32
Southern Appalachian Case Study

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32.1 Introduction

The Southern Appalachian study covers a region of 37.4 million acres. Its mountains, foothills, and valleys stretch from northern Virginia and northern West Virginia to northern Georgia and Alabama. When Native Americans came to the region, forests dominated the landscape and they still do, covering 70% of the land (Figure 32.1).

Terrain characteristics are significant in shaping the ecology of the Southern Appalachians. The region's location and its mountains produce a wide range of climatic conditions that are largely responsible for the great diversity of plants and animals found there. These ecological characteristics also influenced the cultural history and economic development of the region.

One of the most important events affecting the region was the logging that peaked around the turn of the century. Following this era, change came slowly to the Southern Appalachian Mountains. The region was considered a backwater of cultural and economic development. But, today, change is advancing at a rapid rate, especially change that affects the relationship of people to the land. The efforts of the Appalachian Regional Commission, creation of the national forests and parks, rural electrification through the establishment of the Tennessee Valley Authority, and the construction of the interstate highway system are some of the factors that have influenced development. The most important effect has been a change in the attitudes and culture of the people that live in and visit the Southern Appalachian region. Meanwhile, time has also brought change to the land and forest resources of the region.

Land managers and planners today are confronted with a baffling array of demands on the region's natural resources from a public whose diverse values and interests make it difficult to set priorities. Population growth and greater demand for recreational activities elsewhere in the Eastern United States has increased the value of the wildland recreation resources of the Appalachians. In 1988, a group of federal resource management agencies was established to meet the challenge of coordinated resource management. The Southern Appalachian Man and the Biosphere Cooperative (SAMAB) gradually expanded to include 11 federal and 3 state agencies. By 1993, SAMAB had coordinated a number of joint projects; some involved a few of the participating agencies; others, such as conferences and workshops, involved all the participants. Through these efforts, SAMAB was becoming a recognized voice for regional resource management.

Also by 1993, the Southern Region of the U.S. Department of Agriculture, Forest Service, was addressing the need for revising most of the forest plans within the Southern Appalachians. With eight national forests, some of which adjoined, there was an obvious need for close coordination and consistency among the forest plans. It was logical, therefore, to turn to a regional assessment as a framework for the planning process. It was also logical to look to SAMAB as a means of involving other federal and state agencies and to coordinate work on areas of mutual interest. The concept for a regional assessment was not well developed, but the perception was that a broad-scale description of the condition of the land and trends in the natural resources would help to identify important resource concerns and would give a better understanding of how to focus planning efforts.

In early 1994, a meeting of the Appalachian national forests' planning staffs, together with the Re-

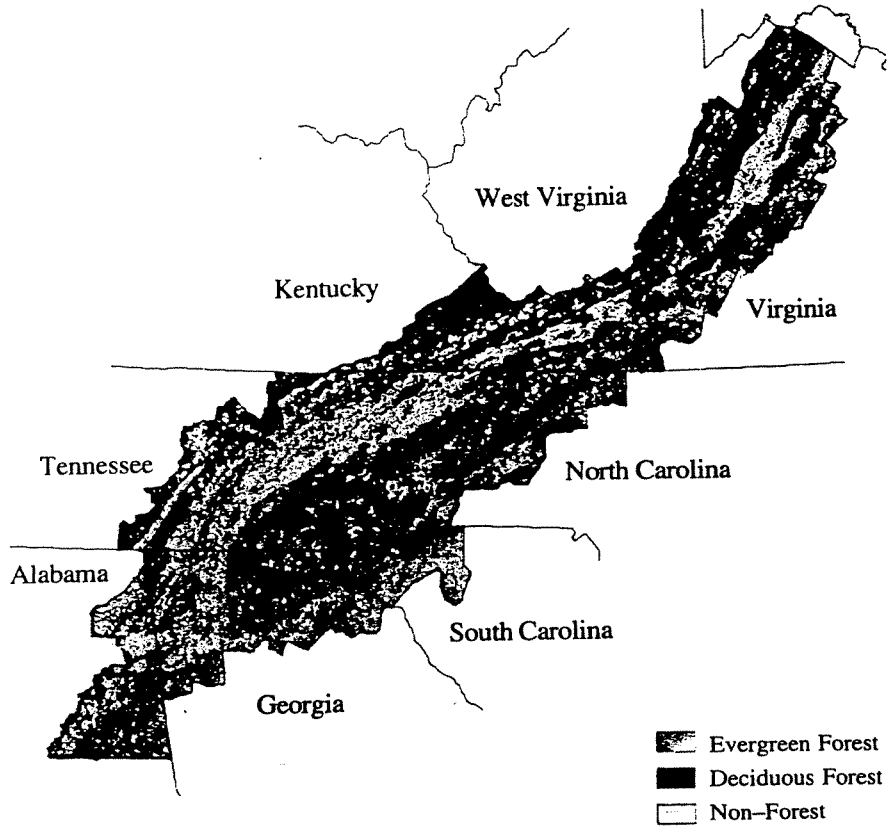

FIGURE 32.1. Forests cover 70% of the land in the Southern Appalachians. (Courtesy of the U.S. Department of Agriculture, Forest Service)

gional Office and Forest Service Research, made a commitment to conduct a regional assessment. At the same time, SAMAB agencies had decided that a regional assessment was needed to focus and coordinate interagency planning. The decision to consolidate these efforts through SAMAB was a natural one. Thus the stage was set to conduct an interagency Southern Appalachian Assessment (SAA).

32.2 Project Organization

32.2.1 Organizing the Leadership

Because the assessment was an interagency effort, an interagency leadership group was necessary to make policy, facilitate support, and provide liaison between the agencies and the assessment. The analyses would be conducted by four technical teams, and technical support would be provided by three facilitating teams: a database management and geographic information system team, a technical writing and editorial team, and a public involvement and media relations team (Figure 32.2). As planning progressed, two of the technical teams further divided their work into subgroups.

Selection of team leaders proved to be a critical step in the process. Team leaders were selected by a joint effort of the SAMAB Policy Group and the members of each team. Team leaders were expected to have some experience working with diverse groups, good communication skills, a vision of the final product of the assessment, and immense patience. Technical expertise in the assessment topic was also helpful, not only to gain the confidence of the team members, but also because the team leader was usually the spokesperson with the public.

Partitioning the work into the four technical analysis areas was a logical approach and had several advantages, but it also had some disadvantages. One clear advantage is that technical specialists communicate best with each other when they share

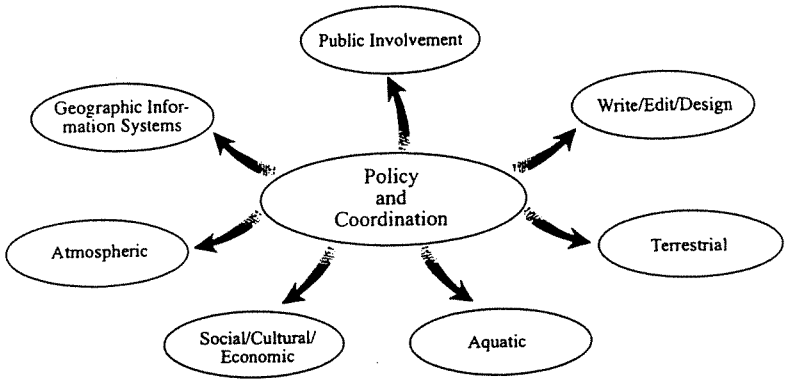

FIGURE 32.2. Interagency assessment teams organizational chart. (Courtesy of the U.S. Department of Agriculture, Forest Service)

a common or related discipline. Another obvious advantage is that the teams needed large data sets that could be shared within the teams for various analyses. A third important advantage was that each team had its own constituency among the public. The questions that arose from public discussion were easily organized around the major themes. Public involvement will be discussed in more detail in Section 32.2.3, but each team had a small and intensely interested group of public commentators who related closely to the issues being addressed.

The most significant disadvantage of the technical organization used was that the teams did not communicate well with each other. Consequently, some opportunities for coordinated or integrated analyses were not adequately exploited.

32.2.2 Communication Strategy

Eventually, more than 150 people were involved in working on the assessment, representing 11 federal agencies and three states. Cooperators from several universities worked on parts of the assessment. A large and diverse public constituency also became involved, including the U.S. Congress. Communication, both internally and externally, became extremely important in the assessment process.

The communication process was challenging because none of the assessment workers were relocated for the project. The Forest Service had effective intraagency communication through the use of the Data General network, but communication outside the agency was much more difficult. Moreover, many agencies and the public do not maintain email addresses. Communication by FAX, telephone, express mail, and other means became an essential part of getting the assessment accomplished. The real challenge was not so much how to communicate as much as what, who with, and when to communicate.

Besides those actually working on the assessment, there was a need to keep many others informed of the decisions being made, rate of progress, and plans for publication. Regular briefings were scheduled for southeastern natural resource leaders, the SAMAB Executive Committee, National Forest supervisors and planners, Washington Office staffs, and public interest groups.

In addition to briefings, a monthly newsletter was distributed to a mailing list that grew to more than 3000 names before the assessment was completed. The newsletter contained information about progress, announcements of forthcoming working-group sessions, invitations to review the assessment products, and plans for release of the final documents. The newsletter was an effective way of communicating with a limited segment of the public. When it was time to present the findings of the assessment, a much more elaborate strategy was clearly needed.

The annual SAMAB fall conference was an ideal forum for announcing the preliminary findings of the assessment. In November 1995, months before the final documents were ready for publication, a special session of the fall conference was devoted to the findings of the assessment. This gave SAMAB an opportunity to publicize the assessment, provided the public with information in advance of the published reports, and afforded the team leaders and scientists some recognition for their work.

Another part of the release strategy was to use current computer technology to make assessment products available on the Internet and on compact disks (CD-ROMs). These products offered many advantages in making data accessible to libraries, classrooms, and individuals.

The final part of the strategy was channeling information to the news media, Washington Office staffs, and members of Congress. The assessment Public Involvement Team worked with the SAMAB Public Affairs Committee to develop a detailed media release strategy. Washington briefings were made by SAA co-leaders and members of the SAMAB Executive Committee.

32.2.3 Involving the Public

One message that came through clearly from town hall meetings, which were designed to encourage public participation in the assessment process, was that people wanted to be included. This did not necessarily mean that everyone wanted to attend every meeting, but rather that they wanted to know what was going on and to decide for themselves whether to attend working sessions. One key decision was to keep the project as open as possible. Regular working meetings were scheduled for each technical team at locations throughout the assessment area. Scheduling meetings with sufficient lead time to get the announcement in the newsletter was often difficult, but a sincere effort was made.

Initially, most teams were very uneasy about the idea of having the public sit in on their working sessions. They anticipated that the public would be a disrupting influence and would make it difficult to accomplish their work. With the short time frames and overwhelming demands being placed on the teams, their concerns were certainly understandable. Public participation did not prove to be the threat that was anticipated. To the contrary, the public was often very helpful and provided the team with insight on controversial and sensitive subjects. Many issues that could have become problems later in the process were identified early and dealt with directly.

An important part of the process for working with the public was establishing the public involvement assessment team. A public involvement team member served on each of the technical teams to provide advice and consultation and to serve as liaison to the public involvement team. This interdisciplinary approach was successful at keeping communications open.

32.2.4 Document Preparation

Packaging a document the size of a regional assessment with scores of writers involved, hundreds of charts and figures, literature citations, tables, photos, and authors to acknowledge is a monumental effort. Someone was needed to worry about the details. Each technical team had the assistance of one or more technical writers plus the guidance of the writing team. Here, too, the skills necessary to present all the materials in an attractive and consistent way did not exist among the scientists and specialists doing the analyses. Getting the editors involved early saved much wasted effort once the work got underway. The Technical Writing Team helped define the overall report format, style requirements, table layouts, and the like.

Manuscript review was not adequately planned for in the initial assessment scheduling. It soon became obvious, however, that this review would become an essential part of the process. Each team leader was asked to arrange appropriate review of the assessment products. Members of the participating public argued strenuously for public comment as part of the review process. In response, it was agreed that public interest groups could nominate qualified reviewers, and names were solicited through the newsletter. The traditional peer review process familiar to most researchers was modified to include both formal peer review and comment from recognized technical experts. This review was called a technical review, rather than a peer review, to better reflect the diversity of the reviewers.

Phase 2 was a policy review of the assessment documents. Each participating agency was sent copies of the draft manuscripts and asked to review and approve the documents for policy. Copies were also sent to selected Washington Office staffs. These reviews proved to be extremely careful and thorough. In fact, they were often more technically thorough than the technical reviews. All reviews were helpful and were appropriately managed and appreciated.

32.3 Identification of Issues

An integrated interagency assessment brings many different viewpoints and priorities. For the assessment planners, issue identification was a critical starting point for organizing the project and setting priorities. Initially, however, there was no clear consensus among participating agencies regarding what an assessment was, what it should accomplish, what it should cost, how it should be funded, how long it should take, or who should lead the effort. One thing seemed clear: developing a process and a strategy for accomplishing the assessment was necessary before determining how long it would take and what resources would be needed. This process, although somewhat crude and poorly de-

fined at first, became more refined as we proceeded and directed the outcome of the final product.

Between the spring and fall of 1994, a number of meetings were held among the assessment organizers. For the Forest Service, the assessment began with a meeting organized by the Regional Office and involved forest planners, research, and Regional Office staffs. This meeting introduced the concept of a regional assessment for the area and identified the broad objectives and expectations of the project. At that time, little or no coordination existed between the various forest planning efforts. A dominant consideration was to assure consistent development of basic data.

In April 1994, the annual SAMAB planning meeting was devoted largely to discussion of the regional assessment, issues to address, and commitments needed. Although various proposals for regional assessments had been discussed before, this meeting officially kicked off the interagency assessment. By the summer of 1994, planning was well underway. As a means of gaining public comment and support, a series of town hall meetings was conducted. The meetings were located in Roanoke, Virginia, Asheville, North Carolina, and Gainesville, Georgia, during July and August. As a result of these discussions, issues and priorities were modified and the assessment area was expanded. The annual fall conference for SAMAB draws a technically oriented audience. Technical papers are presented and scientific issues are discussed. The 1994 fall conference had a special session that explained plans for the assessment, discussed scientific issues, and honed and polished assessment issues.

Nationwide, a number of regional assessments were already underway. They differed widely in approach, scale, subject, agency involvement, and location. In an effort to learn from what had already been accomplished and bring some order to the various data collection and analysis projects, the Environmental Protection Agency held a meeting in Atlanta to review ongoing assessments. This meeting provided an exchange of ideas and approaches.

32.3.1 Assessment Questions

As a result of all these meetings, a broad framework of issues was developed, initial guidelines were formulated for public involvement, and communication links were established with the key representatives of the various agencies. The issues were expressed in the form of questions, and these questions were organized into a charter. The charter was originally intended for Forest Service use, but it was also helpful in explaining and gaining acceptance of the other agency participants.

In framing the questions, a logical approach to the assessment emerged. The assessment consisted of four major topics: aquatic; atmospheric; terrestrial; and social, cultural, and economic. These questions were used to guide the content and direction of the analyses. The key topics that guided the assessment project were the following:

Atmospheric analysis: The major atmospheric issues addressed air pollutants and exposure, concentrations of particulate matter, visibility and how it is affected by air pollution, effects on aquatic resources by acid deposition, and the impact of ground-level ozone on forests.

Terrestrial analysis: The terrestrial analysis included plant and animal resources and forest health for plants and animals. The assessment evaluated what plant and animal resources occur within the region and their habitat associations; the status, trends, and distribution of species and habitats in the region; and the habitat conditions important for maintaining the desired population levels and those needed to recover populations at risk.

Forest health area: The forest health assessment addressed occurring changes in forest vegetation or soil productivity, the potential effects of the presence or absence of fire on forest health, how forest health is affected by native or exotic pests, and how current management practices are affecting the health and integrity of forest vegetation.

Aquatic analysis: The aquatic analysis focused on the status and trends in water quality, aquatic habitat, and aquatic species; the management factors important in maintaining aquatic habitat and water quality; the extent and composition of riparian areas; the laws, policies, and programs for protection of aquatic resources and their effectiveness; how people affect aquatic resources; and the current supplies and trends in water use.

Social, cultural, and economic resources analysis: This analysis addressed several components:

1. The human dimension questions related to how the social pattern of the region had changed over the last two decades and how this change was reflected in natural resources management; how management decisions affected the economic condition of local communities and people outside the region; people's attitudes and values regarding natural resources; the important economic trends with respect to tourism and extractive and other resource-dependent industries; and why and how private and nonindustrial landowners manage land.

2. The timber economy analysis examined the supply and demand for wood products, the dependency on National Forest timber, timber production's effect on employment and income, and the National Forest land tentatively suitable for timber production.
3. The recreation resources and use component evaluated supplies and demands for recreation settings, the unique or unsatisfied recreation opportunities on public land, changes in public land use in the last 10 years, and forecasted trends; how the changing social patterns affect public land use; and how recreation opportunities modify the life-style and local culture of the area.
4. Roadless and designated wilderness areas analysis focused on identifying the location of roadless and primitive areas, the effects of Forest Service management on the integrity of roadless areas or the enhancement of natural processes in wilderness areas, the effect of the proximity to population centers on wilderness use, and the relation of wilderness and roadless areas to other assessment resources.

32.4 Scale, Extent, and Resolution of the Assessment

No discussion of scale and resolution can begin without describing the purpose, audience, and constraints imposed on the assessment. The limitations of time and budgets directly affect the level of detail and amounts of data that can be assimilated.

Two factors influenced the extent of the assessment: no special funding was allocated and the forest plan revisions imposed special requirements. Five of the seven National Forests in the region were beginning plan revision. The Regional Forester, although fully committed and supportive of the assessment, had promised that the assessment would not significantly delay plan revision and requested that the assessment be completed by January 1996. Technical teams had slightly more than 1 year from initial planning to the completion of the draft analyses. The team leaders and a handful of others worked on the assessment full time. The remainder of the 150 people on the project had competing demands on their time. Funding for the assessment, both within the Forest Service and in other agencies, came largely from the administrative units that furnished the people—the forests, research units, and agency staffs.

Because of time and budget limitations, it was decided that the assessment would be accomplished with the use of existing maps and data. Working with existing data meant that it was sometimes necessary to use whatever map scales were available, rather than designing map products to satisfy analysis applications. This did not prove to be a serious handicap and, overall, the constraints imposed on the assessment were useful in determining priorities and allocating effort.

Initially, it was assumed that the assessment would be conducted within the boundaries of the original SAMAB region, a 100-county area covering parts of Virginia, Tennessee, North Carolina, South Carolina, and Georgia. As a result of the town hall meetings, additional counties in Virginia and West Virginia were added so that the George Washington National Forest would be included. In Alabama, one county was added to include the Little River Gorge Preserve. The final 135-county study area encompassed 37.4 million acres and parts of seven states.

Counties do not always follow ecological boundaries, but county boundaries became the primary geographic reporting unit for several reasons. The demographic data were only available by county or census tract. Also, people living in the Southern Appalachian region have a very strong sense of place associated with county of residence. County and community planners were identified as potential users for the assessment data and would be interested in county data.

A number of additional boundary overlays were needed within the assessment area. Watershed and hydrological unit boundaries were needed for the aquatic assessment. Federal and state ownership boundaries were needed for the terrestrial assessment, and highway and road overlays were needed for several applications. Figure 32.3 illustrates some of the many boundary overlays that were included.

It was generally agreed that maps and locational data would be an important ingredient in the assessment. Current GIS technology, which offered new frontiers for analyses, and the maps developed for the assessment would have wide future applications for managers and planners. The first step of the GIS team was to work with the technical teams to complete an information needs assessment. Development of GIS data to support analysis was a major undertaking. Frequently, the analysts asking for the data had little understanding of the cost and effort required to supply the data, and deciding data management priorities was difficult.

A GIS team member was also assigned to each technical team. Their advice and assistance were essential to provide the maps, data, and analyses

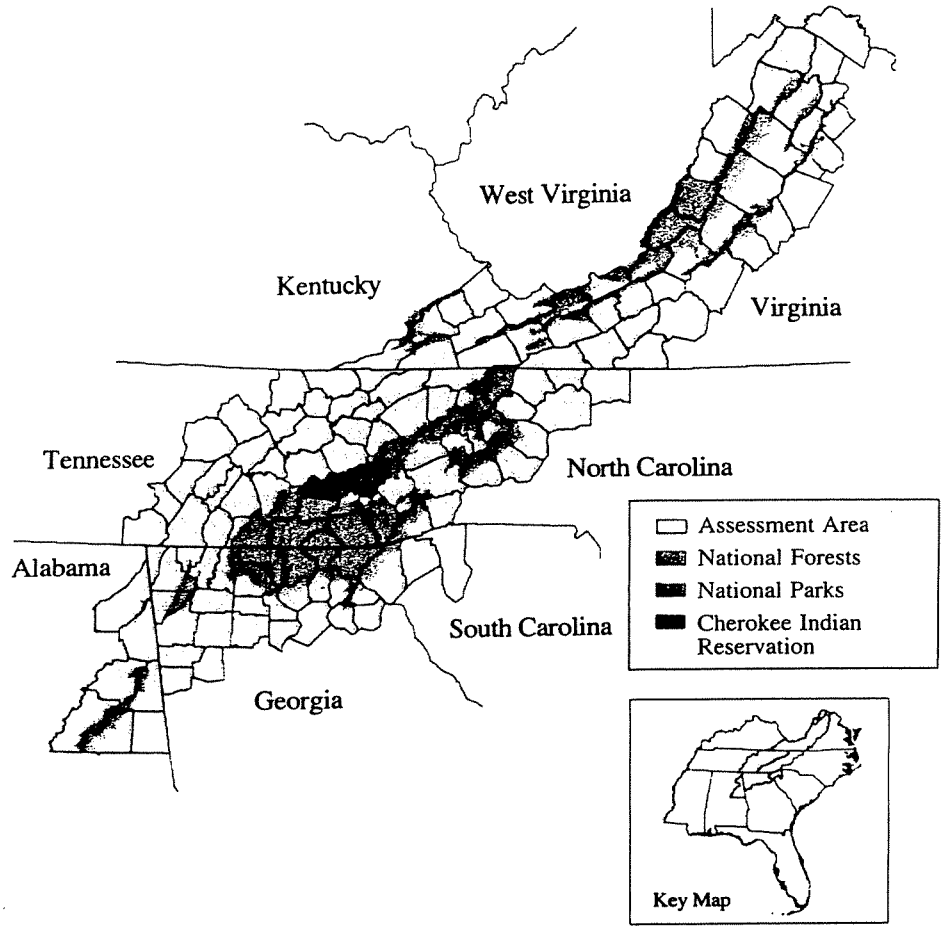

FIGURE 32.3. Boundary information provides a sense of place. (Courtesy of the U.S. Department of Agriculture, Forest Service)

that the technical teams needed. The GIS specialists were aware of techniques and cartographic protocols that added greatly to the refinement in the final reports.

It is difficult to generalize from the separate information needs assessments because they identified widely differing analytical requirements. There were, however, some things common to most of the technical applications. The maps and data assembled were at different scales depending on the intended purpose. For regional analysis, a scale of 1 : 100,000 or 1 : 250,000 was usually considered the most useful. For publication purposes, a scale of 1 : 2,000,000 was a good starting point. Certain kinds of information were needed for planning on the National Forests and for this purpose a scale of 1 : 24,000 was necessary. This was especially true for applications that required public involvement, such as the roadless areas and old-growth inventories.

Several of the teams asked for detailed ecological data. Bailey's ecoregions map was a good foundation, although the resolution at the section level was very crude. For habitat classification and other applications, a much finer level of resolution showing current conditions was needed. Consequently, a major financial commitment was made to obtain a satellite image (Landsat) of the entire area. The classified image was obtained under contract from Pacific Meridian Resources. The final product was delivered late in the process and, although it was helpful, its limited availability meant that it was not used to its full potential. Thus the factors determining scale and resolution were application, data availability, kind of analysis, and anticipated future applications.

32.5 Major Types of Data and Information Used in the Assessment

The completed assessment consists of approximately 900 pages of text, maps, tabulations, and data sets: five compact disks (CD-ROMs); and two separate home pages on the Internet. The maps and data were needed to support the analysis, the analysis supported the text, and the text was used to communicate with a variety of audiences. Thus, in describing the types of information, it is useful to make three distinctions: foundation data, analysis data, and observational data (maps are included in the category of data).

32.5.1 Foundation Data

The assessment depended almost entirely on existing data from other sources, although much of the information resided in separate and often obscure agency data files. What made the assessment unique was that the information was brought together and organized for a specific geographic region. It was a major achievement to identify, locate, and assemble this large and diverse data resource. For this reason, considerable attention was given to obtaining data that would be used by forest planners, educators, and community planners who want to conduct their own analyses. All the maps and data sets were recorded on the CD-ROMs.

There are two advantages of the CD data set (and its counterpart on the Internet). One is that it contains a huge amount of information not available anywhere else in the assessment process. The second is that it can be updated or expanded on a continuous basis. Although plans have not been completed for regularly updating these data, it is widely recognized that this could be a very important SAMAB function.

32.5.2 Analysis Data

Analysis data are the maps and models generated as part of the technical analysis phase of the assessment. These data include materials such as the habitat matrix for terrestrial wildlife, the trout range map, questionnaire survey data, and the LANDSAT land-use and land-cover map. Some of the analysis data are contained on the CD-ROM, but other data sets were not easily adapted to this form of display.

A common form of analysis data is the maps generated by combining (intersection or union) two or more GIS layers. This has been one of the most common forms of integrated analysis. An example was combining geology data with atmospheric data to show the location of streams at high risk of acidification. In some cases, maps with high resolution or precision may be combined with data sets that are low in precision. The result may be very useful, but the product is often difficult to describe in terms of reliability. To the extent possible, maps such as the black bear suitability map or the recreation settings maps need to be identified as analysis products with the criteria and assumptions clearly specified.

32.5.3 Observational Data

A third category of data covers a broad array of information in the form of economic data, demographic data, questionnaire surveys, water and air quality monitoring data, species occurrence data, and many other sources stored as numerical data sets. Observational data are usually linked to maps by geographic coordinates or place identifiers such as county boundaries. In many cases, no further locational information is possible or appropriate.

The LANDSAT Land Cover image is worthy of special mention mainly because of its large size. The ground truth component of this product was not completed at the time that the assessment was released, and users should be aware that many of the detailed classifications still require verification. Limitations of the data set are explained in the accompanying metadata. It is hoped that refining and updating this data set will be a high-priority task for those who maintain the assessment data set.

32.6 Major Types of Analysis

Each assessment team's approach to their subject was unique, but several aspects were common to each analysis area. All teams started with the set of questions from the issue identification process and were given the opportunity to revise or reorder the questions. Once agreed on, they were asked to ensure that the questions were adequately answered. The teams were also asked to focus on the status and trends affecting natural resources, but to avoid drawing conclusions and making policy or management recommendations. Each team was asked to identify missing information and to construct a list of research and monitoring needs. Finally, each team was asked to sufficiently describe their meth-

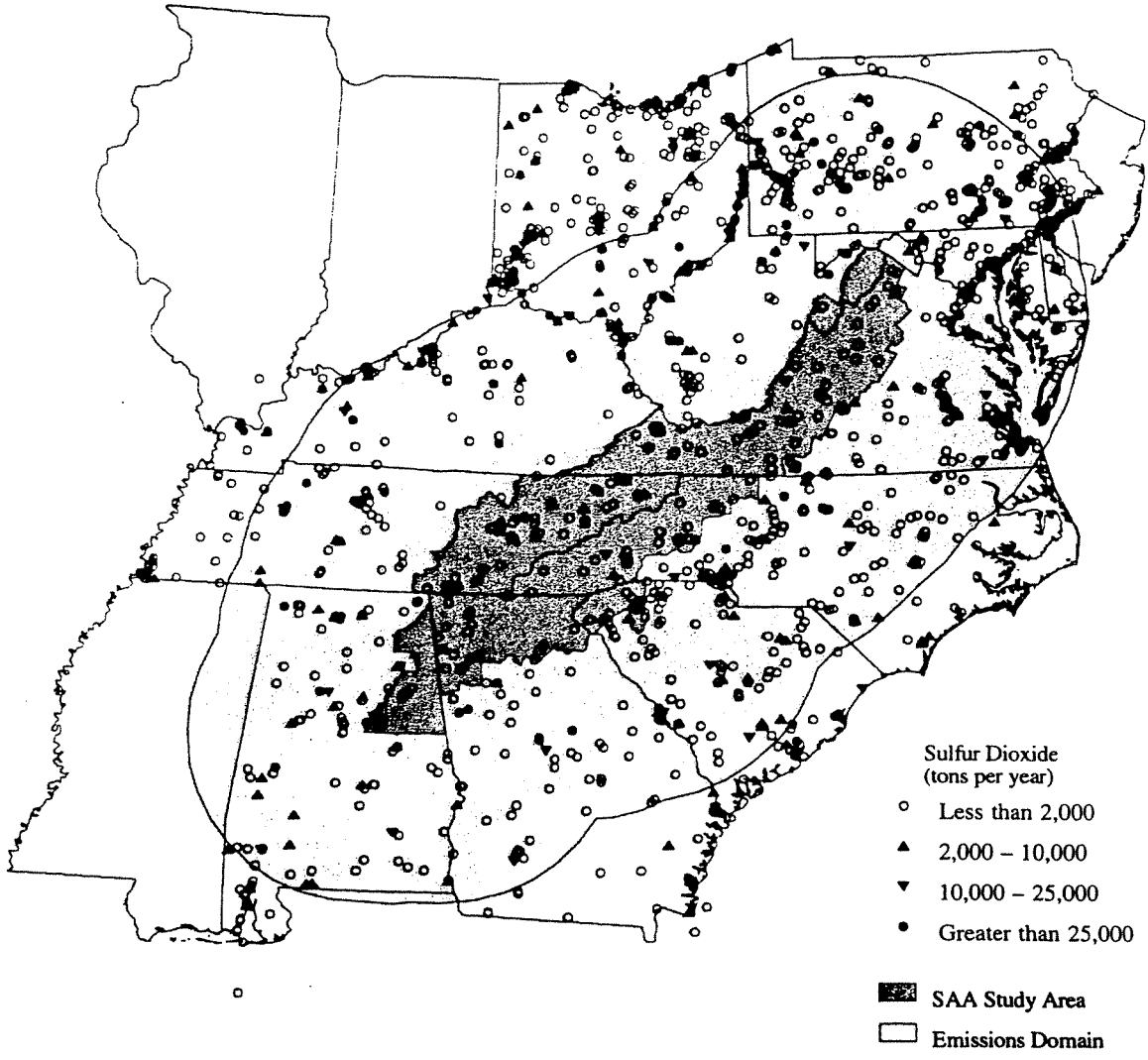

FIGURE 32.4. Location of point sources of sulfur dioxide, 1995. Nationally, point sources release the majority of sulfur dioxide. (Courtesy of the U.S. Department of Agriculture, Forest Service)

ods and procedures so that the technical reader could evaluate the appropriateness of the analysis. Where possible, the aquatic resource assessment findings were integrated with findings from the atmospheric, terrestrial, and social–cultural–economic assessments. Several additional findings emerged from these joint analyses.

32.6.1 Atmospheric Analysis

The major air pollution emissions assessed in the report were particulate matter, nitrogen oxides, volatile organic compounds, and sulfur dioxide. These pollutants are important because their secondary pollutants are suspected of causing visibility reductions, ozone impacts to vegetation, and acid deposition impacts to terrestrial and aquatic environments. They are also directly addressed by the Clean Air Act (CAA) legislation. The analysis described the location of emissions, concentrations where emissions are greatest, and likely future trends. Figure 32.4 illustrates one of several point source maps prepared as part of the analysis.

Although no violations of the national particulate matter standard (NAAQS) are presently occurring within the Southern Appalachians, regional planners need to know existing particulate concentrations to monitor for unacceptable emission lev-

els. Common sources of particulate matter are stationary sources, such as power plants or unpaved roads, but there is considerable interest in the potential effects that prescribed fire might have on local conditions.

The Southeast has the poorest visibility in the Eastern United States, and it is usually worst in the summer months when the greatest numbers of people are viewing scenery in the mountains. Haziness has intensified since the 1940s, and sulphur dioxide emissions are believed to be primarily responsible.

In addition to being an important component of the recreation experience, visibility is specifically addressed in the CAA. The CAA established a national goal of "prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class 1 federal areas where impairment results from man-made pollution." The majority of the visibility data used in the assessment was obtained in the seven Class 1 areas within the assessment area. A description of current conditions was based on data collected through the Interagency Monitoring of Protected Visual Environments (IMPROVE) network. Historical visibility data were based on information collected at airports since the 1950s.

Acid deposition has been the cause for great concern in the assessment area since the early 1980s when some scientists began to attribute the death of high-elevation spruce and fir forests to the effects of air pollution. Moreover, media reports repeatedly proclaimed that acid rain was killing lakes and streams in the area. During the 1980s, the National Acid Precipitation Assessment Program (NAPAP) carried out the National Stream Survey to estimate the extent of stream resources affected. The assessment team used these databases and model results, together with site-specific investigations, to describe the acid-deposition threats to aquatic resources. The assessment also reviewed the EPA's findings to estimate stream reaches sensitive to acid deposition.

Ozone is potentially the most significant pollutant affecting forests in North America. Numerous surveys within the Southern Appalachians have reported ozone symptoms on sensitive plants. Whether growth loss actually occurs depends on the sensitivity of the plant species and environmental conditions such as soil moisture that affect the plants' vulnerability to ozone.

32.6.2 Terrestrial Analysis

The Southern Appalachians are a diverse and complex region. The terrestrial resources are affected by topography, geology, climate, soils, and the history of human use. The questions arising from public discussion and planning needs fell mainly into two groups: What are the status and condition of plant and animal resources, and what is the general health of the forests?

Plant and Animal Resources

To address questions that dealt with species occurrence and frequency, it was first necessary to narrow the species of concern down to a manageable number. More than 25,000 species are known to inhabit the assessment area, but 472 were selected for study based on a number of selection criteria (Figure 32.5). Slightly more than half were animals. Most of these species could be separated into 19 groups based on similar habitat requirements (associations). Species associations helped define the habitat characteristics that would be of interest in the descriptive inventory.

Many characteristics of the landscape are useful for describing habitat condition and suitability. The terrestrial team gathered data and described habitat features as part of their analysis and in response to the questions. In addition to the usual features that include land use and land cover, forest type, ownership, and ecological units, special emphasis was given to the successional stages of vegetation because of its significance for animal habitat.

About 84% of the terrestrial threatened and endangered species and 74% of the viability concern species are associated with rare communities and streamside habitats. These rare communities represent less than 3% of the assessment area, and 1% is high-quality habitat. Thus the future management for species diversity will depend on managing these habitats. Almost two-thirds is in private ownership. The remaining small area is managed under federal or state direction.

Forest Health

Forest health can be defined in many ways, but the purpose of the assessment was to give an overview of the most important factors that are affecting forest condition. These include natural and human-induced disturbance, native and exotic pests, air pollution, and changes in land use.

Historically, the most significant event affecting the Southern Appalachians was the initial logging. By 1901, the condition of the region's forests and streams had reached such a degraded state that the secretary of agriculture was asked to make an assessment of their condition. This assessment ultimately led to passing the Weeks Act, which authorized establishing the National Forests in the

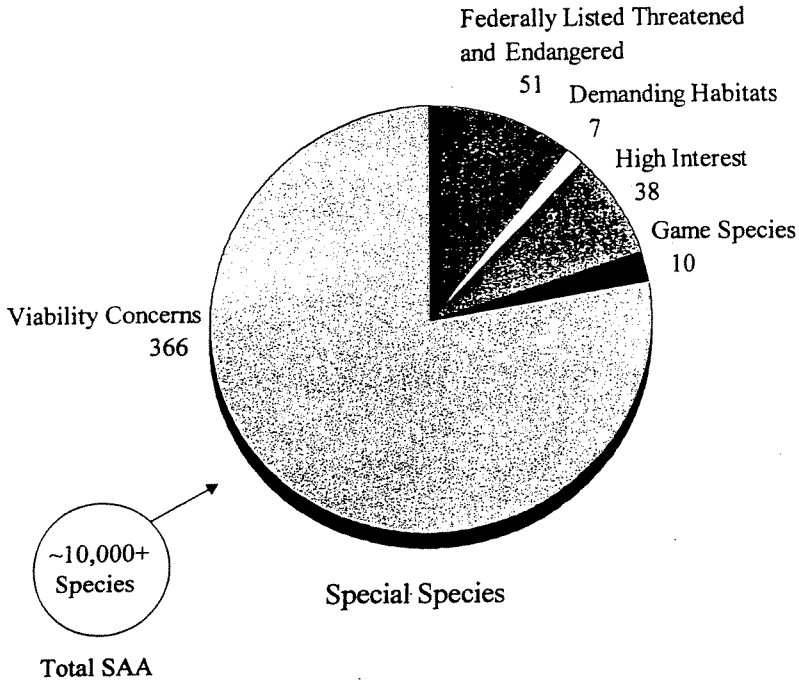

FIGURE 32.5. Selection criteria for terrestrial plant and animal species list for the Southern Appalachian Assessment. (Courtesy of the U.S. Department of Agriculture, Forest Service)

Eastern United States. Today, the region has gone through a long period of recovery and is in relatively good condition. Nevertheless, there are a number of threats to the health of the system.

Although early logging was one of the most significant disturbances to affect the region, the exclusion of fire may also be having subtle but far-reaching effects. Several vegetation communities such as Virginia pine and table mountain pine are fire dependent. Recent studies report that, prior to establishment of the national forests, fire was fairly frequent. The assessment reported on several kinds of natural disturbance, including ice and snow, wind storms, frost damage, and other weather events. Perhaps more important, however, are the insect and disease threats, most are of exotic origin.

Oak decline is a disease complex involving environmental stress (often drought), root disease, and opportunistic insect pests. Although this may be a chronic condition in the oak forests of the Southern Appalachians, it has recently become more common and severe, probably due to widespread drought in the 1950s and again in the 1980s and the advancing age of many forest stands. Recent surveys indicate a widely distributed decline that is changing forest composition and structure.

Gypsy moth is another serious threat to the occurrence of oak in Appalachian forests. The insect was introduced from Europe in the 1860s, but the rate of expansion increased alarmingly in the 1980s. During the last 10 years, the moth has defoliated more than 4 million acres in Virginia and about 1 million acres in West Virginia. Despite existing management strategies, losses are expected to continue as the moth migrates down the Appalachians. Species vary in their ability to recover from defoliation, but most will succumb after a few years of repeated attack.

Southern pine types make up only about 10% of the assessment area, but southern pine beetle is a serious threat in places where the pines occur. Other diseases that are causing concern are dogwood anthracnose, beech bark disease, butternut canker, Dutch elm disease, and hemlock wooly adelgid.

32.6.3 Aquatic Resources

The headwaters of nine major rivers lie within the boundaries of the Southern Appalachians and are the source of drinking water for much of the Southeast. Diversity of aquatic resources is high, with a rich fauna of fish, mollusks, crayfish, and aquatic insects. While human activities that impair aquatic resources have decreased, population growth and concomitant land development are increasing pressure on water resources.

The condition of water bodies is influenced by land uses within the watershed, geology, soil erosion, vegetation, and soil nutrients. Evaluation of

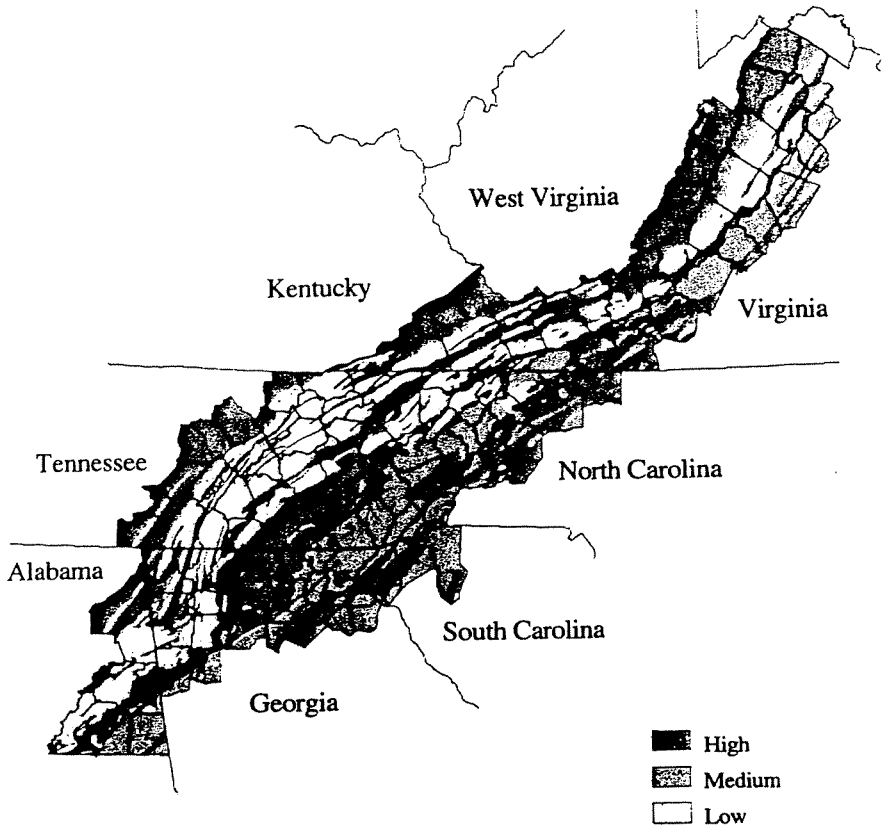

FIGURE 32.6. Soils in the SAA region that have high, medium, and low sensitivity to acid deposition. (Courtesy of the U.S. Department of Agriculture, Forest Service)

aquatic resources condition was based on how well lakes and streams support their designation uses: fishing, swimming, aquatic life, and drinking water. Trophic state of lakes was another measure of condition. Extensive data from a number of federal and state monitoring activities allowed the study team to report the condition of water bodies by county and watershed and for the major stream reaches.

For the analysis of threatened and endangered species, the team obtained the Element Occurrence Records (EOR) from seven state heritage programs. Mollusks and fish had the largest number of Fish and Wildlife Service (FWS)-listed species, reflecting greater interest and higher numbers of species at risk. In the assessment area, there are about 350 fish species, 64 of which are imperiled.

Many people fish for native or naturalized trout. Others find the native brook trout to be a beautiful fish or see trout as an indicator of high water quality. Maps were constructed that show the streams with wild trout potential and the location of stocked trout. From these maps, it was possible to predict the effects that various factors influencing water quality might have on trout habitat. For example, the maps were used to show potential impacts from acidification (Figure 32.6) and gypsy moth and hemlock wooly adelgid.

The conditions of stream habitats are highly dependent on the characteristics of natural bank and riparian zone vegetation. To assess the current condition of riparian zones over the entire region, the team combined the GIS data from the stream reach file with the LANDSAT satellite image. This provided a broad classification of riparian zone conditions and generated a GIS layer that can be used for subsequent analysis.

The last decade has been a turning point in water resource legislation and pollution control. Nevertheless, many sources of pollution still exist. Two-thirds of the water quality impacts are due to nonpoint sources such as agriculture runoff, storm water discharges, and landfill and mining leachate. Many of these sources are identified in the Natural

Resources Inventory (NRI), which is conducted periodically by the Natural Resources Conservation Service. This inventory provided an indication of soil erosion potential from agricultural sources. The universal soil loss estimates, together with the NRI data, were used to calculate an average erosion rate for each county.

32.6.4 Social, Cultural, and Economic Resources

Natural resources have value because of their utility and esthetic or intrinsic qualities that come from the human culture. Thus the importance of natural resources is directly related to people. Early in this century, the Southern Appalachian people suffered from widespread poverty and an undereducated, undernourished, and underemployed population. Today, although pockets of poverty still exist, the mountains are considered an excellent place to visit, settle and raise a family, and retire.

The federal lands that once were purchased so cheaply have now become an enormous asset to visitors and residents. The increased scarcity of these lands, with respect to the demands placed on them, is now the source of frequent controversy. The primary purposes of the assessment were to determine the condition of the natural ecosystems and to provide data that would help determine how the public land would be used, protected, and managed.

To accomplish the social, cultural, and economic analysis, the team established four subgroups. One would address the human dimensions component. A second would analyze the timber economy. The third would address recreation supply and demand. And the fourth would describe roadless areas and designated wilderness. These four groups evolved from the issues raised at the public meetings and also from the common interests among the study team.

Human Dimensions

Most of the social issues dealt with the pattern of population change and the way this is affecting people's use of natural resources. During the last 20 years, economic development was more rapid in the Southern Appalachian Mountains than in the immediately surrounding areas. As the economy grew, it became more diverse and less dependent on manufacturing. Meanwhile, the proportion of families living below the poverty level decreased from 20% to about 10%. The analysis focused heavily on the changing patterns of economic and population growth. It also examined the values and attitudes of people in the area.

In-migration is a significant component of the region's population growth, and newcomers to the region are dramatically changing the social climate for management of public land. Attitudes about the use of public lands are now influenced by retirees, resort owners, and employees in service industries who are more interested in scenery and recreation than in resource extraction. Today, the feelings of residents within the study area toward natural resources are not much different from those across the nation. Most agree that the Endangered Species Act, the Clean Water Act, and the Clean Air Act are needed to protect the region's ecosystems, but should not excessively restrict people's rights.

Increasing population in all counties, especially low-density residential development associated with retirement and second-home development, is removing forests and pastures as habitat for many species of wildlife and fish. The resulting land-use fragmentation is believed to be adversely affecting animal habitat, especially for some neotropical migratory birds. Landownership fragmentation is adversely affecting the availability of timber from private lands and the opportunities for effective forest management.

About two-thirds of the land in the assessment area is forested and, of this, almost three-fourths is privately owned. To learn more about how and why private landowners manage their land, the assessment team analyzed data from two national questionnaire surveys (the National Private Landownership Study and the National Resources Inventory). From these, they learned that most rural landowners place higher priority on the natural condition of their land than on making money from it. About a third of rural landowners derive income from their land, mainly from agriculture and timber. Recreation is the dominant noncommodity use.

Timber Economy

Logging, sawmilling, and other forms of wood processing have long been an important part of many Southern Appalachian communities. The region's timber economy has been generally stable during the last two decades, although sawlog production (mainly hardwoods) has declined somewhat and pulpwood production has increased. More than 17 species of hardwoods comprise the hardwood sawlog production, but the most important are the oaks and yellow poplar. Real prices for high-quality hardwood sawlogs have risen over the last 20 years, with northern red oak leading the group.

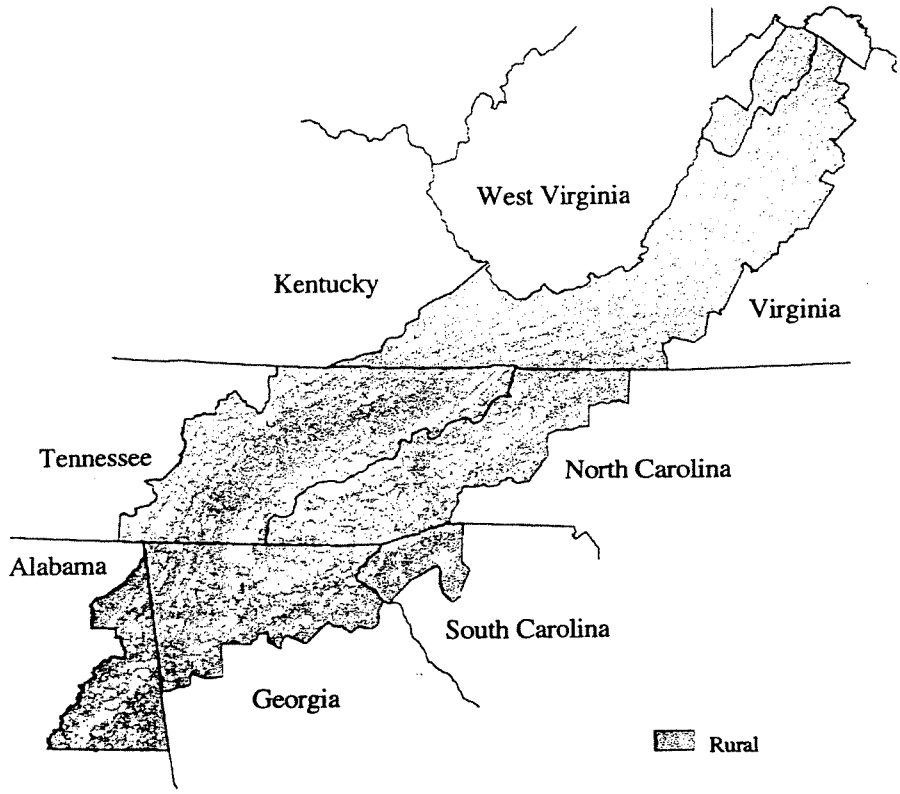

FIGURE 32.7. The recreation analysis focused mainly on rural settings. (Courtesy of the U.S. Department of Agriculture, Forest Service)

Price patterns indicate that high-quality logs are becoming more scarce, although lower quality are abundant.

Economic data for the timber industry have always been fragmentary and sometimes infrequent. The analysis team worked with a number of sources for timber prices, production, and location information. For timber supply, the survey conducted by the Forest Inventory and Analysis Unit of the Forest Service was the principal source.

The assessment analysis was conducted for the region as a whole and for four subregions. The subregions were based mainly on the economic areas defined by the Department of Commerce, Bureau of Economic Analysis. Results for the subregions contrasted important differences within the assessment area. Where possible, county or ranger district data were reported, but economic data at this level were often lacking.

Outdoor Recreation Demand and Supply

The recreation team concentrated mainly on activities in natural settings. Recreation supply was defined as the opportunity to participate in a desired recreation activity in a preferred setting. Although this would not be an economic definition, it was a realistic concept in dealing with public lands where price for participation is not obtainable. Thus the three components of supply were the settings, the activities, and the facilities available to provide support.

Settings are contained within landscapes that provide the physical and social environment that create the recreational experience. By combining the Recreation Opportunity Spectrum (which describes settings by integrating physical, social, and managerial characteristics) with the Scenery Management System (which evaluates natural and cultural influences on the landscape), landscape descriptors were developed with recreation scenery components. The descriptors allowed the team to work with the GIS data base and construct a map of the various settings. Figure 32.7 illustrates one component of the analysis.

Outdoor recreation is increasing in the assessment area partly because of increasing population and partly because rates of participation in most

categories have also increased. The most avid participants are white males under 60 years of age, but in recent years participation by females has risen significantly. Several outdoor recreation surveys provided data useful for the analysis, but the data were not always available in sufficient geographic detail to be able to isolate the assessment area. Nevertheless, the trends are sufficiently clear to verify the increased demand already being felt by most land managers in the region.

Approximately 75 visitor surveys were reviewed to determine kinds of experiences that people were seeking when visiting the region's parks and forests. It was no surprise that most wanted to get away from the urban environment and enjoy the tranquility and beauty of a natural setting.

Roadless and Designated Wilderness Areas

The interest in roadless areas and wilderness focused mainly on national forests, because this topic is important during the revision of the forest plans. In previous planning efforts, the Forest Service was criticized because the criteria for roadless designation were not consistent from forest to forest and there appeared to be little coordination among forests. The majority of roadless areas are on National Forests. However, one area is in a national park and four areas are in state parks. The Great Smoky Mountains National Park is the largest single area, making up more than one-third of the total acreage.

There are 39 units of the National Wilderness Preservation System in the assessment region. The Shenandoah National Park is the largest (80,555 acres) and also the only National Park Service unit in the area. Others range in size from less than 100 acres to more than 35,000 acres on Forest Service land.

32.7 Results of the Analysis

The results of the assessment are published in four technical reports and a summary report (see Section 32.9). Each team produced a detailed report that was organized in the same general way. The questions are stated, key findings are highlighted, data methods and analyses are described, and important data gaps and research or monitoring needs are identified. The summary report attempts to capture the essential elements of the technical reports and presents them for a more general readership.

The conclusions of the assessment had both immediate and long-term implications. The key findings have been published in the *Federal Register* as part of the Notice of Intent to revise the forest plans. This is the first time that the plans of five National Forests were coordinated around a set of common issues.

32.8 Innovations Resulting from the Assessment

Analysts working on the assessment started with a broad and somewhat undefined assignment. The teams were made up of specialists representing several agencies and disciplines confronting a relatively large geographic area and a diverse body of public interests. They seemed eager for the opportunity to tackle difficult problems that sometimes challenged their discipline, but were often outside their usual sphere of responsibility.

Nationwide, several regional assessments were underway simultaneously, and we make no claim that the innovations we developed are unique. Other assessment teams probably arrived at similar solutions to problems that they faced, but there was little communication between the regional assessment efforts. The only effective means of sharing information between these regional efforts was through the Ecosystem Management Staff of the Forest Service in the Washington Office.

The widely varied initial conditions that exist for each assessment make each project fundamentally different. Consequently, every assessment must take an approach that is tailored to these conditions. In the Southern Appalachian region, the existence of the SAMAB cooperative was one of these initial conditions. SAMAB offered the Forest Service an opportunity to enlist the participation and support of an established network of cooperating federal and state agencies.

Rallying the cooperation of numerous agency partners requires compromise. Objectives must be negotiated with all the participants. The scope and time schedules need to be compatible with the human and financial resources that are being committed. During the course of the assessment, numerous opportunities emerged to expand our efforts and take advantage of data sources or partnerships that we simply did not know existed when we outlined the initial objectives. Each of these new possibilities had to be evaluated to see how it might add to the assessment and whether it would be consistent with our time and content constraints.

Projects such as the assessment involve learning as you go. The majority of the participants had no

prior experience with regional assessments. Those that did, helped and encouraged the rest. Flexibility must be maintained throughout the process, because many of the problems cannot be foreseen. For example, data sources may not materialize, and analytical models sometimes do not work satisfactorily. Usually, these problems can be solved or bypassed as alternatives are considered.

The assessment teams consisted of interagency and, to a large extent, interdisciplinary specialists. The effectiveness of these groups depended on a team dynamic that encouraged participation and consensus. The Policy Team allowed the technical teams broad latitude in the hope of encouraging innovation and fostering better teamwork. The work was accomplished in a very dispersed organizational environment. That is, everyone who worked on the assessment remained at his or her established work location except for periodic working sessions. This arrangement required considerable emphasis on communication, but it also allowed people to maintain job and family obligations.

Regular briefings for agency leaders and the public were also a key part of the process. The briefings reassured line officers that the work was moving ahead as planned and gave everyone an opportunity to offer advice and suggestions.

Public involvement is more than just public relations. We were committed to include the public as much as possible in all phases of the assessment effort. A good-faith response to public involvement and customer comment meant that the project's objectives must be sufficiently flexible to allow refocus or redirection to accommodate public input. The guiding questions for the assessment were modified and embellished as a result of public involvement, agency comment, and input from the technical teams. The only factor limiting public participation was restrictions imposed by the Federal Advisory Committee Act. Even these limitations on the conduct of public meetings were largely overcome, and there was considerable benefit from the fact that any perception of restricting public access to the process was avoided. The result was an environment that facilitated open dialogue and participation between the public and the assessment teams.

The form of public participation ranged widely. On some occasions, people were only interested in satisfying their curiosity or seeing that their personal interests were not being threatened. But, more often, people were interested in the larger issues involving the welfare of the region and its resources. Meetings were held at locations throughout the region so that people could attend without undue hardship. Public participation ultimately provided many hours of very productive work in support of the assessment.

The benefits of public involvement are hard to evaluate, but were substantial. On two occasions, the assessment leaders were asked to testify before congressional subcommittee hearings regarding regional assessments. These committees were generally critical of regional assessments and the implications they might have for private landowners and public land management. At both hearings, members of the public testified in favor of the Southern Appalachian Assessment and the benefits it would provide in support of better resource management. This testimony did much to defuse hostility toward the assessment.

Data resources can be both an asset and a burden. The huge amount of data available for and requested by the assessment analytical team was an organizational challenge for the Data Management–GIS Team. A detailed listing of all maps and most data sets is available on the Internet through the SAMAB on the Forest Service home page.

The technical analysis produced many innovations. Most involved imaginative uses of GIS technology, such as the bear habitat suitability map or the map of recreation settings. Others involved constructing models that allowed extrapolation of the often limited data sources. The Atmospheric Team, for example, modeled the distribution of mean, wet sulfate loadings. In this analysis, weighted least-squares regression techniques were used to take into account the influence of regional topography on deposition.

The assessment contains numerous examples of integrated analysis, that is, joint analyses between resource elements. The analysis of atmospheric deposition effects on aquatic resources conducted in response to a specific question is an illustration. Because of the way that the teams were organized (separate teams for the major resources), other opportunities were sometimes overlooked. In an effort to facilitate more integrated analysis, the Policy Team organized a special workshop to explore the possibilities. Conducting integrated analyses involving the separate teams proved to be more difficult than anticipated. By the time this difficulty was recognized, the teams were well advanced in their separate efforts. This limited the time available to pursue integrated analysis opportunities, but it also meant that each team had well-developed databases and analyses that they could share with the other teams. The workshop facilitated several discussions of interacting resource influences that are included in the reports. In all, we believe that

the integration that was accomplished was a good first step. It certainly highlighted opportunities for future work and exposed some of the limitations of the data.

32.9 Conclusion

The assessment was not the first for the region and we hope it will not be the last. As in 1901, when the first Southern Appalachian Assessment was completed, people had expressed a concern about the condition of the region's natural resources. They wondered about the health of the forest, the quality of the water, and the effects of population growth and agricultural practices. Our assessment attempted to answer these and many other questions and to show where improvements are needed. Unlike the conditions at the turn of the century, conditions today are much improved. Now the Southern Appalachians are regarded as a valuable asset that can supply the people of the United States with places to live, play, and produce essential commodities.

The Southern Appalachian Assessment began in the fall of 1994 and was completed in the spring of 1996. Although it was broad and comprehensive, it was aimed at specific questions that arose during a public outreach process. The schedule for completion was tightly maintained so that the results would be timely and relevant. This sense of urgency probably helped to sustain enthusiasm and maintain involvement. Although this approach might have limited the quality of data or the depth of analysis, we tried to make allowances for these weaknesses by highlighting opportunities for additional research or data collection.

We believe that regional assessments are not an end in themselves, but a continuing process that fosters interagency cooperation and professional networking. Maintaining a quality living environment will require hard work on the part of both public and private landowners. It will require the dedicated assistance of scientists and educators. We hope that the assessment will facilitate planning and good management and serve as the basis for continuing study.

The Southern Appalachian Assessment is presented in five separate reports as follows:

Hermann, K. A., editor. 1996. *The Southern Appalachian Assessment GIS Data Base CD ROM Set.* Southern Appalachian Man and the Biosphere Program. Norris, TN.

1. Southern Appalachian Man and the Biosphere (SAMAB). *The Southern Appalachian Assessment Summary Report. Report 1 of 5.* Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region.
2. Southern Appalachian Man and the Biosphere (SAMAB). *The Southern Appalachian Assessment Aquatics Technical Report. Report 2 of 5.* Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region.
3. Southern Appalachian Man and the Biosphere (SAMAB). *The Southern Appalachian Assessment Atmospheric Technical Report. Report 3 of 5.* Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region.
4. Southern Appalachian Man and the Biosphere (SAMAB). *The Southern Appalachian Assessment Social/Cultural/Economic Technical Report. Report 4 of 5.* Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region.
5. Southern Appalachian Man and the Biosphere (SAMAB). *The Southern Appalachian Assessment Terrestrial Technical Report. Report 5 of 5.* Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region.

Van Sickle, Charles. 2001. Southern Appalachian Case Study. In: Jensen, Mark E.; Bourgeron, Patrick S., eds. A guidebook for integrated ecological assessments. New York: Springer-Verlag New York, Inc.: 472-488.