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Department of
Agriculture

Forest Service

White Mountain National Forest
Monitoring Report
1994

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FOREST SUPERVISOR'S ASSESSMENT

The 1986 White Mountain National Forest Land and Resource Management Plan (Forest Plan) set the direction for conducting responsible land stewardship while providing high quality public service on three-quarters of a million acres of National Forest land in New Hampshire and Maine. The Forest Plan, which received in-depth analysis and public consensus, also identified ways to evaluate the success of implementation. These include formal monitoring measurements and reviews as required in Chapter IV of the Plan, letters and comments from the public, site-specific project monitoring, and informal observations.

As an interested user of the National Forest, we are sending you our Monitoring and Evaluation Report for 1994. It has several interrelated sections designed to portray the condition of ecosystems rather than individual resources. The first section explains our ecosystem management philosophy. Subsequent sections assess the current condition of terrestrial and aquatic ecosystems and identifies important biological issues currently facing the Forest. We added a section entitled "Human Dimensions of Ecosystems." It addresses how the National Forest provides recreational opportunities and produces commodities needed by society. The Summary outlines (1) important biological and social issues based on the monitoring results and (2) actions needed to improve management while taking into account the realities of limited budgets.

The trends identified in last year's report appear to be continuing. Demand for the benefits produced by the forest remains high. Recreation use continues to climb. Bid prices for timber products are up from 1993. This year's monitoring results provide more detail about our ability to reach the timber production level estimated in the Forest Plan and about our wildlife strategy. The results of the research project on public perceptions about the visual effects of clearcutting indicate that Forest visitors continue to place a high value on scenic quality.

I concur with the recommendations contained in the summary section of the Monitoring Report. We need to continue to evaluate the effects that management activities have on our ecosystems and society so that we can better assess the trade-offs we face. We need to implement state-of-the-art ecosystem monitoring techniques that will provide information critical for decisions that lie ahead. The Committee of Scientists will be meeting soon to help us further evaluate the Forest

Plan's wildlife strategy, based on data collected to date. We will work with regional researchers to identify additional management indicator species or communities to assess ecosystem health. We also plan to work with our research partners to develop a comprehensive recreation monitoring program which will provide information needed for evaluating the effectiveness of Forest Plan standards and guidelines.

Our monitoring results indicate that our greatest challenge as conservation leaders will be meeting the needs of society while maintaining forest ecosystem health and integrity. The spirit of regional cooperation and the philosophy of stewardship which led to the development of our Forest Plan will allow us to meet that challenge.

We know you have busy schedules but we would appreciate your reviewing this report and sending us your comments on the issues and the monitoring results and how you think we should proceed.

RICK D. CABLES
Forest Supervisor

AN OVERVIEW: ECOSYSTEM MANAGEMENT

An ecosystem is defined as "the sum of all biological and non-biological parts of an area that interact to cause plants to grow and decay, soils or sediments to form, and the chemistry of water to change" (Aber and Melillo, 1991). The area referred to can be very small or very large, its boundaries defined by the interactions of its living and non-living components. An ecosystem, therefore, could be the underside of a log or the entire planet.

Our view of ecosystem management is based on recognizing people as part of the land we manage, and is therefore defined as the use of ecosystems to provide for human needs while protecting and maintaining ecosystem processes.

Over the last 3 years, this approach to managing natural resources has been adopted by federal, state, and private land managers across the country. Some have adopted this approach fully, others are just beginning. Because we are dedicated to managing for multiple benefits, we strive to implement ecosystem management practices.

A key component of ecosystem management is sustainability. To sustain the products and values we as a society desire, we must manage forests in a manner that will sustain them into the future.

In New England, it was a group of dedicated, passionate people looking to the future who helped establish the Weeks Act in 1911, creating the White Mountain National Forest. Today, the Forest is the most heavily used outdoor recreation attraction in New England, accommodating nearly 7 million visitors in 1994. It is scenic beauty and wild places which draw the greatest share of visitors to New Hampshire and Maine.

Visitors to the Forest provide economic benefits to New England, helping to sustain communities far beyond the Forest boundary. In addition to revenue from tourism, communities in northern New England rely on a continuous flow of wood products from the Forest. Clean water for many local communities originates from headwater streams of the Forest, making it imperative to manage watersheds wisely. Recreational activities such as winter sports, hunting and fishing, wildlife viewing, hiking and driving for pleasure all depend on sustaining the ecosystems that provide these benefits.

It is important to note, however, that ecosystems are constantly changing. Natural processes such as wind, insects, disease, and fire change the ecosystem from one condition to another. Other processes such as the introduction of exotic plants and animals, land clearing, wildlife habitat maintenance activities, and timber harvesting also cause change. As these transitions occur, the soil and the composition of associated plant and animal species change.

For example, insects may attack trees, causing some to die. Small openings in the forest will likely result from fallen trees. Changes in the amount of sunlight and other conditions may encourage new species of plants to grow on the site. The wildlife dependent on vegetation will change accordingly. The number of standing dead trees will increase and woodpeckers may become more abundant. As the woodpeckers create holes in the snags, bird species dependent on these holes for nesting may move into the area. As this example illustrates, organisms living in an area are affected by each other and by changes taking place in the environment. As one Native American Salish elder said, "Every part is medicine for another part."

Changes in an ecosystem occur on different levels or scales. In order to effectively manage these changes, we must identify the scale appropriate for the affected species or community of species, which in some cases includes humans. For some species, we must focus on a small scale such as a single stream reach where wild brook trout are known to spawn. For others, we must consider the changes taking place over very large areas, such as from the forests of New England where neotropical migrant birds nest, breed and raise their young, to the tropical forests of the Southern Hemisphere where these birds spend their winters.

In addition to having specific habitat requirements, many wildlife species depend on corridors, or appropriate travel routes between feeding sites, water resources and areas providing cover or nesting sites. The required features of such corridors, of course, vary by species. One species may need large blocks of old trees while others require open areas. Recognizing there are thousands of individual interactions taking place on many different scales led Frank Egler to conclude, "Ecosystems are not only more complex than we think, they are more complex than we CAN think."

This is why we believe it is important to assess the physical, biological, and social processes affecting ecosystems as we plan our management activities. To help us understand these processes, we identify suitable benchmarks with which to compare the effects of our management on dynamic Forest ecosystems. By looking at a

number of benchmarks for reference, we can establish the natural ranges of variability within ecosystems. These ranges help us describe the structure and function of landscapes. One benchmark that is often used is "pre-settlement," because considerable changes have occurred in the forests of northern New England since European settlement.

Although Native Americans had been inhabiting this region for thousands of years prior to the arrival of Europeans, their impacts to the landscape were different (DeGraaf and Healy, 1993). We therefore use the pre-settlement benchmark, along with other points in time, to compare the current and predicted human impacts to the land. This helps us understand the risks associated with different management alternatives.

Fortunately, history indicates our forested ecosystems, especially northern hardwood communities, are resilient to disturbance. In fact, most major plant species have been present in the White Mountains for at least 7,000 years (Spear, et al. 1994). Even most large-scale disturbances will eventually lead to the same complement of plant species, after the ecosystem proceeds slowly through a series of vegetative successions. Each successional stage will exhibit plants of different ages, in different quantities distributed uniquely across the landscape. Each vegetative stage supports a distinct array of wildlife species. The desire to provide essential habitat for a diversity of wildlife guides our vegetation management practices on the White Mountain National Forest.

Land use changes in New England have been dramatic since the arrival of Europeans. As settlement occurred, forested areas were converted to agricultural land or harvested for timber. This reduced the size and distribution of forests, changing the number and kinds of plant and wildlife species. As forests were converted to open areas by early settlers, certain wildlife thrived such as purple martin and Eastern bluebirds. Populations of such species became dependent on these openings. Settlement patterns changed in the last century and many farms were allowed to grow back to forest. The habitat of some open area species was reduced, whereas species requiring young forests had more available habitat.

To maintain biological diversity, we must manage for a balance of early to late successional communities, providing a tapestry of forest vegetation of different species at various ages.

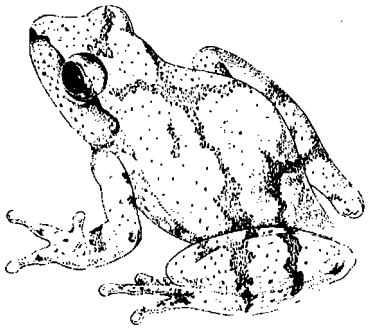
As our forests mature, we are concerned that some populations of wildlife species will decline accordingly. Today in New England, about 90 percent of vertebrate woodland species are dependent upon regenerating or young age classes of all forest community types during some portion of their life history (White Mountain National Forest Land and Resource Management Plan, 1986).

In addition to managing forested and open areas, we have also focused attention on aquatic ecosystems. While the quality of water on the Forest is good, we are concerned about the physical structure of our streams. Prior to European settlement, most area streams were likely shaded by canopies of large trees which also provided cover and nesting sites for riparian wildlife. As trees died, many fell into the streams forming small dams, slowing the flow of water during periods of high runoff. In addition, large populations of beaver left many streams with strings of dams. These processes may have resulted in a larger number of pools than exist today, providing better habitat for fish and other aquatic species. As settlers arrived, beaver were trapped and trees growing along the streams were harvested. Some streams were used as sluices to drive logs downstream to mills. This activity straightened and scoured channels, damaging fish habitat and the adjacent riparian environment. These changes may have affected the function and structure of stream ecosystems. (Likens and Bilby, 1980).

Our monitoring indicates we have many streams with a limited number of deep pools. This, coupled with the propensity for winter ice to build up in northern New England streams, may impact Eastern brook trout and other native fish species which require pools for over-wintering. The abundance of pools in a watershed also alters the speed and volume of water flowing through the system, which in turn affects the condition of streamside vegetation and habitat for wildlife using stream corridors as feeding sites or migration routes.

Uses of the Forest, such as those described above, have changed over time. Prior to the early 1900's, subsistence and commodity production were the major uses. Today, recreation on the Forest has become increasingly important. Our initial endeavors in management of this land base began with planning management strategies for the White Mountain National Forest and immediately adjacent lands.

The existing Forest Plan encourages a balance of early to late successional ecosystems on the Forest. Eight years into the Plan, we find this balance has been difficult to achieve, taking into consideration the capability of the land (i.e., its ability to maintain or revert to a specific community type), the needs/expectations of citizens, and budgetary constraints. We have also found it increasingly important to consider the status of ecosystems in the entire New England area and to evaluate regional trends. As we refine our expertise in classifying ecosystems we can better coordinate habitat management for all successional stages at the regional level. State planners, private landowners, and our research partners in New England also recognize the need to coordinate efforts and are working with us to piece together the ecological picture of New England.



TERRESTRIAL ECOSYSTEMS

Management and Monitoring Framework

We define ecological capability to mean the ability of the land to produce, maintain and/or revert to a particular vegetation community type. Our goal in managing vegetation based on ecological capability is to provide diversity of wildlife habitat, timber products, and recreational opportunities, while promoting forest health and maintaining ecosystem integrity.

The physical landscape, climate, and biological communities within this landscape comprise the White Mountain National Forest ecosystems. When we speak of terrestrial ecosystems on the Forest, we include those areas of forested and non-forested vegetation which do not require high water tables or surface water as key habitat features. The living components of Forest ecosystems comprising various communities of organisms are then broadly categorized into "community types" as defined in Appendix B of the Forest Plan, such as northern hardwood, spruce-fir, hemlock, alpine, and cliff/talus.

Monitoring biological components of terrestrial ecosystems helps us to measure success in meeting the goals and objectives of the Forest Plan. Monitoring of wildlife, rare plants, and threatened and endangered species (TES) includes (1) assessing habitat requirements and habitat availability and (2) assessing population trends of selected Management Indicator Species (MIS). These two components of monitoring are used to evaluate the effects of Forest Plan implementation on the viability and diversity of the plant and wildlife communities on the Forest. For some species, determining the direct effects of our management on populations can be very difficult. This is especially true of migratory birds which utilize forest habitats in New England for part of the year and forests in the tropics during our winters. Clearly these neotropical migrants are affected by tropical deforestation as well as by land management activities in New England.

The Forest Plan specifies 22 individual species to serve as indicators of the effects of management practices on specific habitats. Monitoring the habitat available for these species and trends in their population structure helps us to assess how well we are doing in maintaining habitat and viability of species. We have not been able to collect sufficient data to accurately determine the effects of management on some of our less common species. The status of each MIS, the habitat they represent, and how much of that habitat is now present on the Forest is summarized in Display 1.

Display 1
Comparison of Trends in Habitat and Management Indicator Species on WMNF Lands where Timber Harvest Occurs

Community Type	Community Age Class	Current Acres 1994	Number of Acres Desired	Management Indicator Species	Population Status on Forest	Population Status in New England
Northern Hardwood Evenage	Regeneration	11,790	11,443	Chestnut Sided Warbler	Sightings Down in 1994	Declining
Northern Hardwood Evenage	Mature	106,008	51,493	Northern Goshawk	Sightings Down in 1994	Unknown
Spruce Fir Evenage	Regeneration +Young	2,385	12,563	Snowshoe Hare	Increasing	Increasing
Spruce Fir Evenage	Mature Overmature	4,398 3,679	19,744 3,529	Cape May Warbler	No Sightings	Unknown
Hemlock Unevenage	All	7,105	5,924	White-Tailed Deer	Sightings up in 1994	Declining
Paper Birch + Aspen Evenage	Regeneration Young	1,920 2,851	5,720 22,212	Ruffed Grouse	Increasing	Increasing
Paper Birch + Aspen Evenage	Mature Overmature	4,291 7,496	16,489 4,935	Broad-Winged Hawk	Unknown	Unknown
Open Acres		616	6,731	Eastern Bluebirds	No Sightings	Unknown

Terrestrial Ecosystems in General

For the past 5 years, the National Forest Health Monitoring Program has collected information at several sites on the Forest. Permanent plots monitored for crown condition and damage, lichen species, vegetation structure and photosynthetic efficiency indicate the health of our forests is satisfactory and shows no indication of decline. The WMNF has been relatively free of large-scale pest problems for the past several years. Our own surveys and ongoing research at the Hubbard Brook Experimental Forest indicate forest stands are restocking after harvest, and forest growth does not appear to be decreasing as a result of soil nutrient depletion from timber harvesting.

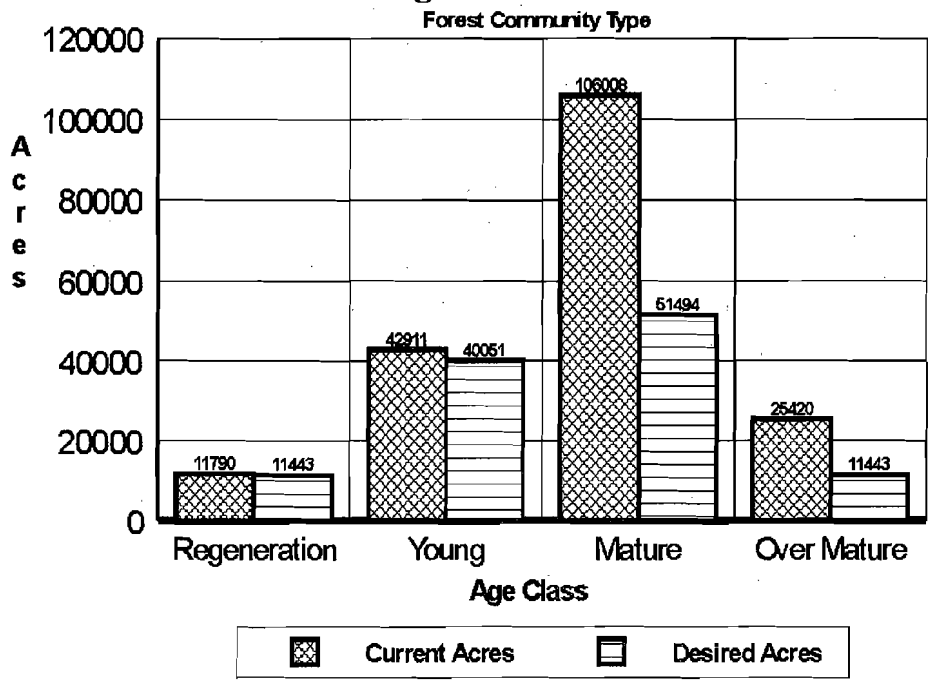
An emerging issue on the Forest has been long-term soil productivity and the potential impact of whole-tree harvesting on forested ecosystems. Current research indicates nutrient depletion is potentially severe in repeated short rotation whole-tree harvests, especially where outwash sands are present. The Forest has not engaged in repeated short rotation harvests. Forest Plan standards and guidelines limit removal of whole trees to soils with sufficient nutrient content and storage capacity to maintain soil productivity. We will continue to monitor and evaluate the effects of whole tree harvesting in these areas.

It is important to note that vegetative management to achieve wildlife composition occurs on about 50 percent of the Forest. We assume those portions of the Forest where no timber harvesting occurs are also providing a diversity of habitat for plant and wildlife species. The Forest Plan outlines goals for species composition in areas on the Forest where vegetation is managed to enhance wildlife habitat. Data show that all community types, with the exception of spruce-fir, possess a greater number of over-mature even-aged acres than the desired future condition (Display 2-5). This, coupled with a trend away from even-aged harvesting methods, likely has implications for many wildlife species.

Northern Hardwood Communities

Northern Hardwood is the most abundant vegetative community type on the Forest, with over 200,000 acres under even-aged or uneven-aged management. We have met our desired future condition for number of uneven-aged management acres and even-aged regeneration acres. On the other hand, we continue to retain more acres in mature hardwoods than is prescribed in the wildlife objectives of the Forest Plan (Display 2).

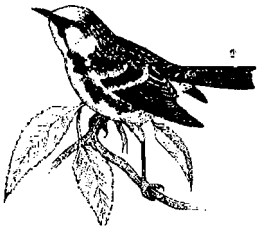
Display 2



In the past, we have routinely included "mixed woods" stands within our northern hardwood community type. These acres often include a considerable abundance of conifers. It is likely that mixed woods should either be counted within other community types or should comprise a separate category to better depict actual habitat available to wildlife species.

We monitored the habitat and population of small whorled pogonia *Isotria medeoloides*, a federally listed threatened plant found in the mixed woods component. This species has recently been reclassified from Endangered to Threatened, indicating improved status throughout its range. Protection of its habitat is critical to ensure continued survival in New England. Monitoring efforts in 1993 discovered colonies of small whorled pogonia in younger mixed hardwood-conifer forests with relatively open understories. In 1994, surveys located additional sub-populations, essentially doubling the number of plants counted in 1993. Since the small whorled pogonia is a Federally listed species, we will continue to monitor population trends.

The chestnut-sided warbler is the MIS for the regenerating stage of the northern hardwood community. Monitoring results from the past 3 years suggest chestnut-sided warblers prefer areas under even-aged vegetative management. This is consistent with the species' general preference for breeding sites in regenerating hardwood forests.



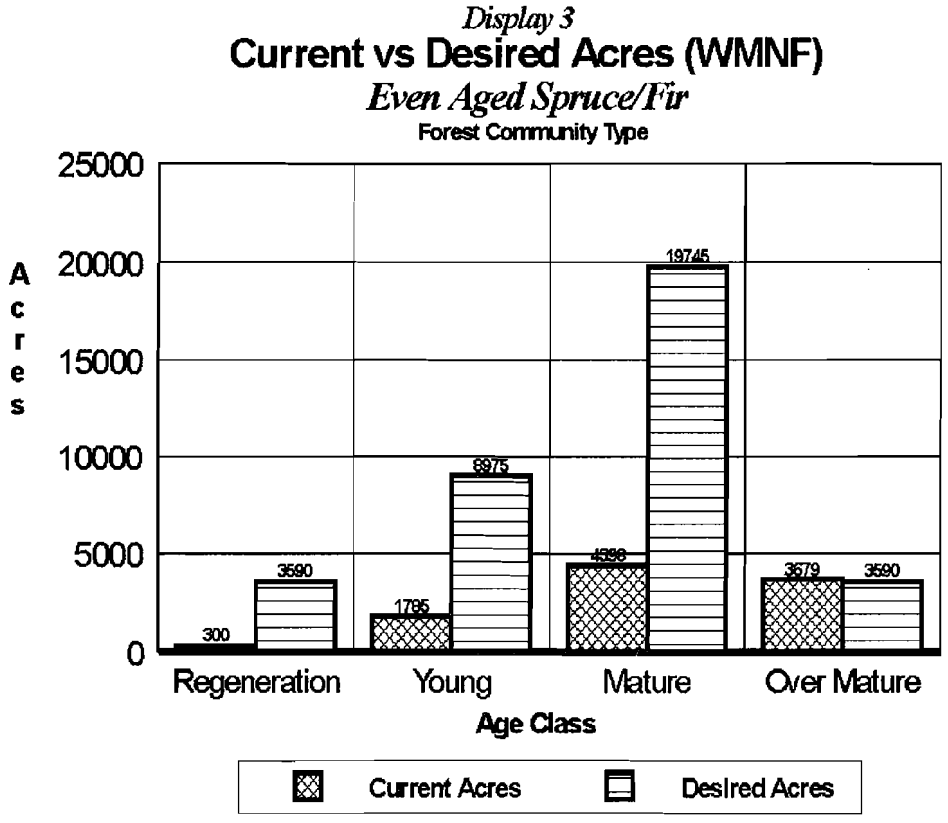
Data indicate chestnut-sided warblers are still relatively abundant in the monitoring plots in managed areas. Additional research conducted on the Saco and Ammonoosuc Ranger Districts in 1993 verified the presence of this species in clearcut stands, whereas in group-harvested or untreated stands none of the birds were present (Costello, 1993 research in progress). The population of chestnut-sided warblers on the Forest is likely to decrease as currently available northern hardwood habitat matures. This corresponds to an overall decline in this warbler species due to an increase in mature hardwood forest in New England (Litvaitis, 1993). Monitoring indicates a decline in acres of regeneration harvests over the past several years (see display 11 in the section on the Timber Sale Program, later in the report).

Data also indicate an excess of mature and over-mature acres of northern hardwoods under even-aged management compared to Plan goals. Northern goshawk is our MIS for the mature component of this community type. In cooperation with the Audubon Society of New Hampshire, we have completed 2 years of directed searches for this species with highly variable results. Goshawk are not common on the Forest and it is possible we have not adequately surveyed their habitat. We have submitted funding proposals to the National Biological Service to increase directed searches for goshawks in 1995.

Spruce-Fir Communities

The spruce-fir communities of the Forest support more rare animal species than do other major forest community types. Many of these species are associated with mature spruce-fir forests. Sound management of this community type is critical to the biological diversity of New England. Data indicate that in all but one age class, we have not attained our desired condition for number of acres of this community in even-aged managed lands (See Displays 1 and 3). This may be because we (1) over-estimated our capability to reproduce spruce-fir, using even aged harvest methods without planting and control of hardwood competition or (2) under-estimated the actual number of acres of spruce-fir community regenerating by labeling them "mixed woods" and thereby including them in the northern hardwoods community data. In addition, a trend toward uneven-aged management of softwood stands has resulted in fewer acres classified as even aged regeneration.

Display 3



For the past 3 years, we have been monitoring MIS for the spruce-fir community type. Cape May warblers, which utilize mature spruce-fir, have not been recorded in bird surveys in any of the 3 years. This may be a reflection of normal variations known to occur in Cape May warbler populations in response to cyclic fluctuations in its major food source, spruce budworm.

Snowshoe hare serve as the MIS for young spruce-fir communities. Despite being below desired condition for number of acres of regenerating and young spruce-fir communities (See Display 3), monitoring indicates an increasing trend in snowshoe hare populations in Maine and New Hampshire. Regeneration of spruce-fir communities is complex: clearcutting in stands which do not already have spruce-fir seedlings emerging may result in the growth of early successional hardwoods. These sites may not return to spruce-fir communities for many decades. For this reason, we are tending not to clearcut spruce-fir stands. Based on preliminary wildlife monitoring data, the lack of clearcutting does not appear to be adversely affecting snowshoe hare populations.

Hemlock Communities

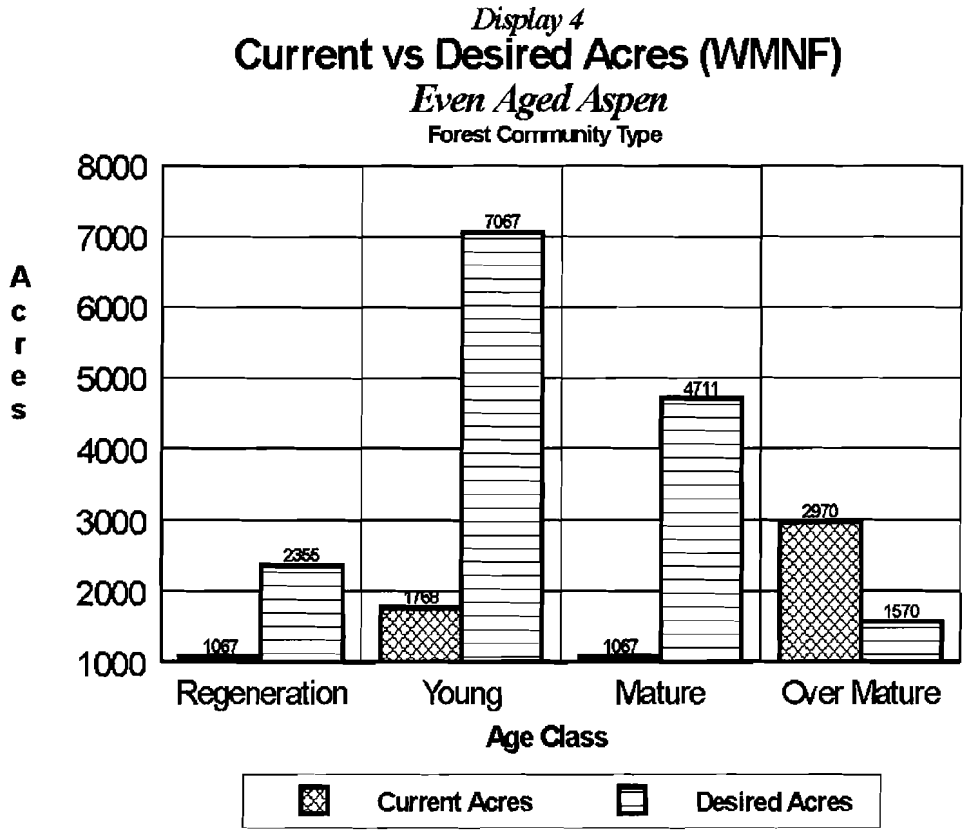
Hemlock communities on the Forest are managed under uneven-aged regimes. Currently, our number of acres of hemlock community slightly exceed the DFC. The 1994 winter track census revealed an increase in the number of white-tailed deer, the MIS for hemlock communities. This contrasts with state data which suggest a decline in deer populations. Because the hemlock community is not represented extensively on the Forest, additional years of data are needed to fully assess its status. Preliminary monitoring results suggest existing hemlock communities are supporting deer and current management regimes are meeting Forest Plan objectives.

Paper Birch and Aspen Communities

Data indicate we are not currently meeting goals for paper birch and aspen communities in various age classes (See Displays 4 and 5). As with our spruce-fir communities, this could reflect an over-estimation of the number of acres of managed land capable of producing aspen and, especially, paper birch. Although we exceed our desired number of acres of over-mature paper birch and aspen, we have not attained the desired number of mature acres.

The broad-winged hawk is our MIS for both mature and over-mature paper birch and aspen communities. We have not been successful in monitoring this species, with only four sightings recorded in 1994 point counts. Hawk populations may be limited

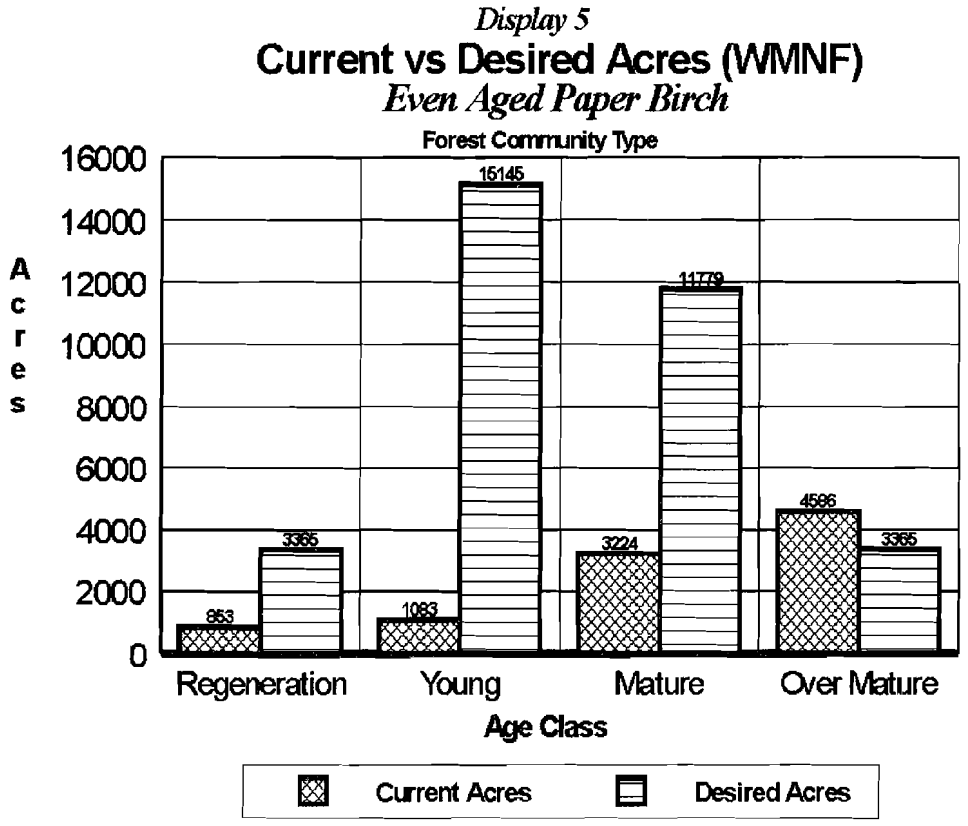
Display 4



by the relatively infrequent occurrence of paper birch and aspen communities on the Forest. Alternatively, our point-count protocol may be inappropriate for this species. It may, instead, be necessary to employ direct search methods to detect trends in hawk populations.

Trends in ruffed grouse populations are used to monitor the extent to which regenerating paper birch-aspen communities on the Forest offer suitable wildlife habitat. Winter track surveys in 1994 showed an increase in the number of sightings

Display 5



over 1993. The states of Maine and New Hampshire also report increases in ruffed grouse populations since 1990. Despite not meeting our DFC for paper birch and aspen regeneration, grouse populations appear to be increasing (Display 1). Continued monitoring will help us to better determine what are the suitable habitat needs for this species.

Alpine Communities

The alpine communities of the White Mountains are the most vegetatively diverse in the United States, east of the Mississippi. As such, they have been the focus of numerous research endeavors over the years. Land management in this community is directly related to recreational use and includes habitat protection, trail construction and/or maintenance, and backcountry patrol. Current monitoring includes bird counts and measures of air quality, dispersed hiking use, and population dynamics of the federally endangered alpine plant *Potentilla robbinsiana*, or Robbins' cinquefoil as it is commonly called.

The Monroe Flats population of Robbins' cinquefoil has continued to respond favorably to management strategies and to this year's relatively mild weather conditions. The population is considered stable, suggesting the plant and its habitat are being well-protected from plant collectors and hiker disturbance. This species serves as an indicator of the condition of the alpine community. However, additional assemblages of plant species with more widespread distribution may serve as better indicators of alpine community health. The Appalachian Mountain Club (AMC) has nearly completed an intensive mapping of the alpine community types of the Presidential Range. This project will assist us in choosing appropriate alpine plant groups as management indicators (Dr. Kenneth Kimball, personal communication).

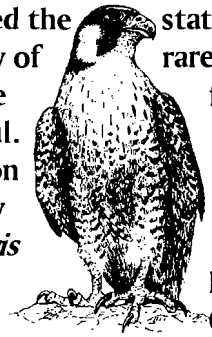
Major threats to the integrity of our alpine communities are human disturbance and high ozone concentrations which cause injury to plant foliage. Records taken by backcountry trail crews, botanists, and AMC personnel indicate that where trails are well-defined and regularly maintained trampling of alpine vegetation is minimal, especially considering the enormous number of hikers visiting these areas. Although ozone concentrations in 1994 were lower than in previous years, alpine vegetation surveys showed some widespread foliar injury. Other environmental factors, such as weather and soil moisture content, may cause an increase in the uptake of ozone in alpine plants.

Two species of birds, Bicknell's thrush and blackpoll warbler, utilize high elevation spruce-fir sub-alpine communities of the Forest during their breeding season. Bicknell's thrush is currently being considered for federal listing as Endangered and is considered a sensitive species by the Eastern Region of the Forest Service.

Directed searches conducted in 1994 recorded a total of 129 Bicknell's Thrush (population status: of concern) and 319 blackpoll warbler (populations status: abundant). Data collected these last 2 years will be used to provide baseline population estimates with which to compare in future years.

Cliffs/Talus Communities

This community is utilized by nesting raptors (particularly peregrine falcon), various plant species, and ever-increasing numbers of human rock-climbers. In 1994 we monitored the status of peregrine falcon populations and conducted an inventory of rare plants on the cliffs of Rattlesnake Mountain. Recovery of peregrine falcon to the Forest and to New England has been very successful. Two of nine nesting pairs in New Hampshire in 1994 were located on the Forest. Three offspring were also counted. Our plant inventory on Rattlesnake Mountain documented the presence of *Dryopteris fragrans*, or fragrant fern, a state-listed species. The plant was located in cliff areas potentially impacted by rock-climbing activity. Continued monitoring is recommended as field personnel work closely with local rock-climbing clubs to ensure protection of this rare plant.

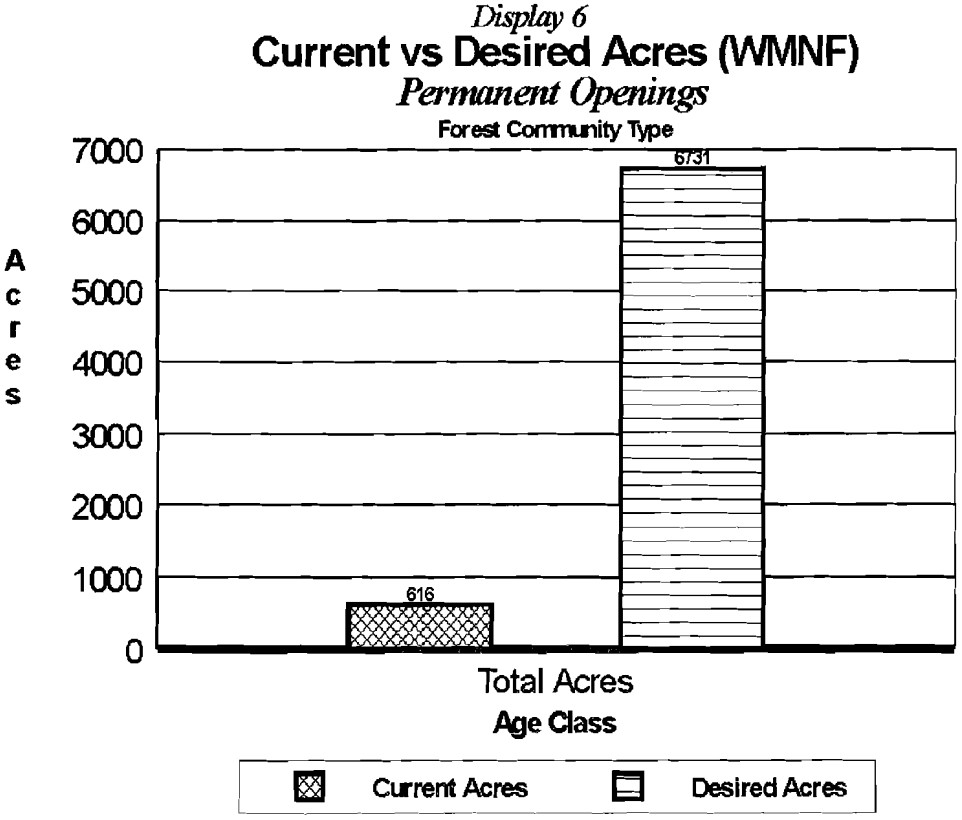


Open Upland Communities

The Forest Plan objectives include establishing and maintaining small, permanent forest openings to serve as a component of the home ranges of many species of birds, as well as white-tailed deer and other mammals. Openings created by past agricultural practices are decreasing in number and not widely distributed across the Forest. Kingbirds and bluebirds, the MIS for open upland communities, have been monitored for the past 3 years. Neither of these species has been recorded, indicating their habitats are not well represented in monitored areas. Beginning in 1995, we should initiate directed searches for these species in randomly selected openings across the Forest.

Many openings generated for wildlife by the Forest Service have not been maintained due to budget constraints. For the same reason, new openings have not been established at a rate which will enable us to meet the goals set forth in the Forest Plan (Display 6). We need to identify creative, less expensive ways to establish and maintain these small gaps of early successional habitat in order to maintain the community and species diversity of northern New England.

Display 6



AQUATIC ECOSYSTEMS

Management and Monitoring Framework

Aquatic ecosystems of the Forest include wetlands, ephemeral pools formed by rain or snow melt, natural and man-made ponds, streams and rivers, and associated riparian corridors. For the most part, we have focused our monitoring on habitat condition for aquatic species, stream channel stability, and water quality to assess the health and integrity of these ecosystems.

Wetland and Ephemeral Pool Communities

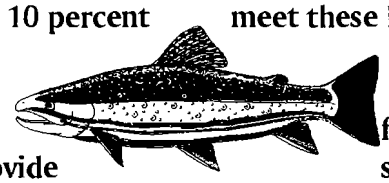
Forest wetlands and ephemeral pools are generally well-protected by (1) adhering to standards set by the states to protect wetland resources during timber harvest and by (2) restricting activity in sensitive areas. The American black duck is the Management Indicator Species (MIS) for these wetland communities. It is a hunted species whose populations have declined in the Northeast over the last 20 years. The Northern Atlantic Waterfowl Survey results for 1994 showed a decrease in black ducks in New Hampshire and Maine. However, our monitoring resulted in 24 black ducks recorded on 10 Forest wetlands, an increase over the previous 2 years. Because ephemeral or temporary woodland pools are critical breeding sites for many amphibians, these relatively obscure wetlands may play a key role in maintaining the functional integrity of our forest ecosystems. Further research and monitoring is needed to determine the structural and biological qualities of these ephemeral pools necessary to support breeding amphibians.

Pond Communities

Ponds located on the Forest comprise a diversity of aquatic communities. These include: "put-and-take" stocked ponds; wild trout ponds; warm-water fish ponds; backcountry secluded ponds; and wilderness ponds. Many Forest ponds provide fishing and interpretive opportunities to meet the diverse recreational needs of our visitors. Field crews working with New Hampshire Departments of Fish and Game and Environmental Services, and Maine Department of Environmental Protection, monitor ponds for water quality, fish production, recreational use, and accessibility. For the most part, Forest ponds are healthy functioning ecosystems. Occasionally, man-made ponds, especially those frequented by waterfowl, require draining to mimic natural water level fluctuations and promote the growth of native vegetation.

Stream Communities

Our stream inventories provide data useful in evaluating watershed condition in general and the condition of fish habitat in particular. Many of our forest streams are relatively straight and shallow throughout their length. Pool areas are critical for the over-wintering of fish that use pools for refuge from ice build-up and/or minimal flow. Atlantic salmon, for example, require pools to comprise 15 percent of a stream's total area; Eastern brook trout require 20 percent. Of the 500 miles of streams inventoried, only 10 percent meet these Forest Plan standards for desired pool levels.



This may be due to the fact that streamside forests are not yet old enough to provide sufficient quantities of large, dead and dying trees which, upon falling into the stream would help create pools (Bilby and Likens, 1980). Smaller trees falling in Forest streams tend to be swept away with each spring melt. Restoration projects which include promoting growth of large diameter coniferous trees in riparian areas and adding large wood to the channel to slow water and encourage pool formation can accelerate the watershed recovery process. An evaluation of the geomorphic, social, and biological processes occurring in the watershed is critical to the success of any watershed restoration project. We are currently developing an aquatic classification system incorporating our stream inventory data to help us evaluate which watersheds, if any, are most appropriate for restoration projects.

A diversity of aquatic species live in Forest streams, according to fish population monitoring. Species recorded include: wild and stocked brook trout, rainbow trout, brown trout, and non-game fish such as dace, sculpin, suckers and chub. Each year we stock thousands of Atlantic salmon fry in headwater streams on the western portion of the Forest in an effort to help restore this species to New England. For the past 2 years, we have collected stream insects to monitor productivity and biological diversity of our headwater streams. Insect populations sampled to date are representative of granitic stream ecosystems. Fishing pressure is considerable on Forest streams and stocking of hatchery fish to supplement natural reproduction of trout species will continue. We are coordinating inventory efforts with New Hampshire Fish and Game and Maine Department of Inland Fisheries and Wildlife to identify streams where naturally reproducing brook trout populations should be maintained. We will need to conduct research to identify factors limiting aquatic species survival and impacting aquatic community integrity. Efforts to restore stream habitat should increase production of trout and Atlantic salmon smolts, as well as improve overall condition of native aquatic communities.

Riparian Communities

Healthy riparian, or stream/riverside communities are very important to the integrity of our watersheds. These areas trap suspended sediments, serve as "brakes" for water during high flows, help to shade streams from sunlight, and provide food sources for the aquatic food chain. They are also habitat for neotropical migrant birds, deer, amphibians and many other plant and animal species. Riparian areas thus serve as effective indicators of aquatic ecosystem health and watershed condition.

The condition of riparian areas on the Forest varies, depending on where they are located and also on their dominant vegetation. Rivers and streams adjacent to major travel corridors such as the Kancamagus Scenic Byway are popular sites for camping, picnicking, fishing, hiking and relaxing. These activities in turn may impact fish habitat, water quality, and riparian wildlife habitat both at the affected site and throughout the remaining watershed downstream. As we focus on this issue in 1995, we will develop more specific monitoring parameters to help us evaluate the effects of recreational use on sensitive riparian ecosystems.

HUMAN DIMENSIONS OF ECOSYSTEMS

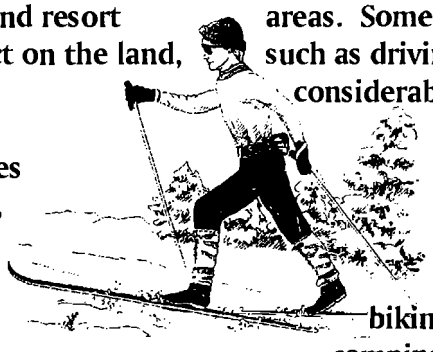
Management and Monitoring Overview

One of the key principles of ecosystem management is to provide for a full spectrum of society's needs. As we move toward incorporating this principle into our Forest Plan, monitoring and evaluation activities must focus on developing techniques to measure how programs and management practices meet human needs while contributing to the sustainability of ecosystems. This section of the report evaluates our management in recreation, heritage preservation, visual resources and timber sales in meeting Forest Plan goals to provide products, services and amenities.

Recreation, Trails and Wilderness Programs

As we near the end of the first decade of Forest Plan implementation, we are interested in how our accomplishments in recreation resource management compare with projections. Although it is difficult to obtain a precise count, we estimate total recreation use of the Forest to be near 7 million visits. This estimate is far more than we envisioned when the Plan was written.

The White Mountain National Forest is the most heavily used outdoor recreation attraction in New England, receiving visits on a level comparable or greater than our largest national parks including Yellowstone and Yosemite. Use figures in the last 5 years have increased from 4 to 7 million, due in part to promotional programs of the NH Office of Travel and Tourism, Ski New Hampshire, and individual advertising campaigns from ski and resort areas. Some of this recreational use may have very little impact on the land, such as driving through the Forest. Other activities may have a considerable impact.



The Forest Plan divides recreational activities on the Forest into dispersed, developed, and Wilderness use. Dispersed use includes motorized and non-motorized activities such as driving for pleasure, hiking and biking. Developed recreation use includes picnicking, camping and swimming at designated sites, downhill and cross country skiing, and the use of cabins, huts and resort areas. Wilderness use includes all activities occurring in Congressionally designated Wilderness. These opportunities are provided both directly by the Forest Service, and through private sector partnerships.

According to a recent report "Outdoor Recreation in America," released by the Recreation Roundtable, a nationwide survey indicates that changes in societal values, attitudes, demographics and economic conditions are: (1) altering the reasons Americans recreate, (2) presenting new barriers to participation in particular activities and (3) changing the specific benefits people seek from recreation. For example, according to the survey, the main barrier to participation was diminished leisure time. This may mean that visitors are using the Forest more frequently but for shorter duration. We need better information about visitor preferences, satisfaction levels, and visitation to see if these national trends are applicable to the WMNF.

The Forest Plan predicted the greatest amount of recreational activity would be related to dispersed use. All indications are that this is true and that actual dispersed use exceeds Plan estimates. For example, driving for pleasure is estimated to be at least double the prediction made in the Final Environmental Impact Statement.

Bicycling and cross country skiing have continued the increase first noted in 1993. Shelter and tent site use reached a 5 year high in 1994. Wilderness use in 1994 was about 60 percent higher than Plan predictions. We need to improve the accuracy of dispersed recreation use figures with continued monitoring.

We have more accurate developed site use estimates, since most are based on either fees paid or supervised site administration. In 1994, camping, picnicking and swimming use at developed sites was about 60 percent of the end of decade level predicted in the Plan. We continue to be very successful in providing recreation through private sector partnerships. Downhill skiing, provided at winter sports sites under special use permit, exceeded end of decade Plan predictions by about 30 percent in 1994. Visitor use at backcountry facilities provided by the Appalachian Mountain Club (AMC) and other backcountry permittees has increased.

Facing deterioration of facilities and steady increases in visitation, we continue to struggle with inadequate financial resources and increasing costs. Maintenance and reconstruction of developed sites and trails again took precedence over new facility construction in 1994. Much needed reconstruction of toilets, repair of electrical and sewerage systems, and provisions for universal access for all visitors are nearing completion at Russell Pond Campground. The reconstruction of Wild River Campground was also completed in 1994.

We have made progress in rebuilding our infrastructure, considering budget limitations. We have completed major rehabilitation of 10 campgrounds, constructed over 50 new restroom facilities, and have made significant progress in providing universal access. In 1995, we hope to complete renovations at Campton Campground. In addition, we have completed designs for improvements along the Kancamagus Scenic Byway.

Increased funding for trail construction in 1994 enabled us to make substantial progress on trail reconstruction and relocation, with priority assigned to projects aimed at resource protection. We have also completed 66 of the 89 miles of new trails scheduled for completion at the end of the first decade of Plan implementation.

For the last 88 years, the Forest has worked in partnership with the Appalachian Mountain Club (AMC). As part of the partnership, the AMC holds a permit to operate a mountain hut system. Huts are an important component of our backcountry recreational facilities, providing refuge for hikers while protecting the mountain ecosystem. In addition, AMC conducts research activities, environmental education, and search and rescue operations.

AMC's permit expires in September of 1995. We have begun the process to issue a new permit. A number of concerns regarding the Forest Service/AMC partnership as well as operations and activities at the huts and the Pinkham Notch Visitor Center will be reviewed and addressed.

Implementation of our backcountry management goals includes use of the huts as an aid to long distance hikers. It also recognizes the impact hikers may have on vegetation around the huts and on nearby water sources. The Plan concludes that mitigation in place when the Plan was signed, in addition to strict adherence to Forest Plan standards, would protect these sensitive areas. General monitoring over the last 8 years has not indicated unacceptable impacts have occurred. Composting and solar toilets at hut sites also help reduce the impact of almost 300,000 trail users. Without the huts, sanitation problems in this fragile alpine ecosystem could be overwhelming. The huts are part of meeting the Forest Plan goal to feature "quality recreation opportunities not likely to be provided elsewhere on other lands."

Heritage Resources

We continued this year to pursue Forest Plan objectives in managing heritage resources, which pertain to areas or items of cultural or historical value, such as foundations, ruins and artifacts. The Plan seeks to survey such areas to avoid disturbing them when implementing other Forest Plan objectives. Although we recognize the need to conduct site evaluations in accordance with Plan guidelines to determine long term management of these resources, our efforts remain backlogged due, in large part, to funding priorities. Such site evaluations, which would provide an historic perspective on land use, could also be useful in ecosystem management planning for the WMNF. With limited heritage funds, we have prioritized project mitigation efforts in support of recreation facility and trail construction and timber harvesting over heritage site evaluations.

Visual Quality

Protection of the scenic resource or visual quality of the Forest was a major public issue during development of the Forest Plan. Maintaining the outstanding scenic attributes of the White Mountain region while implementing management activities, particularly timber harvesting, was of primary concern.

The Final Environmental Impact Statement (FEIS) assumed that clearcutting had the greatest potential to adversely affect visual quality. In looking at the long-term cumulative effects of proposed harvesting, the FEIS predicted that implementing all programs in the Forest Plan would result in a landscape which is 94 percent "naturally appearing," with 6 percent showing evidence of human activity at the end of the fifth decade.

Results of monitoring indicate the Forest is meeting visual quality objectives outlined in the Plan. This has largely been accomplished through pre-project planning using computer simulation. The Forest has retained its exceptional scenic quality during implementation of the Forest Plan. As we near the end of the first decade, the amount of land showing evidence of human activity, i.e., timber harvests, ski area and recreation developments, utility corridors, roads and mineral developments is estimated at 5 percent of total Forest acres. This is essentially the same percentage estimated to be present at the time the FEIS was developed.

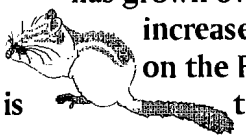
However, there are several areas on the Forest which may be at or near the threshold of concern with regard to visual quality due to cumulative effects of past management activities. These are areas where past timber harvesting or recent harvesting on private land is quite evident.

In 1994 we obtained preliminary results of a monitoring study begun in 1991 by the Forest Service and the State University of New York at Syracuse. The project incorporated public response to simulations of multiple timber harvest activity and the resulting changes in the landscape over time. The study shows public response to such harvesting may not support the proportions of landscape with evidence of human activity envisioned in the Plan.

Timber Sale Program

Consistent delivery of the timber sale program on the White Mountain National Forest is important since it relates to one of the goals of ecosystem management on public lands--the production of goods and services by or for people, and achievement of desired vegetative conditions.

The Forest is an important source of raw material, particularly high quality hardwood logs, which supply local and regional furniture and specialty product manufacturers. Demand for timber products has grown over the last 4 years. Average advertised values for timber sales increased by 31 percent from 1993 to 1994. The timber sale program on the Forest also provides a model for sustainable harvest practices, and is the primary tool for maintaining a diversity of wildlife habitat.

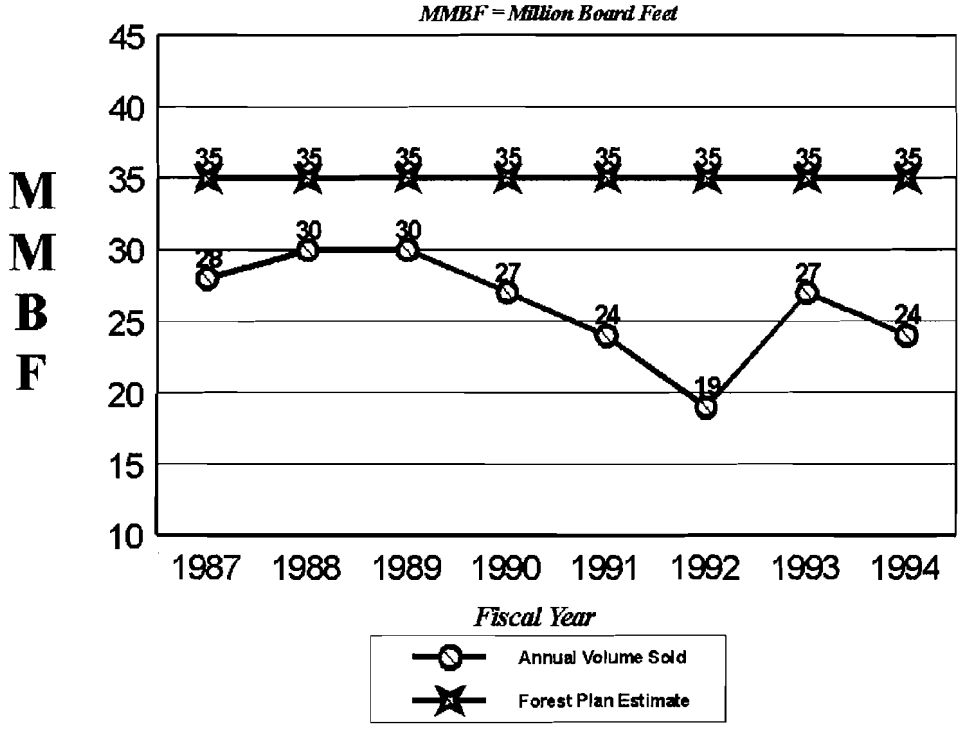


The amount of timber sold on the WMNF has not occurred as predicted in the Forest Plan. As of 1994 we sold an annual average of 26 million board feet (MMBF), roughly 75 percent of the 35 MMBF allowable limit as established by the Forest Plan. Display 7 shows the annual volume sold since 1987.

Display 7

Timber Volumes Sold

White Mountain National Forest

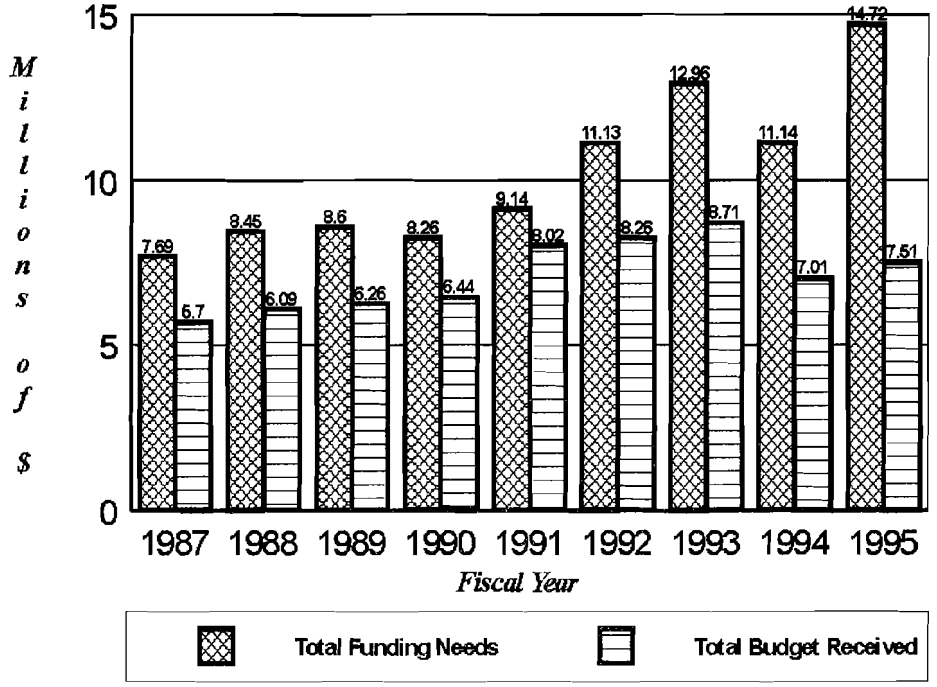


At this point we have not done an analysis which would allow us to quantify in detail or specifically identify the reasons for the differences between the Plan versus actual timber quantities sold. We think that the most probable factors are (1) rising unit costs and (2) differences between predictions and assumptions made in the Forest Plan and actual experience in implementing projects on the ground. These are discussed as follows.

Budgets and Costs

Declining budgets have affected implementation of the Forest Plan for all resource programs. We base our budget requests on the Forest Plan, and appropriations affect the rate at which we implement the Plan. Overall Forest budgets have been funded at about 60 percent of the level necessary to fully implement Plan objectives (Display 8).

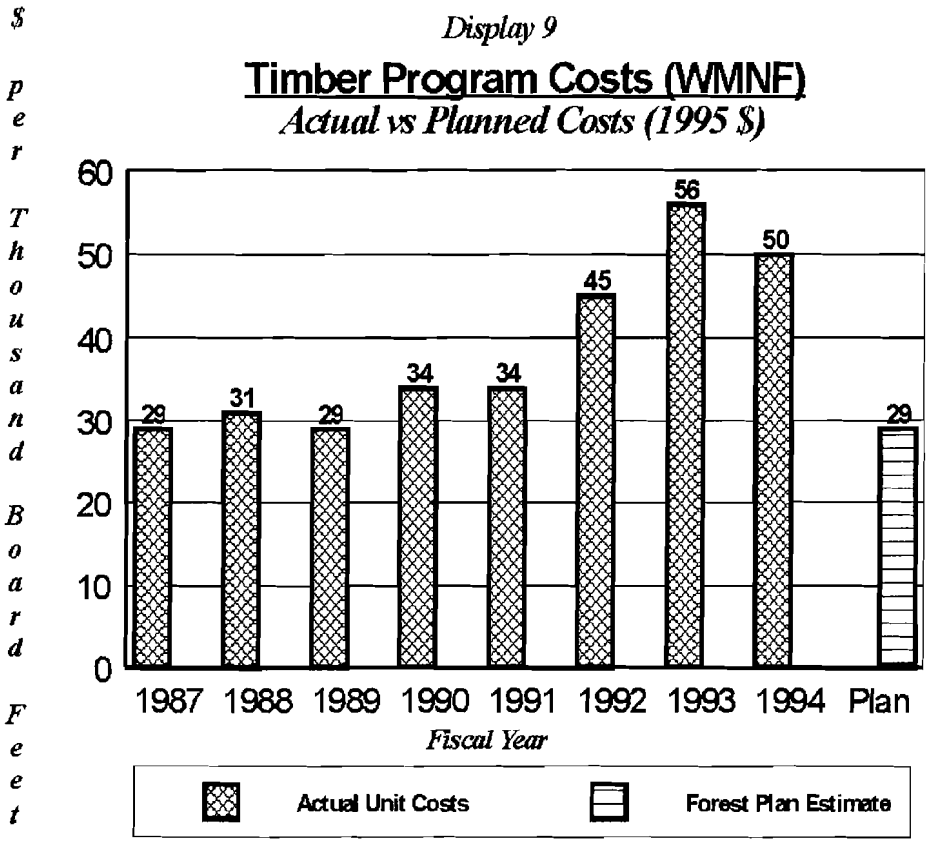
Display 8



The initial budget for timber funding in Fiscal Year '95 was based on sales of 9 million board feet (MMBF)--35 percent of the average for the period and only 25 percent of the Plan limit. Due to widespread public and congressional support, the final '95 budget supported a program of 18 MMBF, double the initial program. But even with the increase, sales in 1995 will only be 70 percent of the 8 year average.

The level of environmental analysis required to prepare timber for sale has become increasingly complex, resulting in a steady rise in associated costs since 1990 (see Display 9). Implementation costs have also risen, primarily due to the increased use of uneven-aged management, and reduction of clearcutting. This level of increase in unit cost was not anticipated in the Forest Plan.

Display 9



Other Factors

The Forest Plan estimated the quantity of future timber sales by use of a forest planning model. Reliability of these estimates depends on the accuracy of the assumptions and the information used to build the model. As would be expected with any modeling technique, actual implementation provides the basis for adjusting the model.

Timber sale volumes may be lower than anticipated in the Plan because the model could not take into account all of the site conditions that arise during implementation of projects on the ground. At each site we consider a multitude of factors including the time elapsed since last harvest, the size, dispersal, age and visibility of openings created by past clearcutting, wildlife habitat quantity and distribution, ecological land types, watershed size, and riparian vegetation structure.

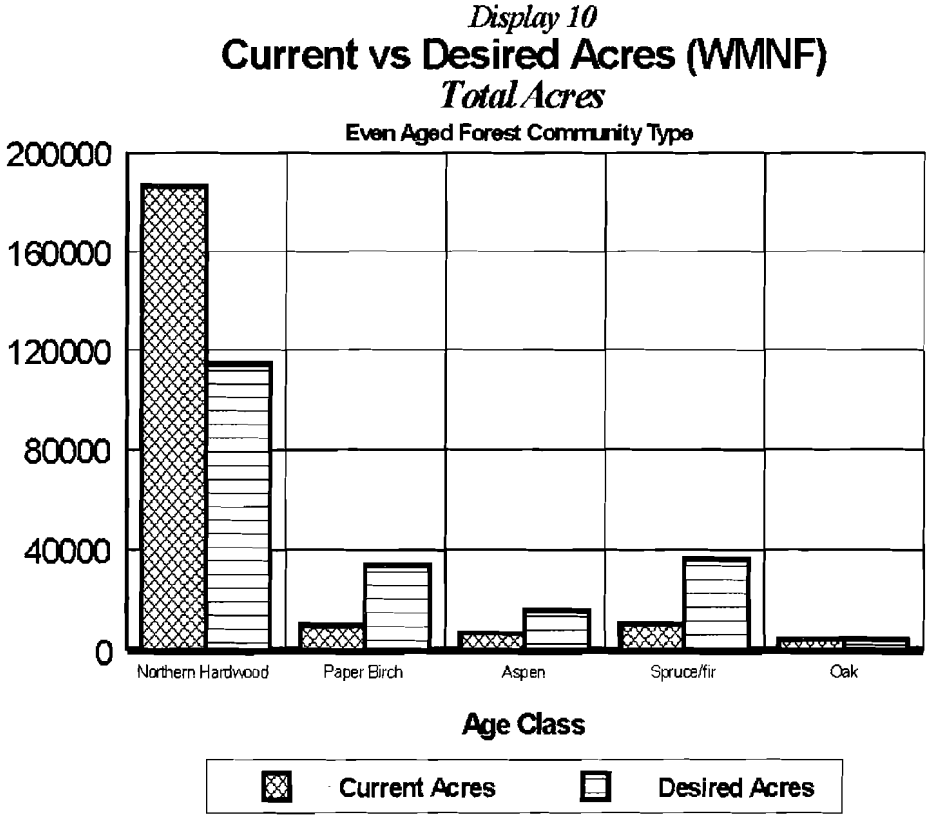
When we apply the Forest Plan standards and guidelines for visual quality and desired regeneration age classes, we find these more limiting in the short term than we had predicted. Forest Plan guidelines say that new regeneration cuts will not be made adjacent to previous cuts until the pre-existing harvest areas have "grown-in." Our experience in planning regeneration cuts in some viewsheds with extensive past harvesting indicates that applying this standard often reduces the number of acres we can regenerate.

Prior to issuance of the Forest Plan, the Forest had been practicing even-aged management, including clearcutting, for about 20 years. In some parts of the Forest, these past harvests are still visually evident. Preliminary results from a collaborative research study of public reaction to vegetative management, were published this year. The study, conducted on the White Mountain National Forest, indicates that some viewsheds may not be able to absorb the cumulative visual effects of clearcutting envisioned in the Plan. (Palmer et.al. 1995).

As indicated in the discussion of the northern hardwood type, we have already achieved or exceeded the desired quantity of regeneration habitat (i.e., stands 0-9 years old) for even-aged northern hardwood stands, in many Habitat Management Units. This means in the short term, that managers may be constrained from producing additional northern hardwood regeneration in these areas, unless conversion to other community types is possible.

Forest Plan timber output predictions depend in part, on estimates of the capability of land to respond in various ways to achieving desired future conditions. For example, the Forest Plan's wildlife management strategy emphasizes the need to convert a portion of the more abundant northern hardwood type to paper birch, spruce-fir and aspen forest habitats, which are needed by some wildlife species. Monitoring data indicates this community type conversion has not occurred to the extent anticipated in the Forest Plan, (See Display 10). This may be due in part to the lack of natural regeneration response for these species on some sites. See also discussions of this issue in the previous section on Terrestrial Ecosystems.

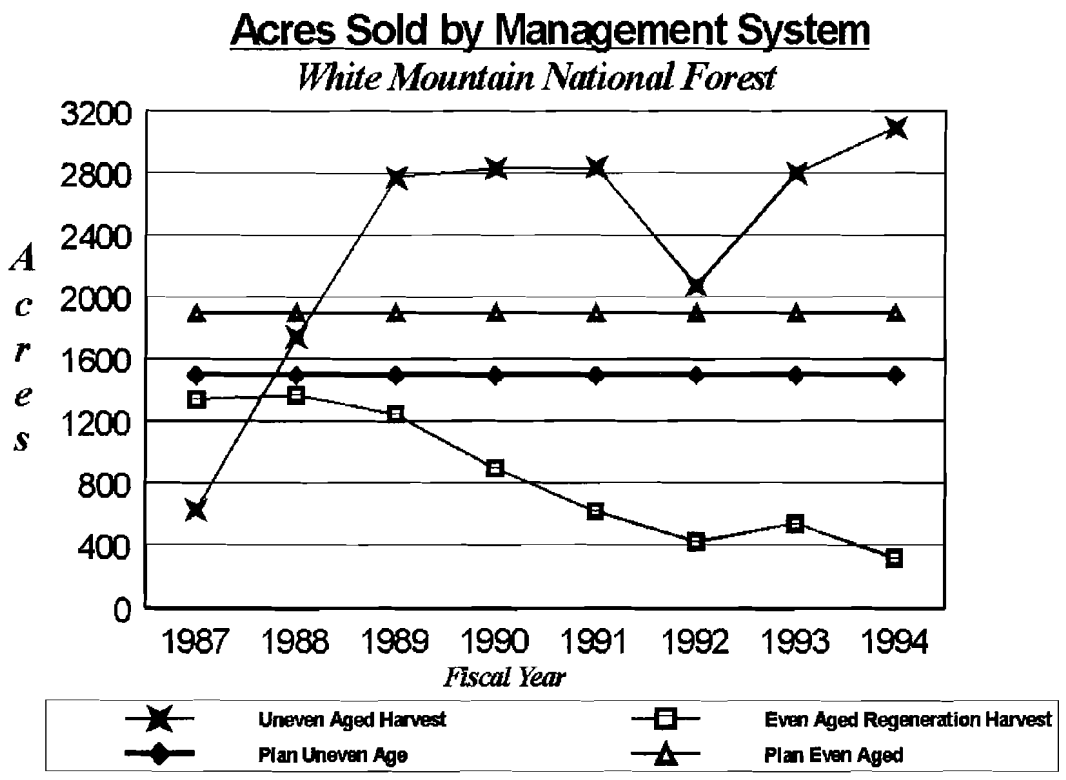
Display 10



Public interest in the timber program remains high. In recent years we have received greater public input which helps us improve project plans. More public involvement also means we spend more time addressing issues in environmental documents, responding to requests for information, and resolving administrative appeals.

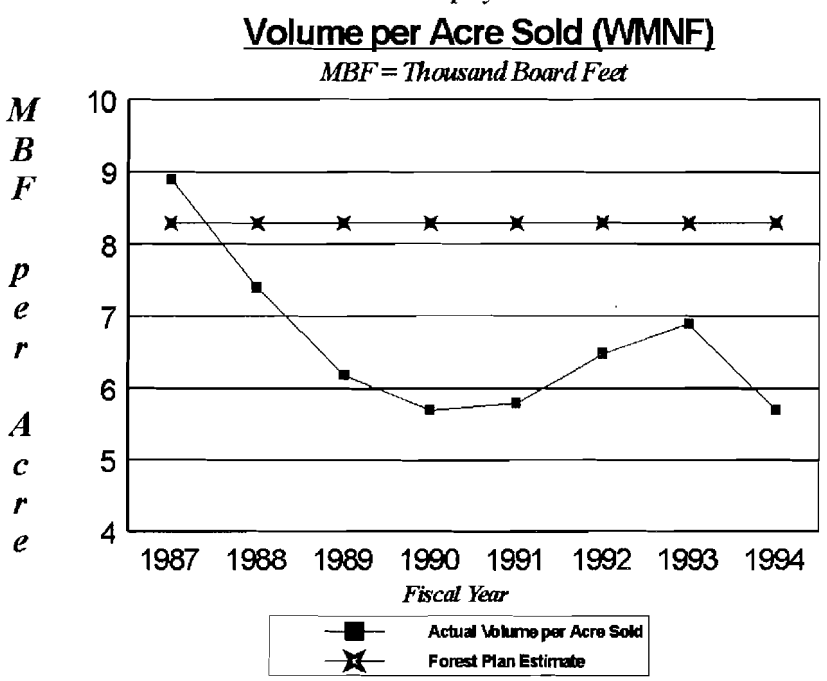
Over time, the use of even-aged regeneration methods (clearcutting) has diminished on the Forest as site specific project decisions address issues and concerns (See Display 11). At the same time, we have found greater applicability of uneven age

Display 11



management for addressing the variability of timber stand conditions as well as visual concerns, than we anticipated. However, uneven aged methods do not produce as much timber volume as clearcutting, and implementation costs are higher. Display 12 shows how average volumes per acre sold have declined in past years.

Display 12



Information contained in the Revised Northern Hardwood Silvicultural Guide has affected the standards we apply to identify timber stands in need of harvest. The 1987 revision, published after the Forest Plan, indicates that we can grow fewer trees more efficiently in most hardwood stands, than was presumed in the earlier guidelines. The effect of applying the revised guidelines is that some lower density stands, formerly considered as having too few trees to manage efficiently, would not now be considered in need of harvest. In the short term, application of revised guidelines, potentially reduces the number of acres we consider to be in need of harvest.

SUMMARY

As Forest Plan implementation nears the end of a decade, we are able to reflect on our accomplishments in meeting goals and to assess areas in which the Plan would benefit from revision. To better achieve the principles of ecosystem management, we must review Plan goals in a broader context. We will need to continue to evaluate and update management strategies to maintain viable ecosystems and biological diversity in the New England region. In addition, we need to continue to meet the needs of society. Several assumptions made in the Plan may need to be revised, such as how much change to the scenic qualities of the Forest people are willing to accept. Other predictions set forth in the Plan may differ from results we see due to societal changes and nationwide trends occurring over the last 8 years.

To enhance biological diversity, we seek to maintain a variety of successional stages and vegetative conditions in terrestrial communities. Currently, we appear to be meeting our goal for desired young forest only in the northern hardwoods community.

A shift away from clearcutting has led us to use more uneven-aged management cutting regimes. As a result, northern hardwood forests are not being converted to regeneration in paper birch, aspen and spruce-fir types as planned. This, in turn, may have an impact on some wildlife populations. The Plan's desired future condition for vegetative communities may need to be adjusted when we consider landscapes at a broader scale, and issues such as scenic quality. We need to continue validation monitoring of our wildlife strategy. Subsequently, we will need to use this information to help us decide what the role of the White Mountain National Forest will be in maintaining biological diversity in New England.

We continue to be well below the established Forest Plan goal for permanent wildlife openings. Funding constraints have not allowed us to create many openings and we do not expect that situation to change. In 1995 we will do our best with the available funds to keep existing openings maintained.

In assessing whether we are meeting Plan goals for terrestrial ecosystems, we have identified difficulties with monitoring methodologies. For some community types, the chosen management indicator species may be ineffective for evaluating effects of vegetative management on population trends. We will soon be discussing this with the New England scientific community to revise monitoring protocols for 1995 and beyond. Additional indices of ecological integrity are also needed to fully evaluate

the ecological health of terrestrial ecosystems. This would include recreational use impacts in all communities, forest stand surveys which identify which vegetative species are regenerating, wildlife population trends, and species diversity trends.

A concern with current methodology is the use of forest cover types to describe wildlife community types. This system may not reflect specific wildlife needs in its characterization of vegetative communities. We need more information about the extent to which tree species composition functions with forest age and tree size to provide diverse wildlife habitat. This year we will begin to collect additional data, including vegetative species composition, in our regeneration studies. We will need to explore ways to integrate our inventories so they will generate the collective information we need to make decisions based on ecosystem management principles. This will also allow us to more reliably track actual conditions and predict impacts on plant and animal communities.

Water quality, as defined by temperature and chemical composition, continues to be good in the aquatic ecosystems on the Forest. However, few of our streams meet the Forest Plan standard for desired amount of pool areas. This is partly due to the geomorphic make-up of granitic streams. However, we suspect concentrated historical human activity may have greatly influenced the physical structure of Forest streams. To assess human impact, we plan to work with researchers to evaluate the condition of a sample watershed and the processes which cause stream channel responses. If needed, and if funding permits, we will follow through with restoration projects, and monitoring the success of such efforts.

Currently, monitoring of Forest aquatic ecosystems evaluates important components of biological integrity, including water quality and community structure. Flow regime data is available from U.S. Geological Survey records and amount of instream large wood are monitored during stream surveys. The effects of recreation activities such as streamside camping, picnicking, and fishing on riparian condition however, is not adequately monitored. We will need to identify areas where people can recreate while evaluating the cumulative impacts of natural processes and human activities to watershed integrity.

We continue to provide the range of recreation settings, including premier backcountry, for which the White Mountain National Forest is known nationwide. In so doing, we are meeting the goal stated in the Forest Plan: "to provide quality recreation opportunities not likely to be found elsewhere on other lands." With approximately 7 million people visiting the WMNF each year, we need to adopt

better measures of monitoring both dispersed recreation use and user impacts. We are exploring strategies to improve our recreation monitoring, including the development of cooperative agreements with research, state government, and other partners. Data we begin to collect this year will provide the baseline to define when impacts on the Forest ecosystems exceed acceptable limits. We can also use this information on recreational use to guide facility construction, marketing, and visitor management efforts.

With increases in Wilderness and backcountry use, we need to emphasize monitoring and staffing efforts in those areas. Our experience with visitor behavior at Wilderness and backcountry sites has shown the best method of influencing responsible wildland recreation use is by providing on-site information from backcountry rangers. This is an area where more volunteerism and partnerships are needed to increase visitor contact and information sharing.

We believe we have made the correct choice to direct funding toward maintenance of existing infrastructure rather than expanding site capacity or building the number of new trails envisioned in the Plan. It appears camping at developed sites has not increased at the rate anticipated, and hiking use may not be increasing at the rates we thought would occur.

While we have made substantial progress in upgrading facilities and trails, there is much left to do. We also recognize the need to upgrade facilities at special use permit areas, like ski areas and backcountry sites.

As funding constraints continue, achievement of our facility upgrades and recreation program delivery may require greater involvement from the private sector in both facility construction and operation. We will need to experiment more with concessions, such as those in the backcountry and the winter sports operation at the Lincoln Woods area. We also plan to improve both the quantity and quality of information currently available about our facilities, recreational opportunities and interpretive offerings. There is a national system called Meaningful Measures which we hope will help with this process.

We believe that we are achieving Forest Plan multiple use goals through our timber sale program, within the context of budget constraints and the need to meet our land stewardship responsibilities. It is important to recognize that decisions to produce specific quantities of timber are not made in forest plans. This occurs later as harvest projects are evaluated on a site by site basis, with public and interdisciplinary review.

We will continue to monitor the factors that affect the delivery of our timber program, and work to reduce our program costs. We also intend to improve the quality of our information and continue to validate the assumptions used to estimate outputs. Experience gained through on-the-ground implementation will continue to allow us to adjust. We will report on needed changes in future monitoring reports.

As we near the end of the first decade of Forest Plan implementation, we have learned more about Forest ecosystems and land use. However, many of the issues discussed in this report indicate some assumptions in the Forest Plan may need to be refined to better reflect the actual condition of ecosystems and the attitudes and desires of Forest visitors. At this point, we do not have all the information necessary to conduct a complete Plan revision. Therefore we will continue to monitor the existing Plan and begin to collect the additional data we need to address issues outlined in this report.