G	I
Thin	3,311	4,061	2,614	675	3,705	417	2,563
Uneven-Aged	444	964	483	407	2,588	410	459
Shelterwood	0	0	0	0	820	0	0
Clearcut with Reserves	1,506	2,553	3,849	660	3,984	36	1,382
Total All Harvest	5,261	7,578	6,946	1742	11,097	863	4,404

Source: SPECTRUM model outputs December, 2002 for Alternatives A thru G; September 2003 for Alt.I.

Exposed soils immediately adjacent to stream channels generally result in increased sediment delivery to streams. As a result, an increase in stream sediment concentration is a potential effect from stream crossings. There are many different types of stream crossings used on the National Forest, including natural fords, concrete fords, culverts and bridges. The road segments leading to and from crossings are also a factor in stream crossing function. If a large amount of road runoff (water volume) is transported directly to the crossing, then the crossing is at greater risk of failure and potentially delivers more sediment to the stream.

A second indirect effect from land management activities is changes in stream channel morphology. The physical characteristics of river systems can be investigated at spatial scales ranging from the individual particle to the entire drainage basin and over an equally broad temporal scale. Richards (1982) distinguishes present time (1-10 yr), modern time (10-100 yr) and geologic time (1000+ yr), and notes that the interdependence of river channel variables changes across time scales. In the short term, channel form is unvarying. Daily fluctuations in discharge result simply in changes in width, depth, velocity and sediment transport. Over the intermediate or modern time frame, channel form approaches its state of dynamic equilibrium between sediment and water transport on the one hand, and the longer-term inherited conditions of gradient, sedimentology, and paleochannel features on the other. (Allen, 1995)

Changes in sediment concentration or stream flow regime from management activities may cause channel aggradation or degradation in present time resulting in a change in the channel width/depth ratio. Shifts in dominant streambed particle size distribution may also occur. The most vulnerable areas for this effect are stream segments directly downstream of road and trail crossings.

Recreation

Water quality and stream geomorphology impacts from recreation are increasing on the Chattahoochee-Oconee NFs. Localized effects from off-highway vehicle use have been documented. Effects include increased stream sedimentation from trails (legal and illegal) and unstable stream crossings. OHV trails are difficult to maintain due to a high level of use, limited funds, and poor location. The increased demand for more recreation trails of all types is expected to continue. This demand is present in most alternatives, and it's emphasized in alternative D, which emphasizes a variety of recreation experiences including concentrated use and off-highway vehicle use. The current condition of OHV trails varies widely across the Forest, and illegal trails and uses have resulted in degraded watershed conditions.

Recreational gold panning causes short-term increases in turbidity directly down-stream of panning activity. If panning activity is concentrated or a high intensity of activity takes place in a stream reach, then stream banks become unstable, affecting overall channel stability.

Fecal Coliform

The coliform bacteria group consists of several genera of bacteria. These mostly harmless bacteria live in soil, water, and the digestive system of animals. Fecal coliform bacteria, which belong to this group, are present in large numbers in the feces and intestinal tracts of humans and other warm-blooded animals, and can enter water bodies from human and animal waste. If a large number of fecal coliform bacteria are found in water, it is possible that pathogenic (disease- or illness-causing) organisms are also present in the water. Fecal coliform by themselves are usually not pathogenic; they are indicator organisms, which means they may indicate the presence of other pathogenic bacteria. Pathogens are typically present in such small amounts it is impractical to monitor them directly.

The Oconee NF is currently managing a relatively small grazing program of approximately 1,100 acres in 15 allotments. All but two allotments have fencing in the riparian corridor to limit cattle access to streams. The small number of allotments and current conservation measures result in minimal water quality effects from the existing grazing program. This program is consistent across alternatives and the number of allotments is not expected to increase in the future.

Impacts Of Sediments On Designated Or Beneficial Uses

Indirect effects caused by excessive sedimentation can affect designated or beneficial uses. Excessive sediments deposited on stream and lake bottoms can choke spawning gravels (reducing survival and growth rates), impair fish food sources, fill in rearing pools (reducing cover from prey and thermal refugia), and reduce habitat complexity in stream channels. Excessive suspended sediments can make it more difficult for fish to find prey and at high levels can cause direct physical harm, such as clogged gills.

High levels of sediment can reduce water clarity for swimming and adversely affect aesthetics. Swim areas on the Forest are not impacted by excessive sedimentation. Short term increases in turbidity due to high recreation use or storm events could cause localized problems. Aquatic habitat impairment by sediments can also interfere with fishing.

Sediments can cause taste and odor problems, block water supply intakes, foul treatment systems, and fill reservoirs. Although most treatment systems can remove most turbidity, very high sediment levels sometimes require that water supply intakes be shut down until turbidity clears or system maintenance (e.g., back-flushing) is performed. (US EPA, 1999) There are two source water watersheds designated on the Forest. Forested watersheds generally provide clean water with low turbidity levels. These two watersheds were allocated to the 9.A.1 prescription for all alternatives.

Best Management Practices

Best Management Practices are methods, measures, or practices selected by an agency to meet its nonpoint source control needs. BMPs include but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters. BMP implementation and validation monitoring have proven that BMPs are effective at minimizing effects to the soil and water resource.

Mitigation measures minimize adverse effects to soil and water resources. The mitigation measures that would apply to all alternatives include:

- Best Management Practices – Georgia's Best Management Practices for Forestry were developed in 1981 and revised in 1999 to minimize erosion and stream sedimentation from forestry practices.
- Riparian Prescription – This management prescription recognizes the riparian corridor and associated ecosystems. Riparian corridors will be managed to retain, restore and/or enhance the inherent ecological processes and functions of the associated aquatic, riparian, and upland components within the corridor.
- Forest Plan Standards – Standards are required courses of action or levels of attainment that promote the achievement of Forest Plan goals and objectives.

> Standards are developed when: (1) unacceptable impacts are expected (without the standard); (2) they're critical to Forest Plan objectives; and/or (3) laws or policies do not address a proposed course or when they need further clarification. Standards are mandatory. A Forest Plan amendment is required in order to deviate from an established standard.

Best Management Practices and other mitigation measures would prevent much of the potential sediment yield displayed in Table 3- 16 from reaching streams or other water bodies. This mitigation is not reflected in Table 3- 16. Actual sediment yields from planned activities would be substantially lower. Monitoring of the stream channel and associated beneficial uses is the most effective measure of whether mitigation measures are successful in minimizing effects. Direct and indirect effects for all alternatives are expected to be minimal if mitigation measures are properly implemented.

Cumulative Effects

Cumulative effect is the impact on the environment resulting from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. *(40 CFR 1508.7)*

Model

Watershed Condition Rank (WCR) is a measure that characterizes the condition of 5th Level HUCs or watersheds with respect to current and future sediment load increases. The application of the sediment model and associated WCRs are estimates based on data of various sources, scales, and accuracy. These data are listed in Table 3- 19.

Table 3- 19. Data Sources Used in Modeling Sediment Increases

Layers	Use	Source	Unit
Watersheds	planning unit	from NRCS or USFS	5th level HUC
Ownership/ alternatives	to determine the potential affect of Forest Service ownership on viability of Species of Concern	from individual forests	percent
Streams	used to determine riparian areas	RF3 data from EPA Basins III	not applicable
Roads	road density and riparian road density	from tiger census data	miles per square mile
land use	determine watershed and riparian area land use	1970 GIRAS data from EPA Basins III, 1994 NLCD from EPA Region 4	Percent
Dams	determine altered flow	from EPA Basins III	number per square mile
Point sources	cerlis, ricris, and npdes sites	from EPA Basins III	number per square mile

Source: Clingenpeel, 2003.

These data were used because they are the most current available data for the Southern Appalachian region and allow the National Forests in the planning area to achieve some consistency in process and management direction. This will aid in managing ecosystems and making more informed decisions. These data made it possible to create a method that can describe the effects from the range of alternatives and suggest where potentially a greater water quality risk exists. This process is developed for the forest plan scale. (Clingenpeel, 2003)

Sedimentation

For the purposes of comparing alternatives, sedimentation was assessed by modeling the percent increase in sedimentation from NF management activities beyond the current land use/cover additions. The model also determined the average annual yield of sediment, and expressed this as a percent increase above baseline conditions. Baseline conditions are considered to be a completely forested watershed without roads. The model uses predicted sediment yields as the surrogate for determining cumulative impacts for water quality. Changes in land use and disturbance are modeled with respect to estimated increases in sediment, and predicted impacts are summarized by alternative. The significance of impacts is related to criteria designed to determine levels of Watershed Condition through the Watershed Condition Rank (WCR).

A valid cumulative effects analysis must be bounded in space and time. For the purposes of this exercise in forest planning, 5th level Hydrologic Unit Codes (HUCs) are the appropriate spatial bounds for cumulative effects. A 5th level HUC is a watershed at a specific scale. HUCs are used by multiple agencies to organize and catalog water quality and quantity data. The implementation period for a forest plan is 5 – 15 years, however the appropriate time period captured for the sediment model is 5 decades or 50 years. Results for the first decade will be used to analyze alternatives, because this is the implementation time period for the forest plan.

Watershed Condition Rank (WCR) is a measure that characterizes the condition of 5th level watersheds with respect to current and future sediment load increases. In order to establish WCRs, the current sediment average annual yield is determined and expressed as a percent above the baseline conditions. The next step in the process utilizes the relationship of locally-adapted species with predicted sediment increases to create a species-sediment load relationship or index (SSI). The SSI is a relatively large-scale coarse filter developed to evaluate alternatives in the Forest Plan. See Clingenpeel (2003) for further details about the SSI. This score is modified by a weighted average where the watershed occurs in more than one physiographic zone. Watershed condition or SSI is generalized into three categories of Excellent, Average and Below Average. These categories will be referred to as Watershed Condition Ranks or WCR, and are listed in Table 3- 20. The WCRs for each 5th Level HUC are also displayed in Figure 3 - 6 and Figure 3 - 7.

Table 3- 20. WCR For Current Land Use/Cover Conditions.

HUC	Sq Miles	Percent Increase over Baseline	Excellent Range - 0.0 to D	Average Range - D to E	WCR weighted average	Percent National Forest ownership
0306010201	279.31	774	500	2,800	A	69.6
0306010207	189.56	517	500	2,800	A	59.9
0306010206	130.26	574	11,840	18,618	E	35.9
0306010401	304.91	3,353	20,000	30,000	E	12.1
0307010106	154.03	16,410	20,000	30,000	E	5.1
0307010107	156.74	11,588	20,000	30,000	E	20.7
0307010109	178.51	23,451	20,000	30,000	A	4.3
0307010111	118.02	24,003	20,000	30,000	A	0.6
0307010110	168.02	22,822	20,000	30,000	A	0.01
0307010114	218.63	25,721	20,000	30,000	A	0.7
0307010115	79.04	14,049	20,000	30,000	E	28.0
0307010116	206.81	18,415	20,000	30,000	E	11.2
0307010117	217.13	12,249	20,000	30,000	E	15.8
0307010310	194.37	8,833	20,000	30,000	E	11.8
0307010313	215.96	10,289	20,000	30,000	E	12.8
0313000101	155.61	598	2,704	5,875	E	40.1
0313000102	159.25	2,136	12,223	19,152	E	17.2
0313000105	135.04	686	4,104	7,828	E	31.6
0313000106	97.7	1,267	628	2,978	A	19.2
0315010101	184.52	494	1,293	3,241	E	52.7
0315010102	143.31	840	2,030	3,650	E	19.6
0315010103	178.95	1,018	2,300	3,800	E	1.7
0315010104	116.69	1,169	1,018	3,088	A	26.7
0315010105	108.19	766	2,300	3,800	E	7.5
0315010201	135.67	1,108	500	2,800	A	17.9
0315010202	93.17	1,023	500	2,800	A	22.0
0315010203	73.08	643	500	2,800	A	29.0
0315010204	72.16	1,545	500	2,800	A	2.4
0315010301	117.99	739	2,300	3,800	E	10.8
0315010303	44.62	263	2,300	3,800	E	37.7
0315010304	81.49	446	2,300	3,800	E	15.4
0315010305	143.18	494	2,300	3,800	E	24.2
0315010401	178.34	922	3,450	6,916	E	23.4
0315010402	97.72	769	500	2,800	A	7.1
0315010504	178.42	720	2,300	3,800	E	1.5
0315010505	116.27	859	2,300	3,800	E	3.4
0601020201	81.65	977	500	2,800	A	38.9
0602000109	164.66	853	2,300	3,800	E	4.0
0602000201	188.98	638	500	2,800	A	50.9
0602000204	86.19	928	500	2,800	A	18.9
0602000208	214.32	1,285	500	2,800	A	35.8
0602000301	232.46	554	500	2,800	A	68.4
0602000302	263.11	4,109	500	2,800	BA	17.7

Source: Cumulative effects model outputs, September 2003.

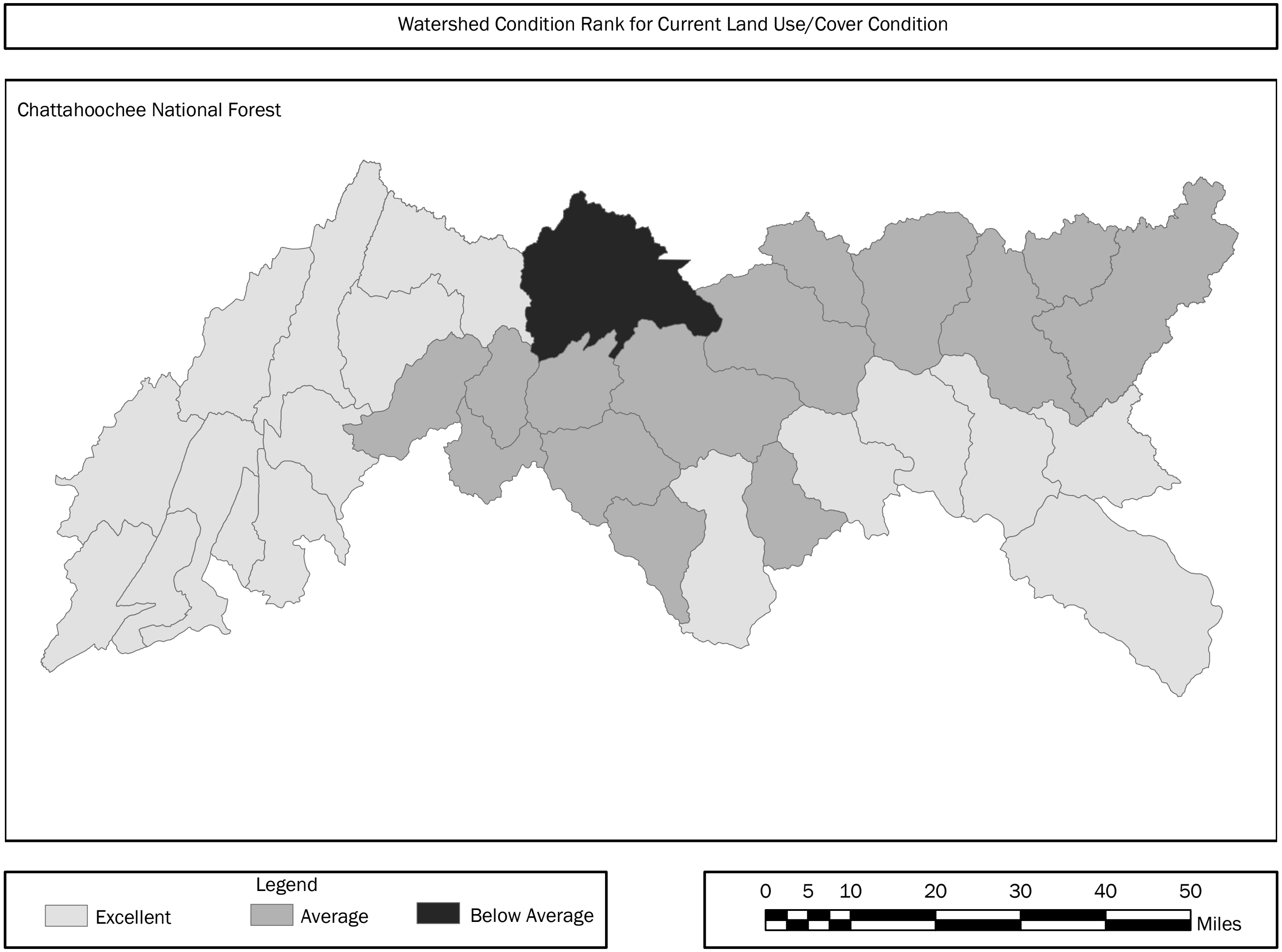


Figure 3 - 6. Map of Chattahoochee NF HUCs with WCR Based On Current Land Use/Cover.

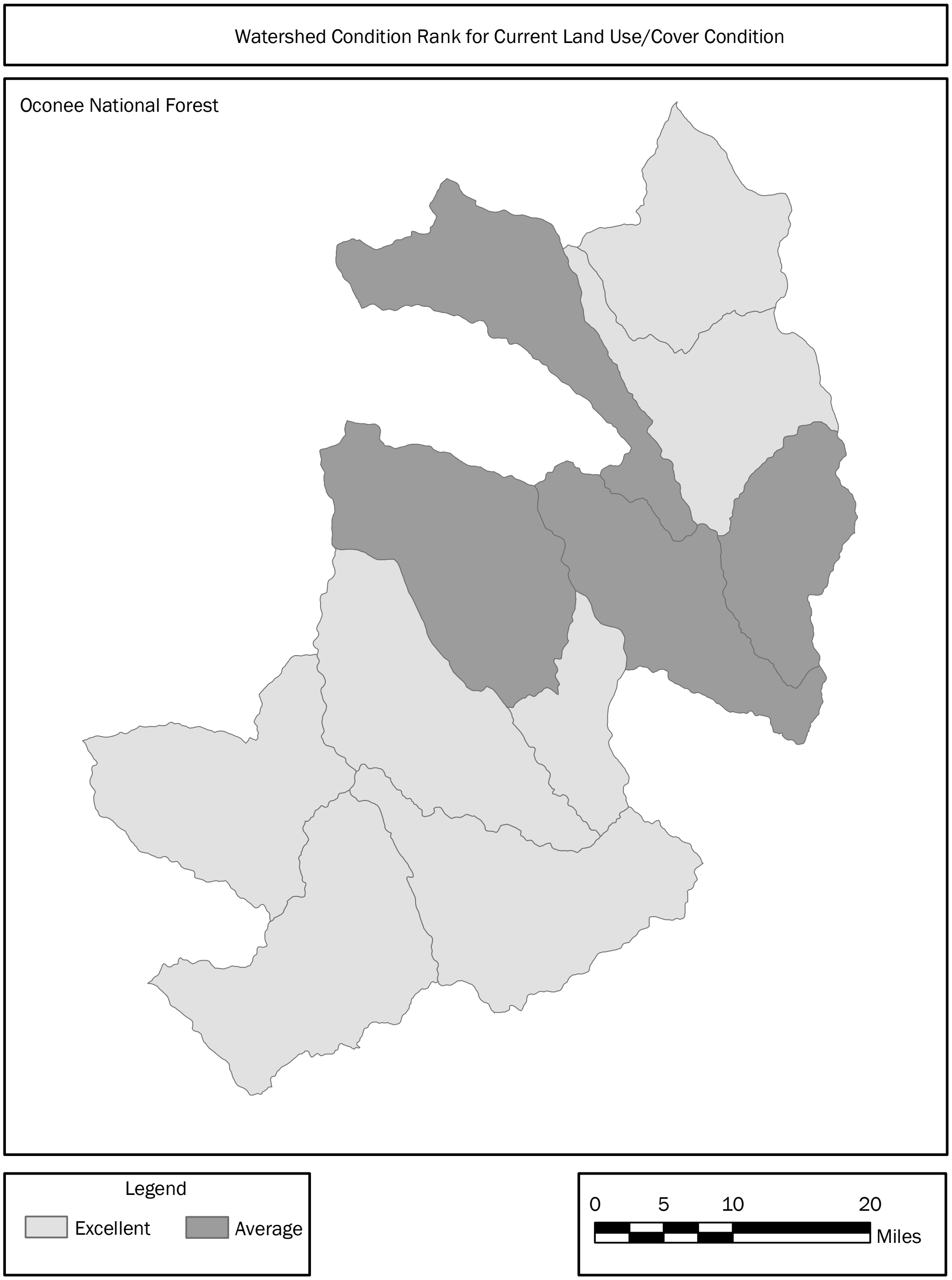


Figure 3 - 7. Map of Oconee NF HUCS with WCR Based On Current Land Use/Cover.

Table 3- 20 lists WCR for period 1 (first decade) for all alternatives. Where a watershed WCR is **excellent (E)**, the probability (or potential) is low for adverse effects to aquatic species.

Where a watershed WCR is **average (A),** the potential to adversely affect beneficial uses is moderate. Watershed assessments for 6th level HUCs in these watershed management areas will provide further details about watershed condition.

Where a watershed with a WCR is **below average (BA)**, the potential to adversely affect beneficial uses could be high, but only the Toccoa River-middle (0602000302) had a model outcome of BA for its initial WCR (based on current land use/cover).

For any WCR, the amount of NF land and its location in the watershed can further influence overall watershed condition. Watershed management areas with a low percentage of NF ownership could be higher priority candidates for partnership development to assure beneficial uses are maintained.

Toccoa River-middle, the Forest's only watershed management area with a 'BA' model outcome, is 18 percent National Forest. This outcome is based primarily on current land use activities on private land within the watershed, but the Copper Hill historical mining activities also took place in this watershed. The management prescriptions for alternative I are listed Table 3- 21. In addition to those listed, the Riparian Corridor management prescription (MRx 11) is embedded within all the prescriptions listed. It applies to all perennial and intermittent streams. Restoration of plant associations (MRx 9.H) is the dominant allocation in the watershed. Due to the small percentage of NF land in the entire 5th Level HUC, an analysis of the smaller 6th Level HUCs would help identify any watershed improvement opportunities on NF land.

Table 3- 21. Acres per MRx for Toccoa River-middle WMA I

Management Prescription	Total Acres
1.A	3,140
12.A	2,474
4.D	153
5.A	38
7.B	896
7.E.1	577
8.E.3	105
9.H	12,376

Source: Spatial analysis outputs using mapped management prescriptions and 5th Level HUCs, September 2003.

Table 3- 22. WCR for Period One of All Alternatives.

HUC	A1	B1	D1	E1	F1	G1	I1
0306010201	A	A	A	A	A	A	A
0306010207	A	A	A	A	A	A	A
0306010206	E	E	E	E	E	E	E
0306010401	E	E	E	E	E	E	E
0307010106	E	E	E	E	E	E	E
0307010107	E	E	E	E	E	E	E
0307010109	A	A	A	A	A	A	A
0307010111	A	A	A	A	A	A	A
0307010110	A	A	A	A	A	A	A
0307010114	A	A	A	A	A	A	A
0307010115	E	E	E	E	E	E	E
0307010116	A	A	A	A	A	A	A
0307010117	E	E	E	E	E	E	E
0307010310	E	E	E	E	E	E	E
0307010313	E	E	E	E	E	E	E
0313000101	E	E	E	E	E	E	E
0313000102	E	E	E	E	E	E	E
0313000105	E	E	E	E	E	E	E
0313000106	A	A	A	A	A	A	A
0315010101	E	E	E	E	E	E	E
0315010102	E	E	E	E	E	E	E
0315010103	E	E	E	E	E	E	E
0315010104	A	A	A	A	A	A	A
0315010105	E	E	E	E	E	E	E
0315010201	A	A	A	A	A	A	A
0315010202	A	A	A	A	A	A	A
0315010203	A	A	A	A	A	A	A
0315010204	A	A	A	A	A	A	A
0315010301	E	E	E	E	E	E	E
0315010303	E	E	E	E	E	E	E
0315010304	E	E	E	E	E	E	E
0315010305	E	E	E	E	E	E	E
0315010401	E	E	E	E	E	E	E
0315010402	A	A	A	A	A	A	A
0315010504	E	E	E	E	E	E	E
0315010505	E	E	E	E	E	E	E
0601020201	A	A	A	A	A	A	A
0602000109	E	E	E	E	E	E	E
0602000201	A	A	A	A	A	A	A
0602000204	A	A	A	A	A	A	A
0602000208	A	A	A	A	A	A	A
0602000301	A	A	A	A	A	A	A
0602000302	BA	BA	BA	BA	BA	BA	BA

Source: Cumulative effects model outputs, September 2003.

A comparison of WCR scores based on current or existing conditions (Table 3- 20) and WCR for period 1 of all alternatives (Table 3- 22) indicated that only Murder Creek Watershed Management Area (0307010116) on the Oconee NF changed WCR score. It changed from “Excellent” to “Average,” however it also has a small amount of NF ownership in the Watershed (11%). This ownership is located in the lower portion of the watershed. Management prescriptions for Alternative I for Murder Creek are listed in Table 3- 23. The small percentage of NF land in the watershed is managed primarily for red-cockaded woodpecker (RCW) habitat (MRx 8.D). Other prescriptions include riparian corridors (MRx 11, embedded); management, maintenance, and restoration of plant associations (MRx 9.H); areas managed to restore or maintain old growth characteristics (MRx 6.B); outstandingly remarkable streams (MRx 4.H); and the Murder Creek Research Natural Area (MRx 4.B.1). The WCR changed in this watershed, because it’s initial WCR from current land use/cover conditions was near the threshold between Excellent and Average before any predicted erosion or sedimentation from FS activities. The modeled land disturbance activity from FS management resulted in enough disturbance to change the condition rank from Excellent to Average, although actual erosion and resulting sedimentation is expected to be less than the modeled increase due to implementation of mitigation measures. Mitigation measures include riparian corridor management direction and implementation of Georgia’s Best Management Practices (BMPs). There are a total of 11,080 acres in RCW or plant association management prescriptions that would be expected to include some land disturbance activity when vegetation management activities are implemented. The remaining allocations would have minimal land disturbance or potential sedimentation. Partnership opportunities for the Murder Creek Watershed and others with small amounts of NF ownership should be explored to reduce nonpoint source pollution, including sedimentation, and improve overall watershed health. This change in WCR for Murder Creek Watershed Management Area was consistent for all alternatives. It changed from “Excellent” to “Average” for all alternatives.

Table 3- 23. Acres per MRx for Murder Creek WMA

Management Prescription	Total Acres
4.B.1	1,004
4.H	1,455
6.B	1,191
7.E.1	17
8.D	7,994
9.H	3,086

Source: Spatial analysis outputs using mapped management prescriptions and 5th Level HUCs, September 2003.

Table 3- 24 lists WCR scores for all periods of Alternative I. WCR does not change for any period. Changes for Murder Creek Watershed Management Area, which were consistent for every alternative, are discussed above. When all watershed management areas are considered, there would be no watershed cumulative effect from any alternative chosen.

Table 3- 24. WCR for Alternative I, All Periods.

HUC	I -1	I - 2	I - 3	I - 4	I – 5
0306010201	A	A	A	A	A
0306010207	A	A	A	A	A
0306010206	E	E	E	E	E
0306010401	E	E	E	E	E
0307010106	E	E	E	E	E
0307010107	E	E	E	E	E
0307010109	A	A	A	A	A
0307010111	A	A	A	A	A
0307010110	A	A	A	A	A
0307010114	A	A	A	A	A
0307010115	E	E	E	E	E
0307010116	A	A	A	A	A
0307010117	E	E	E	E	E
0307010310	E	E	E	E	E
0307010313	E	E	E	E	E
0313000101	E	E	E	E	E
0313000102	E	E	E	E	E
0313000105	E	E	E	E	E
0313000106	A	A	A	A	A
0315010101	E	E	E	E	E
0315010102	E	E	E	E	E
0315010103	E	E	E	E	E
0315010104	A	A	A	A	A
0315010105	E	E	E	E	E
0315010201	A	A	A	A	A
0315010202	A	A	A	A	A
0315010203	A	A	A	A	A
0315010204	A	A	A	A	A
0315010301	E	E	E	E	E
0315010303	E	E	E	E	E
0315010304	E	E	E	E	E
0315010305	E	E	E	E	E
0315010401	E	E	E	E	E
0315010402	A	A	A	A	A
0315010504	E	E	E	E	E
0315010505	E	E	E	E	E
0601020201	A	A	A	A	A
0602000109	E	E	E	E	E
0602000201	A	A	A	A	A
0602000204	A	A	A	A	A
0602000208	A	A	A	A	A
0602000301	A	A	A	A	A
0602000302	BA	BA	BA	BA	BA

Source: Cumulative effects model outputs, September 2003.

RIPARIAN AREAS/FLOODPLAINS/WETLANDS

Affected Environment

Watersheds are defined as a catchment, a topographically delineated area drained by a stream system, that is, the total land area above some point on a stream or river that drains past that point (Brooks, et. al. 1997). Watersheds can include a variety of landscape features influenced by the presence of water. Features such as riparian areas, wetlands, floodplains and the associated or dependent resources found within them are generally described as a part of the watershed environment. These features provide important habitat for many wildlife species and important links between the terrestrial or upland habitats and those associated with the stream habitats. These areas provide water, shade, large woody debris, food and cover. They also serve as filters for sediment and nutrients from upland sites.

The desired future condition, applicable to all alternatives, is to maintain or restore riparian, floodplain and wetland processes to attain their potential functions. Potential, in this context, is defined within the physical and biological capabilities of the system, given social, political and physical constraints. It is not possible, nor desirable, to "shut down" the Forest and re-establish pre-European settlement conditions. Impacts from human activity will continue to influence watershed function and processes to one degree to another, both inside and outside National Forest lands.

Impacts will vary by level and type between alternatives, but will continue to influence watershed processes. Impact levels will vary with the application of management activities to maintain or restore conditions and functions, and with naturally occurring events that can occur within the Forest. For example, geomorphologists, such as Rosgen (1996), have defined channel systems and evolutionary processes, including the type and condition a channel should be in within a given setting. Influences such as roads may affect the actual channel type that would be realistically achievable within given constraints. Natural events such as floods and landslides can also cause dramatic changes to watershed conditions.

Riparian Areas

Definitions of riparian areas vary depending on the region of the United States where they occur. Riparian areas in the western United States are more commonly known as the "green line" when located among grasslands. These areas provide protection for limited water resources. In the eastern United States, however, riparian areas are but one component of a forest landscape, but the one most closely associated with the streams flowing throughout the forests. A widely accepted functional definition used by the Forest Service and other land management agencies in the eastern United States is as follows:

> *Riparian areas are three-dimensional ecotones of interaction that include terrestrial and aquatic ecosystems extending 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 water course at a variable width. (Ilhardt et. al, 2000*).*

This definition is appropriate for natural resource management because it recognizes riparian areas by the ecological functions that occur at various scales. These regulate water temperature, fine and coarse organic matter input, bank stability, regulation of nutrient and sediment flows, and landscape corridor or habitat connection. Riparian areas are more than just buffers, and this functional definition recognizes this. For more than three decades land management organizations and agencies have generally identified the first 100 feet of horizontal distance on both sides of perennial streams or other perennial water bodies such as lakes as this feature. Riparian areas can include wetlands, floodplains, and other areas associated with water movement from uplands to aquatic areas. For the Forest Plan, a GIS analysis was completed to model an approximate acreage on the Forest meeting the definition of riparian areas. The analysis modeled a 100-foot buffer on either side of perennial streams, from the channel bank up slope, regardless of gradient. Streams modeled were those in the current Forest Service stream coverage. Areas modeled classify as forested, excluding areas in roads, administrative sites, and large water bodies. Approximately 66,234 acres of riparian areas were modeled with this analysis. This would occur on about 8 percent of the total Forest acreage. Table 3- 25 displays this acreage by Ecological Section.

Table 3- 25. Acres of Riparian Area on Perennial Streams by Ecological Section

Ecological Section	Total Forest Acres *	Estimated Riparian Acres	Percent
Piedmont	111,459	8,598	8
Ridge & Valley	64,726	5,792	9
Blue Ridge	682,834	51,844	8
Total for Forest	859,020	66,234	8

Source: Forest GIS data, 2002

* Non Forested acres not included in analysis – 6,013

The Southern Appalachian National Forests involved in plan revision developed the term ***riparian corridors*** to describe these areas for both Forest and project level planning. Riparian corridors define a fixed width area for management purposes, which may fall beyond the true riparian area as previously defined, and may include an upland component (USDA Forest Service, 2001). Riparian Corridors are identified as an individual management prescription, MRx 11; however, they are not identified or mapped as a separate component in Forest Plan Alternative maps, but embedded within the surrounding Management Prescriptions. Identification of riparian corridors will be completed during project level analysis and implementation.

Within the riparian corridor, management practices are specified in prescription specific standards to maintain riparian functions and values. These standards focus on the management of activities to provide normal riparian function, erosion control, shade protection and restoration of riparian vegetation communities where needed. As a management prescription area, this includes corridors along all defined perennial and intermittent stream channels that show signs of scour, and around natural ponds, lakeshores, wetlands, springs, and seeps. Appendix C in the Forest Plan provides operational information related to defining and delineating riparian corridors on the ground.

Riparian areas have become a focus of efforts to maintain ecosystem diversity in the broader landscape. Crow et al. (2001) have proposed six general recommendations or guiding principles that should be considered when making management decisions related to riparian areas:

1. <u>Know your ecosystems</u> – manage effectively by using integrated, multi-scale classifications of ecosystems
2. <u>Apply a landscape perspective to riparian management</u> – recognize the linkages and interdependencies between upland and aquatic ecosystems
3. <u>Maintain or restore natural processes that regulate riparian ecosystems</u> – direct management actions to maintain the geomorphologic and hydrologic processes that create diversity in the physical environment
4. <u>Favor native species</u> – control non-native species to conserve biological diversity
5. <u>Buffer width? There are no pat answers</u> – widths depend on many factors and the desired conditions and functions, and the context of riparian areas in the broader landscape, identify a gradient of impact where the impact or intensity of treatment and emphasize continuity of buffers; minimize points of entry for pollutants
6. <u>Timber production is a secondary benefit</u> – primary objective is to maintain or restore riparian habitats and ecological processes, management regimes for producing timber in riparian forests do not degrade or seriously disrupt ecosystem processes.

These principles are reflected in the goals, objectives and desired conditions set forth in Alternative I. The standards, both forest-wide and prescription specific will guide the Forests in implementing this direction.

<u>Floodplains</u>

Floodplains are described as "the nearly level plain that borders a stream and is subject to inundation under flood stage conditions unless protected artificially (USDA-NRCS, 1996). These areas also serve as a buffer to the nearby streams to trap overland flows that may carry damaging sediment or other pollutants. On the Chattahoochee National Forest, floodplains are typically narrow due to the ownership pattern. They are most often confined to a narrow strip of land within the valley originating at the edge of the stream channel and ending as the upland slopes begin to rise up from the landscape. These features create long, narrow floodplains that may occur on one or both sides of a stream. Common tree species include bottomland hardwoods and eastern hemlock with small canopy openings when large trees fall or become uprooted. In the mountains, floodplains have traditionally been the subject of intensive disturbance and use for settlement and homes, cultivation of crops and pasture, and widely coveted for the inherent fertility of the soils and the close proximity to water sources. On the Chattahoochee-Oconee NF, floodplains make up a small percentage of the total ownership base, less than 1 percent as displayed in Table 3- 26 below.

A significant amount of the Forests' floodplain acreage currently has second- or third-growth stands of old field pines or early successional hardwood species, like yellow poplar and sweetgum. These sites are testimony to periods of settlement, clearing, occupation and repeated disturbance. Floodplains on the Oconee are typically much broader due to the gently sloping terrain common to the Piedmont. Along the larger streams and rivers, floodplains have expanded during the last two centuries because of the catastrophic farmland erosion in the 1800s and early 1900s. As streams filled their natural channels with sediment, floodwaters were forced further away from their original channels. Larger streams often exhibit natural levees where sand has been deposited during high water events. Erosion control and land conservation measures initiated in the 1930s have reduced sediment loads allowing some streams to slowly downgrade in old sediments and move back to their original channels.

Floodplains occur on an estimated 5,800 acres of the Forests, or less than 1 percent of the total land area. Table 3- 26 displays the estimated acreage in floodplains.

Table 3- 26. Estimated Floodplain Acres by Ecological Section

Ecological Section	Total Forest Acres	Estimated Floodplain Acres	Percentage
Piedmont	115,354	807	0.7
Ridge & Valley	64,656	193	0.2
Blue Ridge	685,034	4,795	0.7
Total for Forest	865,043	5,795	0.7

Source: Forest GIS data, 2002

Floodplains are a finite resource on the Forests. Increases in ownership occur only through land ownership changes. A significant portion of the existing acreage is located in close proximity to the permanent classified road system of the Forest, under both Forest Service and other jurisdictions. This location has often made floodplains vulnerable to impacts such as sedimentation, loss of vegetation, loss of road function, and reduced capacity to handle overland flows of water. Road crossings of floodplains often become points of entry for pollutants that can impair function and quality.

Forest Plan direction for floodplain management is included in the forestwide standards, Chapter 2 of the Forest Plan. Emphasis is on maintaining normal function, minimizing obstructions to flood flow levels, and avoiding placement of permanent structures or facilities within the 100-year floodplain zone. Federal and state regulations exist for floodplain management. Executive Order 11988, approved in May 1977, is the primary Federal law requiring management of floodplains on Federal lands. Specific requirements are identified for proposals involving land exchanges, construction and maintenance of facilities within floodplains, and maintaining flood channel flows and functions.

Wetlands

In general terms, wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin, et al. 1979). Various assessments of Georgia's wetlands have identified from 4.9 to 7.2 million acres, including more than 600,000 acres of open water habitat found in estuarine, riverine, palustrine and lacustrine environments. Estimates of wetland losses since the colonial settlement period beginning in 1733 and expanding over the next two and one-half centuries are between 20-25 percent of the original wetland acreage (Georgia Department of Natural Resources, 1998).

A statewide land cover survey conducted in 1996 (Georgia Department of Natural Resources, 1996) identified 3,194,593 acres of forested wetlands in the state. This category is the dominant type found on the National Forests in the northern half of Georgia. Hydric soils mapped in soil surveys are good indicators of wetlands. The National Wetland Inventory (NWI), conducted by the U.S. Fish and Wildlife Service, is also a reference source of wetland extent. The Coastal Plains physiographic region of the State has the largest extent of wetlands, estimated at more than three million acres. Forested wetlands make up more than 70 percent of this acreage with the remainder being coastal marsh and open water wetlands.

The wetlands system most dominant on the Chattahoochee is riverine, or those contained within a channel and associated with the larger perennial streams common to the Forest. Palustrine wetland systems are more common to the Oconee, those dominated by trees, shrubs and other emergent wetland plants. These areas are commonly called bottomlands and are subject to short duration periodic flooding events. The current estimate of wetland acreage is 4,500 acres or about 0.5% of the total National Forest area. This acreage estimate was derived from evaluation of soil mapping, field mapping by forest specialists and evaluation of the extent of hydric soils on the Forests. Increases in acreage have occurred with land acquisitions in the past fifteen (15) years on the Oconee National Forest. The larger extent of forested wetlands is associated with the main channel and tributaries of the Oconee and Ocmulgee Rivers. Isolated small wetlands occur on the Chattahoochee along larger perennial streams and the backwaters of reservoirs and small lakes. Beaver ponds also exist in a number of locations on the Forest, with some going through episodes of increase and decline. Table 3- 27 displays the estimated acres of wetlands by Ecological Section.

Table 3- 27. Estimated Wetland Acres by Ecological Section

Ecological Section	Total Forest Acres	Estimated Wetland Acres	Percentage
Piedmont	115,354	3,600	3
Ridge & Valley	64,656	100	0
Blue Ridge	685,034	800	0.1
Total for Forest	865,043	4,500	0.5

Source: Forest GIS data, 2002

Wetlands on the Forests are generally in natural, normal functioning conditions. Exceptions exist where the impacts of road and trail crossings, dispersed recreation use or other ground disturbing activities cause entry of pollutants to wetlands. Implementation of Best Management Practices, forestwide standards and applicable State or Federal wetland regulations provide protection. Section 404 of the Clean Water Act regulates activities that fill or dredge jurisdictional wetlands or waters of the United States. Waters of the United States include most of the perennial water system found on the Forests. Activities occurring within jurisdictional wetlands are required to comply with the permit requirements of Section 404, and the protection requirements of Executive Order 11990, Protection of Wetlands.

Some wetlands on the Forests are classified as rare communities. These wetlands and their status are discussed in the habitat community section of the EIS.

Direct and Indirect Effects

Resource protection has been integrated into the forestwide standards for soil, water, watersheds, aquatic, riparian, wetlands and floodplains at various scales, from forest-wide to site-specific. This direction would result in maintaining or improving these resources and affected beneficial uses. Land management activities on national forest lands are conducted only after appropriate site-specific NEPA analysis has been conducted. This provides opportunities to identify and minimize direct, indirect and cumulative environmental effects that cannot be specifically determined or analyzed at the large scale of this EIS.

Operations involved in timber management, recreation use, roads, wild land fire and prescribed fire that cause disturbance of soils, stream channels or associated resources influence the level of disturbance within a watershed. Soil and site disturbance that occur from these activities can be responsible for increased rates of erosion and sedimentation. These impacts can affect the function and condition of riparian areas, floodplains and wetlands, and the associated aquatic habitats. Physical changes can affect runoff events, stream stability, large woody debris, and stream temperatures. Roads are perhaps the greatest ground-disturbing activity associated with management activities or resource use of the Forests.

Implementation of Best Management Practices, the Riparian Corridor Management Prescription (MRx 11), the Rare Communities Management Prescription (MRx 9.F) where applicable, and forestwide standards will minimize the amount of soil disturbance and the potential for sedimentation. The riparian corridor will encompass a large portion of the acreage of the riparian areas, wetlands and floodplains. Standards included in all alternatives require delineation and protection of a designated buffer between management activities and water bodies, i.e. perennial streams, lakes, etc. The riparian corridor acts as a buffer to: (1) trap sediment and nutrients moving from upland areas; (2) moderate stream temperatures; (3) provide streamside cover and food for wildlife; (4) provide large woody debris reserves and organic matter to riparian areas and aquatic systems; (5) maintain overall channel stability; and (6) moderate cumulative effects of actions within the watershed. Swift (1986) measured travel distance of sediment through forest litter and found that there is less than 0.1% probability of sediment traveling more than 200 feet, assuming barriers and vegetation are present on site to intercept. Swift found that sediment traveled a maximum distance of 314 feet, with an average travel distance of sixty-five feet.

Recreational gold panning has also become more popular over the last several decades. The occurrence of recoverable placer gold deposits is localized within the Forest, primarily within an area described as the Dahlonega Gold Belt. This area generally extends from the southern boundary of the Forest in the Amicalola area northeast through Lumpkin, White, Habersham and Rabun Counties. Recreational gold panning is allowed in most streambeds where the mineral rights are owned by the Federal government. In-stream sluices and suction dredges are not allowed on National Forest lands. Forestwide standards provide protection from ground disturbance and impacts to stream channels.

Damage to watersheds, riparian areas, wetlands and floodplains can occur from recreational activities. Developed and dispersed camping can result in stream bank and in-stream disturbances and soil compaction, and affect the type, density and vigor of vegetation. The increased use of Off Highway Vehicles (OHVs) has accelerated damage within riparian areas and stream channels. Most of the disturbances are localized, but they can have a profound effect on the quality and function of these resources. Potential will vary slightly by alternative. Restrictions on access, ground disturbance, and vegetation alteration will minimize impacts to these resources.

Prescribed fire and wild land fire can affect soil infiltration rates, surface erosion potentials, overland flow, and vegetation composition in riparian areas, floodplains and wetlands. These adverse impacts have the potential to occur if prescribed fire enters these areas when conditions are outside the prescription "window." No prescribed fire treatments are specifically identified in these areas, however the potential exists if the adjacent upland areas are prescribe burned. Implementation of the forestwide standards, riparian corridor standards, and Best Management Practices will provide protection from prescribed burning to these areas.

Cumulative Effects

The cumulative effects of the combined past, present and reasonably foreseeable activities within the Forests that have the potential to measurably affect values and functions of riparian areas, wetlands and floodplains include timber harvesting, road construction and maintenance, recreation, and prescribed burning. Of these, roads construction and maintenance probably represents the greatest impact on these areas forestwide. Timber harvesting is not proposed on a scheduled basis within these areas in any alternative. However, harvest may occur occasionally where needed for improvement or enhancement of the resources occurring in the areas. No road construction is specifically proposed in these areas; however maintenance of existing roads will continue to occur as needed. Prescribed burning is proposed forestwide, but will not occur in these areas except as needed for control areas. The potential for fire to impact riparian areas, wetlands and floodplains is directly dependent on the acres burned.

The combined effects of proposed management activities and resources uses address the issue related to riparian areas and water quality.

Riparian areas, wetlands and floodplains are naturally dynamic. That is, they change over time. However, goals common to all alternatives address maintaining riparian, wetland and floodplain characteristics that are considered good, and improving or restoring those areas determined to be in less desirable condition. The alternatives vary slightly in addressing the health and function of these areas, due primarily to the implementation of the riparian corridor prescription, Best Management Practices, and other requirements of laws and regulations.

The actual rate of potential change for individual areas cannot be determined at the Forest Plan scale. Each individual riparian area, wetland or floodplain will respond differently to various management practices, the type and degree of disturbance, corrective measures taken, natural physical processes, climate, and the like.

AIR

Affected Environment

"Protection and management of the Chattahoochee-Oconee National Forests" covers many items including some that relate to air quality. The level of knowledge regarding those air quality items varies, ranging from substantial (e.g., the regulatory framework), to moderate (e.g., the actual air quality within/near the Forest), then somewhat less (e.g., quantifying the impact that air pollution has on Forest resources and their enjoyment) and least (e.g., the changes we might see in the Forest due to changing air quality).

The Clean Air Act (CAA) is a major part of the regulatory framework that drives Forest Service participation in air quality management within or outside the Forest. The CAA created National Ambient Air Quality Standards (NAAQS), which established regulatory minimums for air quality. The Act also created a program for prevention of significant deterioration (PSD) of air quality in areas where good air quality (not falling below the NAAQS minimums) still existed. While the Environmental Protection Agency (EPA) and the state governments lead these programs, roles have been identified for industry, commerce, land managers, other levels of government and the public.

Areas known (or assumed) to be attaining NAAQS are allocated to one of three PSD "classes." These classes identify the level of effort that must be expended to maintain good air quality where it already exists. Class I Areas (certain wilderness areas and national parks designated by Congress) can receive only small amounts of additional pollution. Further, where it can be shown that the resources of Class I Areas are already suffering adverse impacts from air pollution, there is a process to make reasonable progress toward returning the area to its natural condition.

PSD - Class II areas can receive moderate increments of additional air pollution, as long as neither a NAAQS violation nor a significant deterioration of resources is anticipated. Class III areas can be designated to receive larger increments of additional pollution, enough to bring attainment areas all the way down to (but not below) NAAQS. Except for the 156 Congressionally-designated Class I Areas, all of the United States is designated as Class II.

The air inventory and monitoring efforts lead by the States and EPA have identified a number of areas, mostly centered on metropolitan areas, where it's known that NAAQS are not being attained. While there have been some successes at bringing NAAQS non-attainment areas into attainment, it's apparent that many factors associated with economic growth will make NAAQS attainment increasingly difficult. Non-attainment areas must be brought into attainment before they come under the PSD program. While there is a process to redesignate the PSD class of an area, no effort has been made to change any of the original Class I or Class II designations.

Air Pollution Originating Outside the Chattahoochee-Oconee National Forests

If resources within the Forest suffer impairment from air pollution, it matters little whether the pollutant comes from activity outside the Forest or within. It is important to note, however, that the overwhelming bulk of pollutants of concern (e.g. sulfur, nitrogen, fine particulates & volatile organics) can stay suspended in the atmosphere for days. Such gasses or fine particles may originate hundreds of miles from the Forest. Discrete plumes of air pollution often seem to vanish overnight. Much of this pollution is not removed, but merely dispersed into the regional atmospheric soup.

The regulatory framework, specifically the CAA, provides the greatest distinction regarding air quality that exists among the Forest's land units. The Cohutta Wilderness is a Class I Area. The balance of the Forest is designated Class II. Except for persistent non-attainment designations around Atlanta and Chattanooga, all of the State is in NAAQS attainment and, therefore, Class II. Air pollution control (emission reduction) efforts aimed at bringing these metro areas back into attainment have not formally required any changes in management of the Forest.

The process for determining if current air pollution (or proposed new increments of air pollution) might cause adverse impact on resources of the Cohutta Class I area began with identification of what those specific resources are. Congress labeled these resources as "air quality related values" (AQRVs). Congress also determined that "visibility" should be one of them. The other Cohutta AQRVs, "terrestrial habitats" and "aquatic habitats," were determined from records of public input when the Wilderness was originally established.

Visibility. As an AQRV, visibility is described as the ability of an air mass to convey landscape images. It's often reported in terms of standard visual range (SVR), the distance at which one can discern large contrasting images on the horizon. Natural background visual range throughout the eastern United States is estimated to vary throughout the year from 60 to 125 miles. Now, visibility at Cohutta seldom reaches into that range.

In its Final Report (SAMI, 2002), the Southern Appalachian Mountain Initiative evaluated visibility conditions at Class I areas in the southern Appalachian region. Because Cohutta's IMPROVE monitor had not yet been installed when their work began, they used the monitor at Great Smoky Mountain National Park as a surrogate. For their base period (1991-1995) they estimated that the mean annual SVR at Cohutta was only 19.5 miles. The primary air pollutants causing this impact are, in order of their magnitude: sulfur oxides (~ 70%, SOx), volatile organic compounds (VOCs), soot, nitrogen oxides (NOx), and soil/dust (IMPROVE, 2002). SAMI also projected that, with regulations currently enacted, SVR at Cohutta will improve to 19.8 mi. through the year 2010, then to 24.5 mi. by the year 2040. Further regulations, which should soon be under development to resolve problems with regional haze and NAAQS non-attainment, might bring the 2040 SVR near to 32.0 miles.

Terrestrial habitats. Concerns regarding this AQRV have so far been focused on the impact that acid deposition might have on soils and the impact that tropospheric ozone might have on vegetation. SOx and NOx pollution provide acid deposition in the form of sulfate and nitrate anions. As water moves these anions through the soil, they remove certain essential plant nutrients (e.g. dissolved cations of calcium, potassium, sodium and magnesium).

According to modeling reported in the Southern Appalachian Assessment (SAA), wet sulfate deposition across the Cohutta Wilderness was estimated to range from 20 to 30 kg/ha/yr (as SO4) (SAMAB, 1996). At peak elevations, wet deposition is higher than 30 kg/ha/yr. Also, dry deposition is commonly assumed to be nearly equal to wet deposition in this region. Total sulfate deposition at Cohutta is therefore estimated to lie between 50 and 60 kg/ha/yr (17 – 20 kg/ha/yr, as S). Available information indicates that typical forested watersheds in the southern Appalachian region can accommodate no more than 60 kg/ha/yr of sulfate (20 kg/ha/yr, as S) deposition without adverse impact on terrestrial ecosystems.

Wet nitrate deposition across the Cohutta Wilderness was also estimated in the SAA. It ranges from 10 to 15 kg/ha/yr (as NO3) (SAMAB, 1996). At peak elevations, wet deposition is higher than 15 kg/ha/yr. Again, it's commonly assumed that dry deposition nearly equals wet deposition in this region. Total nitrate deposition at Cohutta is therefore estimated to lie between 25 and 30 kg/ha/yr (6 – 7 kg/ha/yr, as N). Available information indicates that typical forested watersheds in the southern Appalachian region can accommodate no more than 44 kg/ha/yr of nitrate (10 kg/ha/yr, as N) deposition without adverse impact on terrestrial ecosystems.

In its *Final Report* (SAMI, 2002), SAMI projected that there will be substantial sulfate deposition reductions and small nitrate deposition reductions in this area through the year 2040. This is good news, but the effects of acid deposition on soils are cumulative. Even though the loss of soil cation nutrients has been slowed, it has not been stopped.

Ozone is a secondary pollutant that forms in the atmosphere from the effect ultraviolet (UV) light has on oxygen. Although there should be little UV light energy at the earth's surface, certain air pollutants (NOx and VOCs), in the presence of high temperatures, accelerate the formation of ozone. While accelerated ozone formation commonly occurs at mid-day southeastern summertime temperatures, it's often limited in rural/suburban areas by availability of NOx. Hence, ozone pollution is closely tied to NOx emissions.

Summertime ozone concentrations near Cohutta are now high enough to occasionally exceed the revised (8-hour) NAAQS ozone standard. This level of ozone exposure is unhealthy for some people and some plants. At Cohutta, injury has been observed on the foliage of indicator plants known to be ozone sensitive. While computer simulations (SAMI, 2002) did not show an overall reduction in forest growth at Cohutta, a concern remains that particularly sensitive species may be suffering selective decline. SAMI's projections for NOx emission reductions show that regulations recently enacted will reduce ozone exposure.

Aquatic habitats. Concerns regarding this AQRV have focused on the impact acid deposition might have on water chemistry and aquatic organisms. If sulfate and nitrate deposition occurs with sufficient magnitude and time, the anions can deplete a watershed of nutrient cations. When nutrient cations become less available in the soil/rock complex, anions moving with water begin to dislodge other harmful cations (e.g. aluminum and hydrogen) and transport them to aquatic habitats.

The status of Cohutta's aquatic ecosystems regarding acid deposition is discussed in Effects of Acidic Deposition on Aquatic Resources In the Southern Appalachians, With Special Focus on Class I Areas (Herlihy et. al. 1996). It reports pH values as low as 6.2 and acid neutralizing capacities (ANC) as low as 26 ueq/l. Persistent values below these might signal a decline in aquatic organism diversity. Computer simulations (SAMI, 2002) indicate that Cohutta's streams will continue to show a mild decline in ANC through the year 2040, even with SOx and NOx reductions expected from regulations recently enacted.

So far, the discussion of AQRVs has been limited to the Cohutta Class I Area. There is a broader view, however. While visibility may receive less consideration on PSD-Class II parts of the Forest, the health of aquatic and terrestrial ecosystems certainly remains important. Ecosystems, keystone organisms and T&E species that might be sensitive to air pollution are not confined to Class I areas. Similarly, whatever forms of air pollution may be found within Cohutta are just as likely to occur elsewhere throughout the Forest and surrounding areas. For example, levels of acid deposition vary considerably throughout the State. The highest levels are found in the NW part of the State, near Cohutta. Lesser amounts (almost 60% of Cohutta levels) are found near the coast.

Air Pollution Originating From National Forest Management Activity

The only management activity regularly pursued on the Forest that causes a notable amount of air pollution is prescribed fire. Recently, the total annual amount of prescribed burning on the Forest, for all purposes, has averaged approximately 20,000 acres.

Fire has always been a natural part of the ecosystems contained within the Forest. Spatially and temporally, it's an ephemeral feature on the landscape. Under natural circumstances, airborne emissions from fire are not considered to be harmful to forest resources. Airborne emissions from woodland fires can, by themselves, however, have localized adverse impact on public health and welfare. Cumulatively, these emissions may also aggravate existing problems that occur on a broader scale.

In the southeastern U.S., a regional problem with haze and NAAQS attainment is becoming more evident with the passing of each year. While forest fire emissions are a very small contributor to this problem, forest managers will have to recognize this issue in their plans to use fire as a management tool.

Criteria pollutants. The NAAQS standards cover six "criteria" airborne pollutants: lead, sulfur dioxide, carbon monoxide, nitrogen oxides, ozone, and particulate matter.

These were specifically mentioned in the CAA. The lead and sulfur content of forest fuels is negligible, so these two forms of air pollution are not a consideration here.

Forest fires do emit some carbon monoxide (CO), from 20 to 500 lb. per ton of fuel consumed. This could be a concern if there were other persistent large CO sources in a fire's immediate vicinity. CO is a reactive pollutant, however, and its impact is soon dissipated by dispersion and oxidation when there is no atmospheric confinement.

Ozone. Forest fires emit moderate amounts of VOCs and small amounts of NOx. Fire related emissions become important only when other persistent and much larger pollution sources already present a substantial base load of these ozone precursors.

Historically, the state of Georgia has had trouble in attaining the NAAQS ozone standard only near Atlanta. This is changing, as recent revisions to that standard are proving more difficult to meet. The new ozone standard provides that attainment occurs when the average of the fourth-highest 8-hour running average values for three consecutive years does not exceed 0.08 ppm.

For the years 2000 - 2002, the Georgia Department of Environmental Protection (GEPD) reported the results of 21 ozone monitors. Summary data indicate that the counties represented by 17 of those monitors will have some problem meeting the new standard. Perhaps one-quarter of Georgia's counties would show a problem meeting the NAAQS ozone standard, if all were monitored. If ozone non-attainment does occur at that scale, much of the National Forest could become involved in programs to control emissions and restore NAAQS attainment. Figure 3 - 8 (map) and Table 3- 28 show the breadth and depth of the problem.

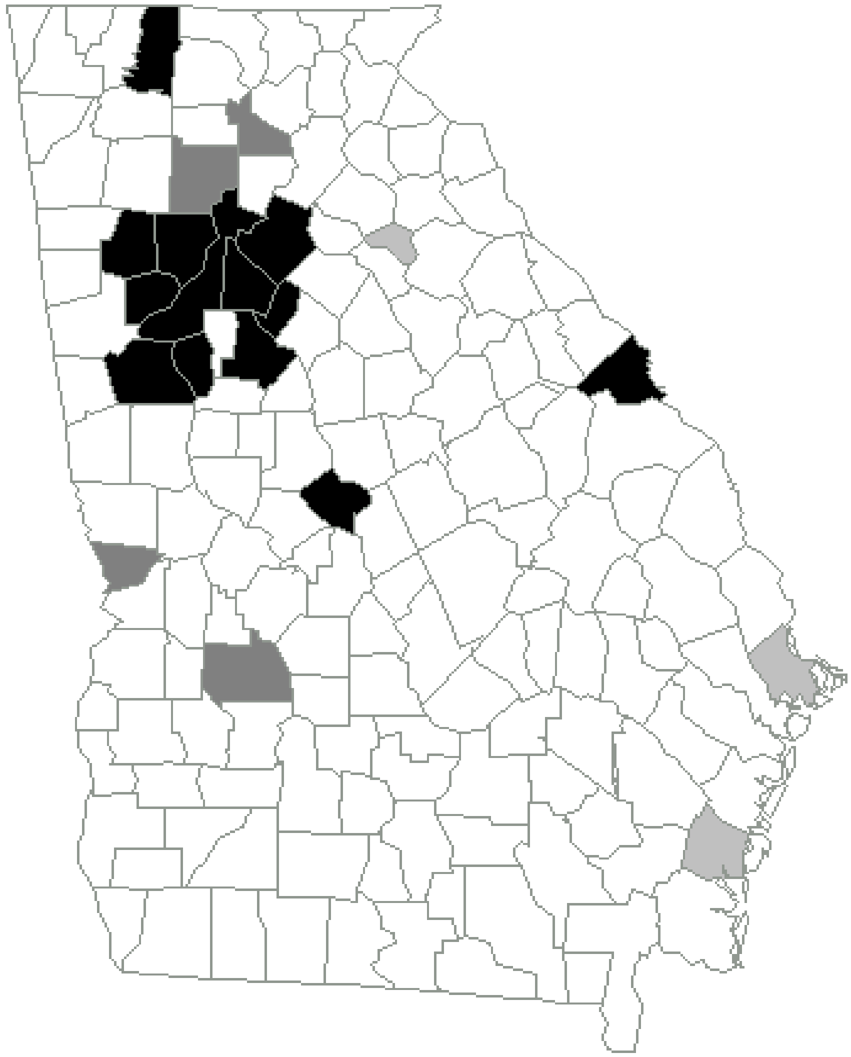
Particulate matter. Forest fires also emit moderate amounts of particulate matter. Most of this is in the form of fine particulates (PM2.5), made up of solid particles and droplets of condensed organic gasses, nearly all with a diameter at or below 2.5 microns. These small particles have a persistent impact on air quality because they are relatively non-reactive and remain suspended in the air for long periods. There are many sources of fine particulate emissions. While fire-related emissions are ephemeral, they become important when other larger and more continuous PM2.5 sources already present a substantial base load.

Historically, the state of Georgia has had little trouble in attaining the NAAQS standard for particulate matter. This too is changing, as recent revisions to the standard, which redirected its focus from small particulates (PM10) to fine particulates (PM2.5), are proving more difficult to meet. The new PM standard provides that attainment occurs when: 98% of the 24-hour samples show a PM2.5 concentration not exceeding 65 micrograms per cubic meter (ug/m3) and the annual average of these 24-hour sample values does not exceed 15 ug/m3, over a running 3-year period.

During the years 2000 – 2002, GEPD reported the results of 26 PM2.5 monitors. Summary data indicate that the counties represented by 19 of those monitors will have some problem meeting the new PM2.5 standard. Perhaps one-third of Georgia's counties would show a problem meeting the NAAQS PM2.5 standard, if all were monitored. If PM2.5 non-attainment occurs at that scale, again, much of the National Forest would become involved in programs to control emissions and restore NAAQS attainment. Figure 3 - 9 (map) and Table 3- 29 show the breadth and depth of the problem.

Statewide Trends in Ozone and PM2.5. A quick look at the information in Table 3- 28 and Table 3- 29 indicates one possible trend. Because ozone concentrations are heavily dependent on summertime weather patterns, it's difficult to infer any trend in that short period of the ozone record. The PM2.5 information may, on the other hand, indicate an improving trend. Most of the PM2.5 monitors were installed during or after 1999 so we'll have to wait a few more years to see if this is a lasting trend or an anomaly.

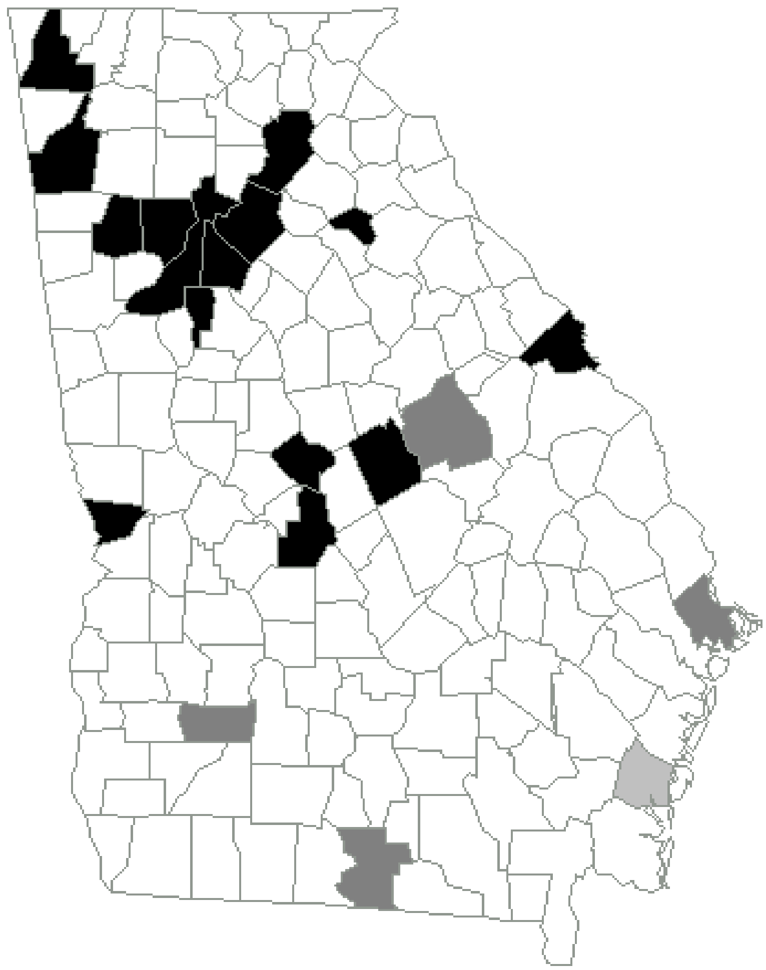
<u>Revised (8-hour) Ozone Standard</u>: To attain the standard, the 3-year mean of the 4th highest daily maximum 8-hr (running) average of continuous ambient air monitoring data over each year must not exceed 0.08 parts per million (EPA, 2002)



Counties where no monitoring data were reported (2000 - 2002).	Counties where monitoring data did not show a significant threat of ozone non-attainment.
Counties where the annual 4th highest 8-hr ozone concentration exceeds 0.08 ppm for at least 1 of 3 years even though the 3-year average did not exceed that value.	Counties where non-attainment threatens because the 3-year average of the annual 4th highest ozone concentration exceeds 0.08 ppm.

Figure 3 - 8. Summary Map of OZONE Monitoring Reported by the State of Georgia (2000 – 2002), From Statistics in Table 3- 28.

Revised Particulate Matter (PM2.5) Standard: This standard has two parts. One covers the maximum value of the individual 24-hour samples collected during the year. The other covers the annual mean of the 24-hour samples. To attain the 24-hour part of the standard, the 98th percentile of the distribution of 24-hour concentrations, for a period of 1 year, averaged over 3 years, must not exceed 65 ug/m3. To attain the annual mean part, the annual mean, averaged over 3 years (from population oriented monitors) must not exceed 15.0 ug/m3. (EPA, 2002).



Counties where no monitoring data were reported (2000 - 2002).	Counties where monitoring data did not show a significant threat of PM2.5 non-attainment.
Counties where the mean annual PM2.5 conc. exceeds 15.0 ug/m3 for at least 1 of 3 years while the 3-yr. avg. didn't exceed that value.	Counties where non-attainment threatens because the 3-yr. avg. of mean annual PM2.5 concentrations exceeds 15.0 ug/m3.

Figure 3 - 9. Summary map of PM2.5 monitoring reported by the State of Georgia (2000 – 2002), from statistics in Table 3- 29.

Table 3- 28 provides ozone monitoring data reported by the State of Georgia from 2000 through 2002. The summary data for specific years are from EPA web page "www.epa.gov/air/data" (1/6/2003). The 3-year averages (far right column) were calculated by the author. The following information is helpful in understanding the data presented in the table. Ozone monitors operate continuously, generally from mid-spring through mid-autumn, recording a mean concentration for each hour. As the data presented are 8-hour running averages (calculated from the base data), there are still 24 values for each day. Only one value per day (the maximum) is used for evaluating attainment of this standard. The data presented in this table represent only the 1st through 5th highest of roughly 230 values generated per year. The 4th highest value for each year and the 3-year average of those values (all highlighted) are critical for evaluating attainment of NAAQS. (EPA, 2003)

SUMMARY STATISTICS of Maximum Daily 8-Hour OZONE Concentrations Reported for each Year (unit = parts per million)

COUNTY	2000			2001			2002			3 - Year Average of 4th Highest Daily Maximum
	1st Highest Daily Maximum	**4th Highest** Daily Maximum	No. of Days with Maximum 8-Hour Value Exceeding Standard (0.08)	1st Highest Daily Maximum	**4th Highest** Daily Maximum	No. of Days with Maximum 8-Hour Value Exceeding Standard (0.08)	1st Highest Daily Maximum	**4th Highest** Daily Maximum	No. of Days with Maximum 8-Hour Value Exceeding Standard (0.08)	
BIBB	0.133	0.097	17	0.109	0.086	5	0.103	0.093	9	0.092
CHATHAM	0.094	0.079	1	0.078	0.067	0	0.086	0.065	1	0.070
CHEROKEE	0.078	0.070	0	0.087	0.075	1	0.113	0.089	8	0.078
CLARKE							0.123	0.084	3	0.084
COBB	0.110	0.107	17	0.095	0.088	5	0.112	0.100	12	0.098
COWETA	0.113	0.096	11	0.101	0.085	4	0.106	0.099	9	0.093
DAWSON	0.089	0.084	3	0.088	0.077	2	0.093	0.088	4	0.083
DEKALB	0.136	0.107	16	0.103	0.088	7	0.120	0.090	11	0.095
DOUGLAS	0.107	0.097	13	0.099	0.092	6	0.109	0.098	21	0.096
FAYETTE	0.137	0.100	9	0.096	0.084	3	0.104	0.088	6	0.091
FULTON	0.132	0.113	22	0.103	0.084	3	0.117	0.100	15	0.099
GLYNN	0.084	0.073	0	0.091	0.070	1	0.083	0.076	0	0.073
GWINETTE	0.123	0.100	12	0.108	0.080	2	0.103	0.089	7	0.090
HENRY	0.138	0.111	22	0.114	0.086	4	0.127	0.099	11	0.099
MURRAY	0.099	0.091	11	0.095	0.080	2	0.096	0.092	11	0.088
MUSCOGEE	0.104	0.094	7	0.081	0.079	0	0.098	0.078	2	0.084
PAULDING	0.092	0.088	6	0.091	0.085	4	0.107	0.099	11	0.091
RICHMOND	0.111	0.090	6	0.102	0.082	3	0.100	0.091	5	0.088
ROCKDALE	0.116	0.099	11	0.108	0.091	6	0.119	0.099	12	0.096
SUMTER	0.100	0.092	6	0.087	0.082	2	0.088	0.070	1	0.081
AVERAGE	*0.110*	*0.094*	*10*	*0.097*	*0.082*	*3*	*0.105*	*0.089*	*8*	*0.088*

Table 3- 28. Summary of OZONE Monitoring Reported by the State of Georgia (2000-2002)

COUNTY	SUMMARY STATISTICS of 24-HOUR PM2.5 Concentrations Reported for each Year (unit = micro-grams per cubic meter)									3 - Year Average	
	2000			2001			2002				
	98 th Percentile	Annual Mean	Number of Samples	98 th Percentile	Annual Mean	Number of Samples	98 th Percentile	Annual Mean	Number of Samples	Annual 98th Percentile	Annual Mean
BIBB	37	18.4	108	35	16.1	77	34	14.8	91	35	16.4
CHATHAM	34	16.1	102	32	15.3	101	25	12.8	111	30	14.7
CLARKE	40	18.5	92	51	17.5	100	28	15.0	106	40	17.0
CLAYTON	53	19.4	100	40	17.1	112	34	15.3	107	42	17.3
COBB	50	19.1	109	35	17.2	108	32	15.1	113	39	17.1
DEKALB	47	18.9	294	44	18.1	310	30	14.9	324	40	17.3
DOUGHERTY	38	16.6	107	36	14.6	107	31	13.8	105	35	15.0
FLOYD	46	17.9	99				32	14.6	109	39	16.3
FULTON	50	21.5	101	39	19.1	114	34	17.4	113	41	19.3
GLYNN	31	14.4	106	27	12.1	88	23	10.9	110	27	12.5
GWINETTE	44	19.4	53	42	15.4	43	33	15.3	57	40	16.7
HALL	39	18.1	102	33	15.5	113	29	14.6	108	34	16.1
HOUSTON	55	21.5	21	45	12.9	47	27	12.4	55	42	15.6
LOWNDES	32	15.6	54	30	12.1	52	33	11.8	48	32	13.2
MUSCOGEE	51	19.4	113	46	15.8	117	31	13.8	114	43	16.3
PAULDING	46	16.9	115	35	14.9	112	32	13.7	109	38	15.2
RICHMOND	42	17.3	103	32	15.0	96	27	14.4	107	34	15.6
WALKER	49	18.5	46				32	14.8	55	40	16.7
WASHINGTON	31	16.4	55	84	14.8	46	25	13.6	55	47	14.9
WILKINSON	39	17.5	107	39	17.0	102	31	13.9	105	36	16.1
AVERAGE	*43*	*18.1*	*N/A*	*40*	*15.6*	*N/A*	*30*	*14.1*	*N/A*	*38*	*16.0*

Table 3- 29. Summary of PM2.5 Monitoring Reported by the State of Georgia (2000 – 2002)

Table 3- 29, above, provides fine particulate monitoring data reported by the State of Georgia from 2000 through 2002. The entries for specific years are from EPA web page "www.epa.gov/air/data" (1/6/2003). The 3-year averages of the annual means and the estimated 98th percentiles (2 far right columns) were calculated by the author. The following information is helpful in understanding the data:

a. PM2.5 monitors operate for continuous 24-hour periods, generally every third day, for the entire year. Monitors set up with this schedule can provide up to 122 values per year. A few monitors are set up to operate daily, providing up to 365 values per year.
b. Monitors, suitable for operating large networks re PM2.5 attainment, have been developed just recently. Technical problems do reduce the number of available sample values.
c. Many of these monitors were installed early in 1999. The data available through EPA's "Air Data" webpage were pulled when data from the last months of 2001 had not yet been verified. Because of the "installation" and "verification" situations, data from roughly 6 months is under-represented in this summary. As air quality in these 6 months is typically better than average, the 1999 and 2001 summaries would portray slightly cleaner air if the data from the missing months were included.
d. EPA's "Air Data" webpage does not calculate the "98th percentile" statistic. While not shown for each year, these values were interpolated by the author at 75 percent of the scale from the 95th percentile to the 99th percentile.
e. While there are few problems with the 24-hour part of the PM2.5 standard, the data do show significant problems with the annual mean part. The columns containing these critical values are highlighted. (EPA, 2003)

Effects

An analysis reported in the Southern Appalachian Assessment (SAMAB, 1996) indicates that smoke from forest fires in the Southern Appalachian area may contribute as little as 1.5 percent of the regional airborne fine particulate budget. This may seem improbable; especially with the dramatic appearance of smoke plumes as they rise above the forest. The National Wildfire Coordinating Group reports, however, that the bulk of those plumes is made up of water vapor and carbon dioxide (~ 90 percent, by mass) (NWCG, 1985). Next comes carbon monoxide (~ 5 percent), then total particulates (~ 3 percent). (USFS, 1976). NWCG also reports that roughly 90 percent of total woodland fire particulate emissions is fine particulates (solid particles and droplets of condensed organic gasses, all with a diameter at or below 2.5 microns).

The earlier discussion on visibility, a Cohutta AQRV, credited sulfur related fine particulates with 70 percent of the impact on visibility. Soot and condensed organics cause about 20 percent of the impact. Considering that forest fires are only one of many sources of soot and condensed organics, it no longer seems improbable that forest fires may contribute as little as 1.5 percent of the regional airborne fine particulate budget.

Recently, the total annual amount of prescribed burning on the Forest, for all purposes, has averaged 30,000 acres. Some alternatives presented in the Plan call for prescribed burning that might increase that by 15 percent. Regardless of the Alternative, the proposal represents only a moderate change in an emissions source that is a very small part of the regional emissions budget. Emissions changes contemplated in the Plan are unlikely to drive any county into NAAQS non-attainment, unless conditions in that county are already ripe for non-attainment.

While management activities contemplated in this Plan have low potential to drive counties into NAAQS non-attainment, we must not conclude that prescribed burning projects can be done without concern for air quality. Current guidelines for individual projects or programs must still be followed. Also, if a nearby county falls into NAAQS non-attainment, the Forest Service must participate in the effort to resolve the problem.

If counties containing National Forest acreage go into ozone non-attainment status, the Forest Service must participate in resolution of the problem. The ozone problem will likely be one of individual bad days, generally in the summer. If the Forest (or the burning community as a whole) can continue at its relatively low rate of emissions, it will deal with the situation by accepting burning restrictions on the bad days.

If counties containing National Forest acreage go into PM2.5 non-attainment, the Forest must, again, participate in resolution of the problem. This, however, is not a problem of individual bad days. The PM2.5 problem is with the *annual mean* part of the standard. Where non-attainment occurs, the Forest Service must participate in development of plans to return counties to attainment status. If the Forest does not obtain an allocation of PM2.5 emissions when county emissions budgets are developed, provisions already existing under the NEPA process (plus some that will be developed under the CAA) can preclude the Forest from conducting prescribed burning projects.

MINERALS

Affected Environment

Mineral resource development on the Chattahoochee-Oconee National Forests has been minimal. The Forest Service manages mineral-related activities consistent with multiple-use management principles. The agency integrates the exploration, development, and production of mineral and energy resources with the use, conservation, and protection of other resource values.

Legal and Administrative Framework

Statutes, regulations, and Executive Orders guide policy toward mineral activities on National Forest System lands. Management direction for mineral resources is found in the following:

36 CFR 228, Subparts A (Locatable Minerals), C (Salable Minerals), and E (Leasable Minerals).

Minerals Leasing Act of 1920 – Provides for leasing of energy minerals (coal, oil, gas, oil shale), sodium, potassium and phosphate. The Bureau of Land Management (BLM) Department of Interior.

Minerals Act of 1947 – Authorizes disposal of mineral and vegetative materials through a sales system on public lands of the United States. The law also provides for free use of these materials.

Mineral Leasing Act for Acquired Lands of 1947 - Extends the provisions of the mineral leasing laws to Federally owned mineral deposits on Acquired status lands in the National Forest System. It requires the consent of the Secretary of Agriculture prior to the BLM issuing a lease.

Mineral Resources On Weeks Law Lands of 1917 – Permits the prospecting, development, and utilization of mineral resources of lands acquired under the Weeks Act of 1911.

Public Law 167 of 1955 – Officially known as the Multiple Use Mining Act – This legislation defined common varieties of mineral materials and distinguished them from "uncommon" varieties.

Lands Not Available for Mineral Leasing or Permit

According to *36 CFR 228.102(b) Subpart E*, the following National Forest lands are not available for the Forest to lease or issue mineral permits on:

- Lands withdrawn from mineral leasing by Congress or by an order of the Secretary of Interior.

- Lands Recommended for wilderness allocation by the Secretary of Agriculture.

- Lands designated by statute as wilderness study areas, unless oil and gas the statute designating the study area specifically allows leasing.

- Lands within areas allocated for wilderness or further planning in Executive Communication 1504, Ninety-Sixth Congress (House Document 96-119), unless such lands subsequently have been allocated to uses other than wilderness by an approved Forest land and resource management plan or have been released to uses other than wilderness by an act of Congress.

Resource Protection Measures

Locatable Minerals

36 CFR 228, Subpart A, requires the mining claimant to file an operating plan or notice of intent for proposed mining activities. The plan must include the name and address of operators, a map of the location of the proposed surface disturbance, access routes, operating period, and a reclamation plan. The District Ranger will work with the claimant to assure that NEPA analysis on the proposed plan or notice of intent identifies the needed environmental protection stipulations and consistency with Forest Plan standards and guidelines. Locatable minerals include the metallic ores (e.g., gold, silver, lead, iron, copper, etc.), uncommon varieties of mineral materials, gemstones, and some industrial minerals (e.g. barite, zeolites).

Locatable mineral development is authorized by the 1872 Mining Law that applies solely to Public Domain status lands. All of the land within the Chattahoochee-Oconee National Forests has Acquired status. Thus, there can be no mining claims located on the Forest, and no mineral exploration or development under the 1872 Mining Law can occur.

Leasable Minerals

When locatable minerals occur on Acquired status lands, they become leasable. The BLM is the agency a person or company must go through to get a lease for any of the leasable minerals. The process involves making an application for a Prospecting Permit with the Eastern States Office, BLM, which will make a case file, serialize the application, and forward it the Forest Service when the parcel in question is on National Forest System land. The Forest will contact the applicant to get the basic information on the proposed prospecting. Once the miner defines his/her proposal, the Forest will do the requisite environmental analysis (NEPA) to determine if the Forest Supervisor should recommend consent to issuance of the permit, and if so, under what operating stipulations. If it is determined that a Prospecting Permit is appropriate, consent will be given to BLM, and they will issue the permit. These permits are issued for a term of two years with the possibility of a 4-year renewal. If the miner thinks a commercial deposit has been discovered, he/she will apply to the BLM for a 20-year Preference Right Lease. The BLM will make an economic analysis to verify the commercial potential of the find. If the BLM believes the deposit can be mined, milled, and sold at a net profit, they will execute a Preference Right lease application and send it to the Forest Service for consent. Even though a commercial deposit of minerals has been found, the Forest Service can deny consent to issue the lease if it finds that the environmental impacts of the proposed mining would unduly degrade the other surface resources and could not be adequately mitigated. The Forest Service consent will be based on another NEPA analysis that looks at the specifics of the proposed mine.

Leasing for oil and gas is handled in a slightly different manner where areas of the Forest with leasing interest or potential is analyzed using the “Reasonably Foreseeable Development Scenario.” This is a study that looks at the long-term (10-15) years potential for oil and gas development in the study area and projects the number of wells that could be drilled. The environmental analysis will disclose the acres of possible surface disturbance, quantitative impacts to air and water quality, and anticipated impacts to other surface resources (i.e., recreation, wildlife, visual quality). The NEPA will determine which areas can be leased and under what stipulations. Once the decision has been made that areas of the Forest can be leased for oil and gas, the consent for leasing them along with the associated stipulations (i.e., no surface occupancy, controlled surface use, standard lease stipulations) will be sent to the BLM. Once an oil and gas lease is issued, a second stage of NEPA would have to be completed before the lessee can occupy the surface and drill a well. The applicant would have to request an Application for Permit to Drill (APD) from the BLM. An APD contains the Surface Use Plan of Operations (SUPO) and the technical downhole-drilling plan. The Forest Service will employ NEPA to analyze the SUPO and come up with site-specific surface use stipulation that will be made a part of the APD when issued. Part of the SUPO is the reclamation plan. Each operator proposing to drill on a lease must have a bond.

The Chattahoochee-Oconee National Forest has low potential for containing hydrocarbon resources. In the past 15 years, there have been no requests for oil and gas leases on the Forest.

Mineral Materials

Mineral materials, or common variety minerals, are generally low unit value deposits of sand, gravel, clay, fill, stone and riprap. These materials are used in road construction, landscaping, and as building materials. These can be given through free use to governmental agencies (county/state highway department) for public projects. They can be sold to individual and private companies through negotiated or competitive bidding. Any sale must be made at no less than fair market value as determined by an appraisal. Sale of these materials is at the discretion of the Forest that can choose not to do so as determined by the Line Officer. Extraction of these materials from the National Forest System Lands is at the discretion of the Forest Service.

Environmental Consequences

Management area prescriptions are common to all alternatives and have little impact on the number of acres available for mineral activity.

Locatable Minerals

Since the 1872 Mining Law does not apply to the Forest, and there are no known areas with geologic potential for discovery of locatable minerals, there can be no impacts.

Leasable Minerals

Based on historic and current activities, there is no probability for energy leasing and some low level expectation for hard rock prospecting demand.

In the last 10 years, the Forest has administered a hard rock lease for amethyst (purple colored quartz) that has since expired. The area of disturbance was small (1 acre disturbed) as was the volume of material extracted. During the past decade, one person inquired about getting a prospecting permit for limestone, but never followed up on it. In the period covered by this Plan, it is anticipated that the Forest will receive one request for a prospecting permit, probably for a non-metallic material like quartz or limestone. If the applicant follows through on the permit, the anticipated exploration method would involve some core drilling that would go to a depth of up to 100 feet. A portable, truck mounted drill would be used. The drilling would take samples to test for quality/purity of the rock. Access to the drilling sites would use available roads to the maximum extent, but some cross-country travel to some drill sites might be necessary. The dust associated with drilling and vehicle travel would temporarily decrease local air quality. Noise from the activity could displace nearby wildlife for a short time (drilling a 100-foot core could take up to a couple of hours). After drilling is complete, the drill tailings will be put back down the hole and tamped down. A negligible amount of soil will be lost from the area around the drill hole until revegetation is complete. If initial surveys for PETS and cultural resources reveal that they are present on the proposed site, the drill location would be moved to eliminate possible impacts.

Salable (Common Variety) Minerals

These mineral materials may be sold for fair market value in all of the proposed alternatives. While no new mineral material sites are being proposed for development at this time, it is likely that during the period covered by this plan some will be needed to meet either in-service or public demand. The environmental effects of establishing a gravel or borrow pit includes scraping off and stockpiling the topsoil for later use in reclamation of the site. There will be some soil loss from wind and water runoff. A localized decrease in air quality will result from dust released from mining the material as well as from vehicle traffic to and from the pit. Vehicle emissions will also temporarily lower local air quality. Wildlife and flora will be displaced from the pit site itself. Noise associated with the vehicles and equipment operating in the pit area and access road may disturb local fauna. Depending on the specific location of the site, visual quality could be impaired. However, vegetative screening can usually be used to mitigate this. Prior to any surface disturbance of the site, the requisite surveys for PETS and cultural resources will have been done to avoid impacting them. If PETS and/or cultural resources are present and mitigating measures will not be adequate to protect them, then the site will not be developed.

Cumulative Effects

There are no known cumulative effects.