Summary of Key Findings

The assessment of terrestrial ecosystems focused on forest health and on terrestrial plant and animal resources. Assessment topics included broad landscape habitat and landcover patterns, federally listed threatened and endangered species, rare species and communities, popular game species, possible national forest old-growth forest, oak decline, exotic pests and diseases, biological diversity, fragmentation, black bear, genetic conservation programs, and neotropical migrant birds.

The information provides a framework for land managers to develop natural resource management objectives that can contribute to sustaining wildlife and plant habitats in the Southern Appalachian Assessment (SAA) area. The information and opportunities identified in the SAA expand the perspective of landowners beyond their own administrative boundaries. For example, most national forests are preparing to begin the first regular periodic revision of their forestland management plans. Decisions on the amounts of various habitats on national forests, and management direction to sustain those habitat levels, will be made during the revision process. The SAA information should help to directly feed that process, and SAA resource elements and parameters should be considered in making forest plan decisions. Private land is vital to the future of some wildlife and botanical resources.

The terrestrial report was designed to answer eight questions, four pertaining to wildlife and botanical resources and four pertaining to forest health. This chapter lists the questions and provides a summary of findings that helps to answer each question. More detailed discussions of these findings can be found in the previous chapters.

Identification of Wildlife and Plant Species and Important Habitats in the SAA

Question 1:

Based on available information and referenced material, what plant or animal species occur within the SAA area, and what are their habitat associations?

More than 20,000 species of plants and animals may occur in the SAA area. A complete list was not prepared; instead, the focus was on species of biological and social importance. Important broad classes of vegetation and landcover, as well as rare communities, were included in the assessment to provide a comprehensive look at habitats.

A “short list” of 472 plant and animal species was identified for focus in the SAA. This list includes 225 plants, 155 invertebrates, 47 birds, 23 amphibians and reptiles, and 22 mammals. The total includes 51 federally listed T&E species, 366 species whose viability is of concern (VC species), 38 species of high interest to natural resource managers and the public, 10 game species, and 7 other species with demanding habitat requirements.

Sixteen land cover types were analyzed: nine forest cover types, plus agricultural pasture, agricultural cropland, grass/forb early successional, developed, barren, wetland, and water. For each of the forested land cover types, four successional classes were recognized.

Thirty-one rare community types occur in the SAA area.

Habitat associations were determined for 442 of the 472 species on the short list and documented in a species habitat matrix.

Information from this work resulted in the grouping of species into 19 species groups based on habitat associations and the development of broad-scale spatial habitat suitability models for selected species groups. The assessment focused on these 19 species groups.

The Status, Trends, and Spatial Distribution of Terrestrial Habitats and Wildlife and Plant Populations

Question 2:

What are the status, trends, and spatial distributions of populations and habitats in the SAA area for:

Federal T&E species?

VC species (regionally sensitive)?

Unique or underrepresented communities (including areas with potential to become old growth)?

Wildlife species that are hunted, viewed, or photographed?

Species for which there is high management/public interest?

Species having special or demanding habitat needs?

Species considered to be true ecological indicators?

Status and trends of SAA terrestrial ecosystems

Distributions of the 26 million acres of forest in the Southern Appalachians are:

Broad Forest Type	Percent
Deciduous	67.3
Mixed	15.4
Evergreen	17.3

Forest type group	Million Acres	Percent of SAA total
Oak	17.6	47.1
Southern yellow pine	3.8	10.1
Mixed pine-hardwood	3.2	8.6
Mixed mesophytic hardwood	3.1	8.4
W. pine-hemlock-hardwood	0.8	2.2
W. pine-hemlock	0.7	1.8
Northern hardwood	0.6	1.6
Bottomland hardwood	0.4	1.2
Montane spruce-fir	0.09	0.2

Land distribution by ownership:

Forested Land Ownership	Million Acres	Percent of SAA Forest
Private	20.2	77
National forest	4.5	17
National park	0.82	3
State	0.531	2
Other federal/Indian	—	1

Total forest acres have decreased by 2 percent since the mid-1970s, and based on past land use trends, this decrease in forest acres is expected to continue at the same pace through the year 2010. This loss is occurring primarily in private forest for development and conversion to other agricultural land uses.

Land distributions by successional class:

Successional Class	Percent of Forest Area
Early	8
Sapling/pole	22
Middle	52
Late	18

Class Percent Change Since Mid-1970s:

Successional Class	Total SAA	NF Land	Nonindustrial Private Land
Early	+26	-4	+28
Sapling/pole	-27	+12	-27
Middle	+3	-6	+5
Late	+42	+34	+50

National forests contain approximately 1.1 million acres that could become old-growth forest. Decisions on which of these acres will be targeted for management as old-growth communities will be made during the forest

planning process.

Acreages occupied by nonforest cover types are:

Cover Type	Million Acres
Pasture land	6.5
Early successional	1.5
Cropland	1.3
Developed	1.2
Water, barren, & wetlands	0.7

Since the early 1980s, large urban areas have grown by 35 percent, and small urban areas by 53 percent. Cultivated croplands have diminished by 25 percent, while noncultivated croplands (orchards, etc.) have increased by 9 percent. Grass pasture has diminished by 3 percent, while legume pasture has increased by 38 percent.

Status of rare communities

Thirty-one rare community types were identified in the SAA area. These types are important for sustaining current populations of federally listed species and VC species. Almost 75 percent of the terrestrial rare plant and animal species and their associated habitats are found in one or more of the 31 rare communities, which occur on less than 1 percent of the SAA land area.

A total of five rare forest communities was identified. About 90,100 acres of montane spruce-fir forest exist in the SAA area. About 62,600 acres (69 percent) are in national parks, and additional acreage is in national forests. More than 80 percent of known beech gap forests is on public land. These communities, therefore, can be adequately managed by public agencies. However, approximately 60 percent of the occurrences of mountain longleaf pine woodlands, Table Mountain/pitch pine woodlands, and Carolina hemlock forests is on private lands.

Ten rare, nonforest communities (calcareous cliffs, calcareous woodlands and glades, caves, granitic flatrocks, mafic and calcareous fens, mafic cliffs, mafic woodlands and glades, mountain lakes, sinkholes and karstlands, and wet prairie) occupy less than 1 percent of the total SAA area. About 95 percent of the occurrences for these communities is on private lands. Public land contains 75 percent of the occurrences of 12 rare communities (beaver ponds and wetland complex, boulderfields, granitic domes, grassy balds, heath balds, high-elevation rocky summits, mountain ponds, river gravel and cobble bars, sandstone cliffs, spray cliffs, swamp forestbog complex, and talus slopes). Four rare, nonforest communities (seasonally dry sinkhole ponds, serpentine woodlands and glades, shale barrens, and sphagnum and shrub bogs) are equally divided between public and private ownerships.

Summary of occurrence data for federally listed and VC species

The determination of the status of rare species was an important part of the assessment. The list of 51 federally listed species and 366 VC species was compiled from information from the U.S. Fish and Wildlife Service, the state natural heritage programs, and peer review of the initial species lists. Habitat relationships were determined for the species in this category, with the exception of 30 species. These species-habitat associations received peer review, but much information about them is intuitive.

About 75 percent of these species is associated with small microhabitats. These species, therefore, are not suited for broadscale analysis of habitat suitability. For these species, the analysis of current status focused primarily on their spatial occurrences, based on records from state natural heritage programs.

Species occurrences in the SAA area are:

Type	Number
T&E animal	251
T&E plant	537
VC animal	908
VC plant	2,335

Eleven of the 19 species groups contain T&E species, and 17 of the 19 include VC species.

The distribution of occurrences for T&E and VC species by ownership class is:

Ownership Class	T&E Species	VC Species
Private	493	1,802
National forest	154	952
National park	90	315
State	47	113
Other federal	4	53
Total	788	3,243

Private land contains the largest number of occurrences of federally listed species associated with five communities:

- Caves (101 of 129 occurrences)
- Mountain bogs (54 of 88 occurrences)
- Fen or pond wetlands (6 of 8 occurrences)
- High pH or mafic habitats (60 of 79 occurrences)
- Mixed mesic habitats (55 of 90 occurrences)

National forests contain the largest number of federally listed species associated with two communities:

- Rock outcrop and cliff habitats
- Southern yellow pine (active red-cockaded woodpecker colonies)

Nonindustrial private land contains the largest number of occurrences for VC species in five communities:

- Caves (318 of 360 occurrences)
- Mountain bogs (213 of 310 occurrences)
- Fen or pond wetlands (40 of 46 occurrences)
- High pH or mafic habitats (222 of 371 occurrences)
- Rock outcrop and cliff habitats (275 of 513 occurrences)

National forests contain the largest number of occurrences for VC species associated with spray cliffs (45 of 88 occurrences).

Landscape habitat suitability analysis

To identify broadscale habitat patterns in the assessment area, spatial analysis of habitat suitability was conducted for 10 of the 19 species groups. These species groups were selected because their habitat associations lend themselves to broad, landscape-level analysis using remote sensing data. Suitability analysis was not attempted for species groups with either highly specific habitat requirements (e.g. spray cliff species, high pH, or mafic species) or very general requirements (e.g. habitat generalist species). Six habitat suitability products were developed:

- Area-sensitive, mid- to late-successional deciduous forest species
- General high-elevation forest species
- Seep, spring, and streamside species
- High-elevation bald/early successional species/early successional grass-shrub species
- Closed canopy deciduous forest species
- High elevation spruce-fir/northern hardwood forest species

Habitat suitability also was modeled for black bears.

These landscape-level models represent only gross habitat suitability based on general habitat requirements. Results of the suitability models provide a regional picture of habitat potential.

- Spruce-fir/Northern Hardwood Habitats (estimated 184,000 acres)

Potential habitat for 23 associated species (4 T&E and 18 VC). About 47 percent of this habitat is in national parks, and 32 percent in national forest. Of 41 occurrences of T&E species associated with this habitat, 15 are on national parks, 13 are on nonindustrial private land, and 11 are on national forests. Of 102 occurrences of associated VC species, 73 are on national parks or national forests. Outlook: uncertain, due to air pollution and exotic pests. A downward trend is expected over the next 15 years.

- High Elevation Balds (estimated 27,000 acres)

Habitat for 18 associated species (4 T&E and 13 VC). About 73 percent of this habitat is on private ownership; 25 percent is in national forests. About one half of these sites is larger than 20 acres. Of 58 occurrences of T&E species associated with this habitat, 37 are on private land, and 14 on national forest land. Of 297 occurrences of VC species, 119 are on national forests, 37 are on national parks, and 129 are on nonindustrial private land. Outlook: stable in extent, but possibly declining in quality due to air pollution.

- General High Elevation Forest Habitats (estimated 350,000 acres)

About 150,000 acres (42 percent) are in tracts larger than 5,000 acres, with the potential to support all seven of the associated T&E and VC species. Of these large tracts, 74 percent of the acreage is in national parks, and 17 percent in national forests. Outlook: uncertain, due to the effects of air pollution and exotic pests; downward trend expected over the next 15 years.

- Early Successional Habitats (estimated 1.5 million acres)

Ten T&E and VC species are associated with this habitat. Approximately half of the occurrences of this habitat is in tracts 20 acres or

larger in size; 97 percent of the total acreage is private land, while 2 percent is national forest.

- Riparian Habitats (estimated 2.3 million acres, of which 1.5 million acres are in forest riparian habitat)

A total of 49 species are associated with this habitat, of which 10 are T&E. National forests contain 37 percent of the occurrences for 12 of these species, national parks contain 16 percent of the occurrences for 8 species, and nonindustrial private lands contain 42 percent of the occurrences for 16 species.

- Mid- to Late-Successional Deciduous Forest Habitats (estimated 17 million acres)

There are 66 species associated with these habitats, not including species identified in other species groups. Approximately 71 percent of these habitats occur on private land, while 23 percent are in national forests. Five T&E species are associated with these habitats; 61 percent of the occurrences of these species are on nonindustrial private lands, while 23 percent are on national forest.

A total of 58 VC species in four species groups are associated with these habitats. These include 44 occurrences of three species in mid- to late-successional deciduous forest species group (66 percent of which are in national forests), one occurrence of a single species in the bottomland species group (on state land), 452 occurrences of 37 species in the mixed mesic forest species group, and 235 occurrences of 12 species in the mixed xeric forest species group.

- Habitats for Area-Sensitive Species Associated with Mid- to Late-Successional Deciduous Forests (estimated 15.8 million acres)

Slightly more than half of this habitat, 8.2 million acres, is in tracts larger than 5,000 acres in size; these larger tracts are thought to have the potential to support all 16 of the bird species in this species group. Approximately 51 percent of these larger tracts is on private land, while 39 percent is on national forests. Approximately 66 percent of this habitat type is considered to be forest interior habitat; the relative proportion of interior by ownership is 97 percent on national parks, 90 percent on national forests, 58 percent on private land, and 49 percent on other federal. Outlook: overall habitat acres in large tracts, and associated forest interior habitat, will continue to decrease due to loss of forestland to other uses. This decrease will occur primarily on private lands.

- Black Bear Habitat (estimated 21 million acres)

Fifty-one percent of this acreage has a total road density less than 1.6 miles per square mile. Approximately 75 percent of the total habitat acreage is on nonindustrial private land, while 19 percent is in national forests. Suitable bear habitat is found on 91 percent of national forestland, 84 percent of state land, 78 percent of national park land, and 51 percent of private land. Outlook: bear habitat will remain stable on public land, but will decrease on private land due to continued loss of forested habitats and increased development.

Status of game species

Estimates of current (1995) and historical (1970) population densities for 10 major game species were provided by state wildlife agencies included in the assessment area. Density estimates were derived from harvest and survey data where available, as well as from professional judgement by appropriate state agency biologists.

White-tailed deer and eastern wild turkey densities were generally low to medium for most of the SAA area, with higher densities in a few counties. Populations of both species have increased greatly across the entire SAA area since 1970. Densities for these species are highest on nonindustrial private land, national forests, and state land. The outlook is for the population increase to level off and become stable.

Black bear population densities have generally increased since 1970. Bears are present at low to medium densities in parts of the SAA area, particularly on national forest and national park land. The species is absent in many areas.

Ruffed grouse population densities are generally at medium to low in areas where the species occurs (generally in areas with moderate or higher elevations). National forests and national parks contain the highest densities. Populations have declined since 1970, possibly due to a decreased proportion of acres in the sapling/pole successional class which grouse favor. National forests will continue to provide the major source of grouse habitat and hunting opportunity. However, both grouse populations and the quality of their habitat are expected to decline over the next 15 years.

The population density of bobwhite quail has decreased markedly in the SAA since 1970. Densities are generally lower on national forests and national parks than on other ownerships. The higher densities for quail are associated with greater proportions of the landscape in agriculture and grass/shrub habitats. Quail populations will continue to decrease due to shifts in agricultural practices and continuing isolation of suitable habitat.

Future Needs and Management Opportunities

Question 3:

What habitat types, habitat parameters, and management activities are important in providing the distribution and types of habitats to maintain viable populations and/or desired habitat capability for the "short list" of wildlife and plants?

And

Question 4:

Based on our current knowledge of ecological unit land capabilities for the Southern Appalachians, what are the general habitat mixes/conditions needed to:

Recover T&E species?

Conserve populations of VC species?

Maintain the existing species and community diversity that will not result in the loss of viability for any plant or animal species (in the context of the entire SAA region)?

Provide sustainable populations of species at desired levels on national forests?

Rare Communities

The rare communities are the key to conserving rare plant and animal species in the SAA area. About 84 percent (43 of 51) of the terrestrial T&E species is associated with rare species community groups and streamside habitats. These habitats occur in less than 1 percent

included in the body of the report. The rare communities are:

- Cave communities
- Mountain bog communities
- Fen or pond wetlands
- High-elevation balds
- High pH or mafic habitats
- Rock outcrop and cliff habitats
- Montane spruce-fir forest
- Seeps, springs, and streamside habitats
- Mountain longleaf forests

Broad-scale Habitat Types

In addition to conservation of rare communities, management strategies should continue to provide:

- Mid- and late-successional deciduous forests (including mixed pine-hardwood forests), particularly in tracts larger than 5,000 acres
- Early successional habitats, with appropriate sizes and distribution
- Black bear habitat
- Oak hard mast capability

The Changes in SAA Forest Vegetation from Natural Processes and Human-Caused Disturbances

Question 5:

What changes or trends in forest vegetation or soil productivity are occurring in response to human-caused disturbances or natural processes?

Currently, 70 percent of the land in the Southern Appalachians is forested. Over three-fourths of that forest is privately owned. About 17 percent of the forest is in national forests and 3 percent is in national parks. Oaks in combination with other species dominate the stands on almost half of the forestland. Mixtures of pine and hardwoods dominate on 12 percent, and southern yellow pines dominate on 4 percent of the forestland.

Forest acreage has decreased by about 2 percent since the mid-1970s. A slow rate

of decrease in forest acreage is expected to continue through the year 2010. Losses of forestland for more intensive human uses such as road and home construction are partially offset by natural reversion of pasture and cropland to forest. Clearing of forest for development or agriculture occurs primarily on private land.

Oak is becoming increasingly susceptible to a decline brought on by the combined effects of maturity, drought stress, gypsy moth defoliation, and root disease. Fir, hemlock, beech, and dogwood are being lost to exotic insects and diseases, Table Mountain pine is failing to regenerate after bark beetle attacks because of the absence of fire, and spruce-fir stands appear to be in decline. Timber harvests and prescribed burning on some public land have resulted in the regeneration of shade-intolerant pines and hardwoods. Lack of active management in other stands has led to the development of dense understories, and to the senescence of overstory trees of some species.

Past land uses and atmospheric deposition have reduced soil productivity in some places. Abusive logging practices and cycles of forest clearing, crop cultivation, abandonment, and reforestation caused soil erosion and reduced soil productivity in the 19th and early 20th centuries. Effects of atmospheric deposition are complex and difficult to measure with precision. Nitrate deposition has a fertilizing effect, but it also can acidify soils with low buffering capacities, and excessive amounts can adversely affect plant health. Reductions in soil productivity attributable to atmospheric deposition have not been fully demonstrated in the Southern Appalachians.

The biggest vegetative trend in the study area is toward a reduction in stocking of oaks and increases in stocking of maples, yellow-poplar, blackgum, and eastern white pine. The composition of future stands will be strongly influenced by timber harvesting practices and the presence or absence of prescribed fire. Current rates of ecosystem disturbance appear to be low when compared to rates estimated for regimes that existed prior to settlement of the area by Europeans and for regimes in the late 19th and early 20th centuries.

Question 6:

What are the potential effects of the presence or absence of fire on forest health?

Fire is perhaps the most common form of major natural disturbance in most of the ecosystems of the Southern Appalachians. Fire is particularly important in systems dominated by southern yellow pine, and its ecological effects in those systems are well understood. Effects on xeric deciduous forests also are important but are less well understood. Fire may be a major factor in the development of oak forests on upland sites.

A role for fire in the development of oak regeneration has been demonstrated in the Coastal Plain, the Piedmont and Cumberland Plateaus, and the Interior Highlands, and one would expect a similar role for the Southern Appalachians. Thinning, grazing, or light burning appears to increase the amount of oak regeneration beneath maturing stands of mixed hardwoods. Periodic fire probably also checks plant succession in oak forests, because later successional species, such as red maple, have low resistance to fire damage. Thus, fire may be useful in slowing or stopping the current ecological trend from oak domination to domination by more shade-tolerant species.

In the absence of fire, two rare forest communities in the Southern Appalachians–mountain longleaf pine woodlands and Table Mountain pine-pitch pine woodlands–are being replaced by hardwoods and loblolly pine. The endangered red-cockaded woodpecker is associated with mountain longleaf pine woodlands in northeastern Alabama and northwestern Georgia. Table Mountain pine has cones that open only when exposed to high temperatures from fires. Fire exclusion will lead to the continued decline of this community.

Other forest types and plant communities in which fire is important for regeneration and maintenance are: red spruce-Fraser fir, yellow birch boulder fields, high-elevation red oak, montane oakhickory, white pine, chestnut oak, dry to mesic oak-hickory, xeric shortleaf pine, xeric Virginia pine, heath balds, grassy balds, ultramafic barrens, and bogs.

Thus, prescribed forest burning appears to promise many potential benefits for ecosystems

in the Southern Appalachians. Additional information is needed on its precise effects in the mountains, and on the risks associated with its use. Prescribed burning is considerably less common in the Southern Appalachians than on the Piedmont Plateau and the Coastal Plain of the South.

The Effects to SAA Forest Ecosystems from Native and Exotic Pests

Question 7:

How is the health of the forest ecosystem being affected by native and exotic pests?

Many important tree species in the Southern Appalachians are being severely affected by attacks from native and exotic pests. Effects of air pollution are less certain than those of pests, but they are potentially quite serious.

Flowering dogwoods are imperiled by dogwood anthracnose. In tests of 300 seedlots, little resistance to the disease was identified. Dogwood anthracnose has been found in every county in the Southern Appalachians, and all the flower dogwoods in some stands have already been killed. Likelihood of infection increases with elevation and amount of overhead shade. The prognosis for the species is not good.

Similarly, the futures of Carolina hemlock and eastern hemlock are clouded by the hemlock woolly adelgid. Individual trees can be protected with insecticides, but survival prospects for unprotected trees are not good. Loss of hemlocks could have severe ecological effects in riparian zones, where they are now common.

Since its presence was first reported in the Southern Appalachians in 1957, the balsam woolly adelgid has killed large numbers of Fraser firs. The adelgid is now found throughout the range of Fraser fir, and is resistant to climate-caused mortality as well as native and introduced predators. Thus, the long-term prognosis for Fraser fir is uncertain. A spruce-fir decline has also been reported in the Southern Appalachians, but it has not been well documented.

Butternut is under attack by the butternut canker. Trees infected with the canker eventually are killed, and very limited resistance has been found. Butternut trees on national forests are being protected from logging, but many private landowners have cut their merchantable butternuts to get some income before the disease strikes.

The loss of the American chestnut to chestnut blight is a well-known story. The ecological effects of the loss of this species were large and may still be occurring. The disease also reduced Allegheny chinquapin to a brush species.

American elms in the forest are killed by Dutch elm disease, but the effects are less serious than in urban shadetrees. The importance of American elm in forest ecosystems is not known.

Table Mountain pine is disappearing from the Southern Appalachians. Death is often caused by bark beetles, but the species is not reproducing because fire is being excluded.

Southern pine beetle outbreaks occur periodically in the Southern Appalachians. The outbreaks kill Table Mountain and other southern yellow pines.

Oaks make up the most common species group in the study area. A combination of factors has made them more important than in the past. Oak decline and gypsy moths are likely to decrease the importance of oaks.

Oak decline is caused by many factors, including diseases, advancing tree age, and insect damage. Oak decline has been reported by forest workers for more than a century, but the damage appears to be accelerating. The vulnerability of a stand to oak decline appears to increase with tree size, tree age, and oak basal area in the stand. Incidence of oak decline is only about half as frequent on private as on public land. Among national forests, those in North Carolina and Virginia have highest incidence.

Introduced to North America around 1869, the European gypsy moth has moved southward through the Appalachians. It is now common in northern Virginia. Control efforts have produced mixed results. Oak leaves are a favored food, and defoliation of oaks by this flightless insect makes the trees more susceptible to oak decline.

The Asiatic gypsy moth poses an even greater threat because adult females can fly and because this species attacks a much wider range of plant hosts. In 1995, Asiatic gypsy

moths were found in two counties in North Carolina. Both these infestations were massively treated at great cost. Eradication of this species while populations are small and their range is limited is paramount to control.

Introductions of exotic plant species have caused significant disruption of some parts of the Southern Appalachian ecosystems. Extensive programs may be needed to manage, control, or eradicate these species. Symptoms of ozone damage are common on the foliage of trees in the Southern Appalachians. At a minimum, ozone exposure stresses forest communities. In combination with other stress factors such as drought and insect attacks, its effects may be magnified. There is some evidence that ozone damage has caused some growth loss to trees in northern Virginia and northern Alabama and Georgia. Some plant species appear to be more sensitive to ozone exposure at high than at low elevations. There is little evidence, however, that ozone has a strong effect on spruce or fir at high elevations in the Southern Appalachians.

Sulfate and nitrate deposition appear to be greatest in the northern tip of the study area, and at the highest elevations. Heavy deposition of these materials has the potential to acidify soils at high elevations, reducing their productivity and altering stream chemistry.

The Effects of Current and Past Management Practices on the Health and Integrity of Forest Vegetation

Question 8:

How are current and past management practices affecting the health and integrity of forest vegetation in the Southern Appalachians?

Management of the area's national forests in the first half of the century concentrated on reforestation of cutover land, watershed improvement, erosion control, and fire protection. Vigorous regrowth, restoration of watersheds, and expansion of wildlife populations were obvious and satisfying results. As timber inventories increased, selective logging occurred across the region (Yarnell 1995).

Selective logging failed to regenerate the desired tree species, so the Forest Service began to rely upon even-aged management, primarily with clearcutting, in the 1960s. This practice created a mosaic of relatively small even-aged stands across the landscape. Other management practices included favoring yellow pine over hardwoods in some places through site preparation and planting, and a limited amount of prescribed burning. The general policy of extinguishing wildfires was continued.

In response to public objections, the Forest Service has severely curtailed its use of clearcutting, and it adopted a general policy of ecosystem management in 1992. Today, prescribed burning is used to retain rare communities, enhance wildlife habitat, and reduce fuel loadings that could lead to catastrophic wildfires. Nevertheless, prescribed burning is not common in hardwood stands in the Southern Appalachians. Current management approaches have not been in place long enough to evaluate the results objectively.

The Chapter 3 of the SAA Social, Cultural, and Economic Technical Report (1996) has three key findings related to management practices:

1. On average, national forestland is at higher elevations and is less productive than private land in the region. National forest stands are logged less frequently, so they have higher average timber inventory per acre, less removals, less growth, and slightly higher mortality than private land in the area.
2. While they contain only 17 percent of the timberland in the Southern Appalachians, national forests hold much larger proportions of the highest quality sawtimber.
3. Timber harvesting from the national forests expanded in the 1970s through the mid-1980s. It peaked in 1985 and has declined rapidly since then. Current levels are comparable to those in the 1970s.

From the standpoint of timber production, the biggest forest health problems in the Southern Appalachians are gypsy moths in northern Virginia, oak decline from southern Virginia to northern Georgia, and southern pine beetles in the southern quarter of the region. These agents increase tree mortality and reduce growth.

Treatments could be imposed to improve the vigor of individual trees and mitigate the effects of oak decline. Evolving markets for low-quality trees and strong markets for high-quality

oak timber could provide profitable opportunities to improve forest health.

Gypsy moth impacts could be reduced through: (1) risk rating to identify vulnerable stands and thinnings and salvage cuttings, (2) quarantine to prevent introduction into uninfested areas, (3) careful monitoring of the spread of the insect. Biological controls of gypsy moths include mass trapping of males, mating disruption through pheromone releases, release of sterile insects, and the use of viruses. Chemical controls include diflubensuron and acephate.

Impacts of southern pine beetles can be reduced by rating risks in individual stands and treating the stands where risks are high. Existing infestations can be stopped by cutting and leaving infested trees, cutting and removing them, or cutting and burning them. Biological control methods include enhancement of habitat for parasites and predators of the beetles. Dursban and lindane are insecticides used against southern pine beetles.

Genetic conservation seems desirable for tree species that might be destroyed by exotic pests. Species at risk include American chestnut, chinquapin, butternut, Fraser fir, flowering dogwood, and eastern and Carolina hemlock. Backcrossing to create resistant hybrids may be feasible for American chestnut, butternut, and hemlock.

Research and Information Needs

The following are items identified as research needs by the Terrestrial Team to help to validate assumptions made during the SAA, to provide answers to deal with current forest health threats to forest ecosystems, and to provide information for broad-scale monitoring of landcover changes, rare communities, and selected plants and animals. The research and information needs include:

- Improve the accuracy of satellite remote sensing technology for use with expanded landcover classes. Accomplish this by completing field checks for accuracy assessment and incorporate needed changes to improve the accuracy of the existing LANDSAT remote sensing data. Also incorporate other existing land cover data, such as exists for TVA lands.
- Develop definitions and operational instructions for identifying old-growth forest types in the SAA.
- Increase baseline data for occurrences of rare communities in the SAA.
- Develop management guidelines for the 31 rare communities in the SAA.
- Develop conservation strategies for the federally listed species and viability concern species based on their association with rare communities and broad habitat types.
- Establish corporate database and procedures for monitoring the trends of selected terrestrial resource elements of both biological and social significance that were identified during the SAA.
- Establish corporate database for occurrences of federally listed species and viability concern species that is secure, yet can be made readily accessible for future management/planning efforts.
- Validate habitat relationships for federally listed species and globally imperiled (G1) species.
- Conduct searches for spruce-fir, moss spider habitat using “smart” technology (use the GIS databases assembled for the SAA, and develop a habitat model to search for suitable habitat).
- Relate broad landscape patterns (i.e., at the section level) and local land uses to forest landbird relative abundance and productivity.
- Develop information for early successional habitat and associated species related to patch size, patch isolation, and relationship to adjacent habitats for upland game species and forest early successional landbirds.
- Develop techniques for translocating selected priority rare plant and animal species.
- Begin looking at genetic conservation programs for selected priority rare plant and animal species.
- Continue refining the current knowledge for habitat requirements related to black bear, with emphasis on remote habitat needs and road density/road use relationships.
- Continue periodical monitoring of spruce-fir populations across the region.
- Study frequency and variability of Fraser fir seed crops.

- Survey the Smoky Mountains and elsewhere in the region for individual Fraser firs which show signs of adelgid resistance.
- Conduct basic taxonomic and autecological research on spruce-fir bryophytes, especially obligate epiphytes of fir, and determine how they are affected by the loss of fir.
- Initiate genetic engineering to transfer adelgid resistance from other hemlock species into eastern and Carolina hemlocks.
- Identify surviving uninfected butternut trees on federal lands.
- Continue research on resistance in butternut and development of resistant planting stock.
- Monitor wild populations of American elm to track species health.
- Standardize native seed mixtures for use by SAA forests based on local testing.
- Conduct an assessment of the extent and ecological effects of exotic plant infestations on national forest lands in the SAA area, including cost/benefit analysis of eradication/control projects on a species-by-species basis.
- Continue research on genetic engineering both to transfer blight resistance genes from Chinese chestnut into American chestnut, and to develop successful hypovirulent strains of the blight fungus for innoculating native chestnut root sprouts.
- Initiate a breeding program in an area geographically isolated from the chestnut blight in order to assure survival of an array of chestnut genetic material.
- Identify areas with extensive chestnut rootstock populations, and employ silvicultural practices in those areas which will protect or enhance chestnut survival.
- Develop strategies for regenerating yellow pine, particularly Table Mountain pine, in areas affected by southern pine beetle (SPB) in order to avoid loss of these types. Prescribed burning in Table Mountain pine sites infested by SPB should be specifically addressed.
- Further develop models for predicting susceptibility of pines to SPB attack in the mountains, including shortleaf, pitch, Virginia, and Table Mountain pines.
- Investigate the role of fire in regeneration of oak species.
- Develop an understanding of oak reproduction in the absence of advance regeneration.
- Develop a better understanding of the overall history and role of fire in the Southern Appalachian forests, including effects on hardwood species other than oaks.
- Determine what role fire played in the protohistoric period (1600s to 1700s).
- Develop methods for using prescribed fire to enhance biological diversity, vegetative composition, and stand structure as related to maintenance of ecosystem components.
- Develop gene conservation strategies to protect declining tree species.
- Develop silvicultural practices to reduce losses to forest pests.