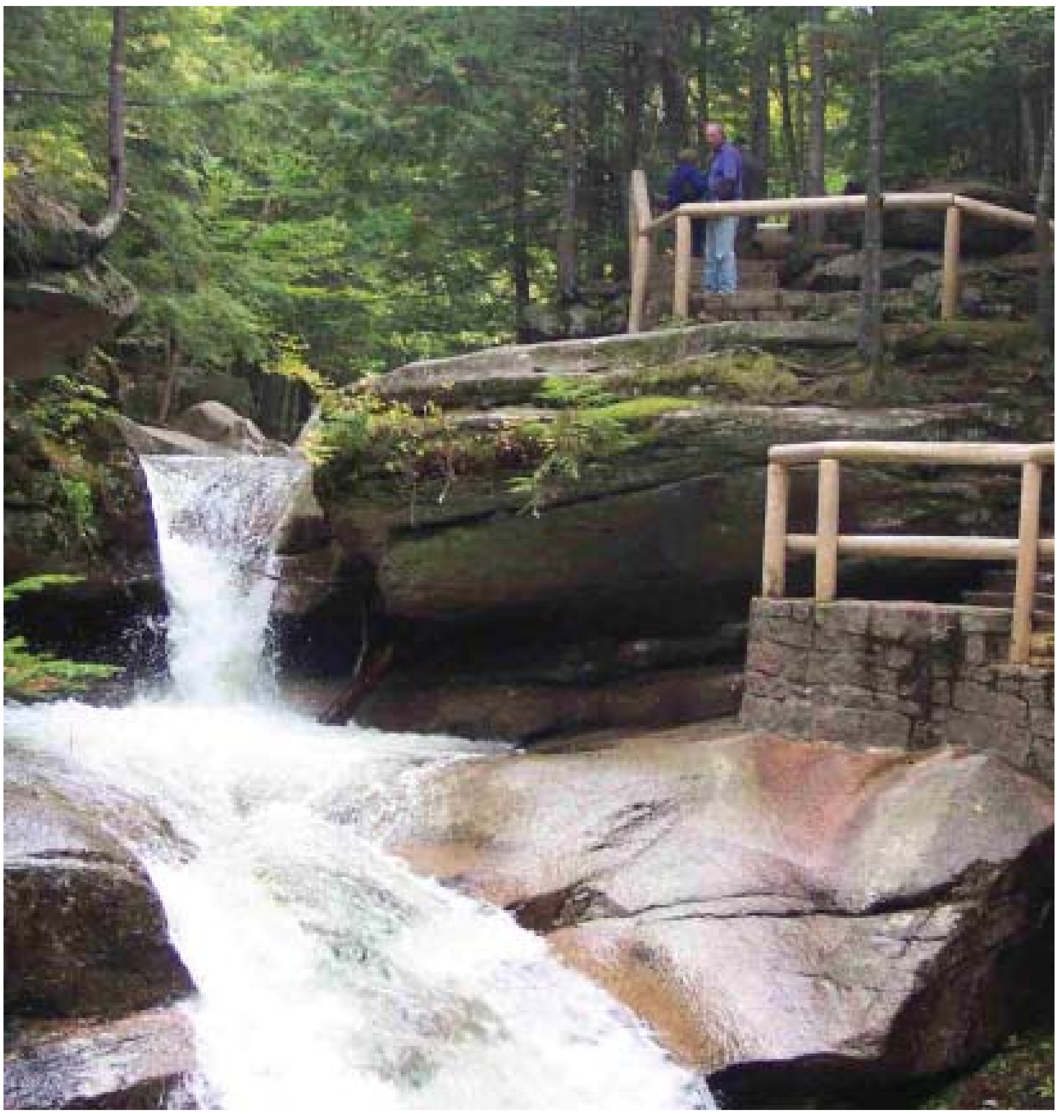
White Mountain National Forest

Chapter 3
Environmental Effects



Chapter Contents

An Introduction to Biodiversity 3
Soils 7
Water Resources 37
Riparian and Aquatic Habitats 59
Vegetation 73
Wildlife 165
Rare and Unique Features 209
Biodiversity Summary 301
Recreation 303
Wilderness 385
Wild and Scenic River 407
Wildland Fire 413
Air Resources 429
Scenic Resources 441
Geologic and Mineral Resources 453
Heritage Resources 467
Social and Economic 473

Cover

Sabbaday Falls (WMNF photo by Terry Miller)

An Introduction to Biodiversity

The National Forest Management Act (NFMA) requires the Forest Service to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives and within the multiple-use objectives of a land management plan." (16 USC 1604 (g)(3)(B)) The implementing regulations for NFMA require that each Forest Plan "provide for diversity of plant and animal communities and tree species consistent with the overall multiple-use objectives of the planning area." (36 CFR 219.26) In addition, these regulations require that the Forest Service manage fish and wildlife habitat "to maintain viable populations of existing native and desired non-native vertebrate species in the planning area." (36 CFR 219.19) USDA departmental regulations (9500-4) extend the requirement to manage for viable populations to "all existing native and desired non-native *plants*, fish, and wildlife species" (emphasis added).

All of these requirements relate to managing habitat. This is because state agencies have primary authority over management of wildlife *populations*. The Forest Service is primarily responsible for managing wildlife *habitats* at levels that will protect rare species and maintain viable populations of all species. The states and the Forest Service work together to determine desired population levels of key species and survey for species of interest or concern.

To make it easier to track how the White Mountain National Forest is meeting this direction, this section discusses the various aspects of maintaining biological diversity on the Forest. The purpose of this section is to

- Define the concept of biodiversity and the context in which it is used in the planning process.
- Present the overall approach used by the Forest Service to maintain and enhance biodiversity.
- Identify where in the FEIS the different components of biodiversity are located.

What is Biodiversity?

Biological diversity (or biodiversity) has been defined many ways (Baydack et al., 1999). For this document, it is the sum of all natural communities, ecological processes, and species. In northern New England it includes broad communities, such as northern hardwood forest, and isolated communities like cedar swamps. It encompasses processes such as nutrient cycling, the decay that creates snags, and natural disturbance. Species of plants and animals, in all their genetic variations, also are part of biodiversity.

Maintaining native biological diversity is a key component of the White Mountain National Forest's desired future condition and management goals. The challenge is twofold: determining how best to conserve biological diversity when it includes forest, open, alpine, and aquatic ecosystems; common and rare species; and innumerable ecological processes; and integrating biodiversity needs with meeting the social and economic aspects of sustainable ecosystem management.

Conservation Approaches

In recent decades, the ecological scientific community has proposed and discussed several methods for maintaining biological diversity (Baydack et al., 1999). Most of these methods are described as coarse filter or fine filter approaches. A coarse filter approach proposes management that would maintain or restore the natural variety of ecosystems in an area (Kaufmann et al., 1994). It assumes that retaining all the ecosystems will simultaneously maintain the species that use those ecosystems. Some coarse filter strategies deal with broad ecosystems based on dominant vegetation (e.g., northern hardwood forests); others address all natural communities identified in a more detailed community classification system (e.g., semi-rich mesic sugar maple forest). Which approach is most appropriate depends on the planning landscape and goals.

A fine filter approach proposes management for individual species, groups of species, or other small-scale elements of biodiversity. Addressing every species occurring in an area individually is usually infeasible. Grouping species based on habitat use or some other parameter and designing management to meet the needs of each group is more feasible, but often has limitations similar to those for a coarse filter (Hunter, 1990). Most often, a fine filter approach is used to address species and small communities of concern whose needs are not likely to be addressed by a coarse filter approach (Kaufmann et al., 1994).

Many ecologists agree that neither coarse filters nor fine filters alone will adequately conserve biodiversity. Some species are rare and have very specific habitat needs or face threats unrelated to habitat. For these species, a coarse filter approach may not maintain viability. Fine filters are so detailed and extensive to be impractical for large-scale assessment. Combining these two approaches is often the preferred approach to managing biodiversity.

The White Mountain National Forest uses a combined coarse filter-fine filter approach. The Forest Service's coarse filter focuses on managing for an ecologically-based distribution of broad habitat types, each of which includes several natural communities. Habitat composition and age-class objectives maintain a representation of common habitat types, such as young northern hardwoods and mature spruce-fir forest, ensuring they are reasonably well-distributed across the Forest. Other communities (such as alpine communities) and ecological processes are conserved through resource goals, standards, and guidelines. Most wildlife and plant species are provided for by maintaining the diversity of communities and processes on the landscape. All of this is the coarse filter.

Goals, standards, and guidelines provide management direction to protect the rarer elements of biodiversity on the Forest and make up the fine filter. A Species Viability Evaluation was conducted during Forest Plan revision to determine which species, subspecies, and variations of plants and animals may not be covered by the Forest Service's coarse filter. These taxa are addressed as species of concern. Uncommon communities were evaluated separately to determine which ones that could be affected by Forest management might not be sufficiently protected by the coarse filter.These are addressed as outstanding natural communities.

During the alternative development phase of Forest Plan revision, the Forest Service considered changing management area allocations to protect these species and communities. However for many species, the primary threat on the Forest is recreation, which occurs in all management areas, so changing MA allocations would not reduce potential impacts. In addition, removing small patches of land from MA 2.1 to protect species or communities affected by timber harvest would result in isolated islands of some MAs, which makes management more difficult, and likely would not increase protection beyond that afforded by proposed standards and guidelines.

Biological Diversity as Addressed Within the FEIS

As stated previously, maintaining biological diversity is a primary goal on the Forest. As a result, the coarse filter-fine filter approach described is an integral part of all alternatives. Goals, standards, and guidelines designed to protect communities, processes, and species are largely the same among the alternatives. However, all three issues (see Chapter 1) cause management activities to vary among alternatives to meet social, economic, or ecological objectives. The various management approaches result in slightly different mixes of ecological communities and species on the landscape. Therefore, each alternative is evaluated to determine how it would affect biological diversity on the Forest (direct and indirect effects) and in the surrounding area (cumulative effects).

Table 3-01 shows how each of the three issues identified for Forest Plan revision affects biological diversity on the Forest.

Table 3-01. Plan revision issues and their effects on biodiversity.

Issue	What it means	How it affects biodiversity
Management Emphasis through Land Allocation	This issue focuses on allocation of lands to Management Areas (MAs) with different purposes and desired conditions. Changing the amount of land in each MA alters where various activities can occur.	Many management actions have the potential to impact communities, processes, or species. Changing how much of the Forest each activity can occur on can alter the potential for effects and the resulting biodiversity.
Timber Management and Wildlife Habitat	This issue addresses how much timber is harvested, where it is harvested, and the types of treatments used, especially even-aged regeneration harvest.	Acres of all types of timber harvest, acres of even-aged regeneration harvest, and proximity of harvest to various habitats can change communities and species.
Recreation Management	This issue addresses how recreational use is managed across the Forest and its effect on recreational experiences and ecological conditions.	The types of recreational uses allowed and the way these uses are managed on the Forest can change the impacts of recreation on ecological conditions.

Biodiversity is a large topic with many pieces, even on a finite land base such as the White Mountain National Forest. It is covered, in many places in this document, usually by broad resource topic.

The Vegetation section deals with three components of biodiversity: terrestrial vegetation as wildlife and plant habitat, the commercial timber resource, and non-native invasive species. The habitat subsection addresses the basic terrestrial ecology of the Forest, including potential natural vegetation, natural disturbance, past management, and identification of broad habitat types. It describes the current condition for those habitats, and evaluates effects of the alternatives on habitat composition and distribution. The timber resource subsection discusses some of the same subjects as the habitat subsection, such as natural disturbance and forest age, but with a focus on how these affect the quality or production of a timber commodity. It also describes products supplied by the Forest, demand for these products, and timber management techniques used on the Forest. The non-native invasive species subsection focuses on plant species that did not originally occur in the United States and that may be altering local terrestrial and aquatic ecosystems.

The Wildlife section takes the habitat information presented in the Vegetation section a step further and describes effects of habitat changes on individual species or groups of species, including Management Indicator Species, Ecological Indicators, migratory birds, and species potentially affected by fragmentation.

The Riparian and Aquatic Habitats section describes the current condition and potential for alternatives to impact streams and associated riparian habitats, emphasizing habitat structure and function. Lakes, ponds, wetlands, and overall hydrology, as well as water quality for streams, are addressed in the Water Resources section. Soil, bedrock, and other surficial materials are described in the Soils section.

The Vegetation, Wildlife, Riparian and Aquatic Habitats, Water Resources, and Soils sections are part of the coarse filter analysis for maintaining biological diversity. They deal with the more common aspects of biodiversity. Species of concern, the microhabitats on which they depend, and outstanding natural communities are discussed in the Rare and Unique Features section. Endangered, threatened, and sensitive species also are addressed in the Biological Evaluation (Appendix G). These sections of the document address the fine filter component of our biodiversity approach. Overall conclusions about how the alternatives would maintain biological diversity are summarized in the Biodiversity Summary that follows the other sections mentioned here.

Soils

This document contains two subsections:

- **Soil Productivity**. Soil productivity is defined by the Forest Service as the inherent capacity of the soil to support the growth of specified plants, plant communities, or sequences of plant communities. Soil productivity may be expressed in a variety of ways, including volume, weight/unit/area/year, percent plant cover, or other measures of biomass accumulation (FSH 2509.18). Heavy recreational use areas, such as trails and campsites, are places where these measures have declined and the soil has become unproductive. A productive soil is able to help support a healthy and growing forest. Soil may also play a role in buffering the impacts of other environmental concerns, such as changes in stream chemistry, which may originate from acid deposition. For these reasons, and to meet the requirements of the National Forest Management Act, permanent impairment of forest soil productivity is to be avoided. This subsection focuses on potential losses to soil productivity through acid deposition that occurs Forest-wide.
- **Forest Soil Erosion**. This subsection focuses on the loss of soil from a site due to management or user activities. These are site-specific impacts on relatively small areas.

Soil Productivity

Affected Environment

Soil Productivity Measurement, and Nature of Concern

In the past, soil erosion was the principal concern affecting forest soil productivity. The issue was loss of organic matter that harbors nutrients and helps maintain soil aeration. However, it has been found that soil organic matter is not lost from timber harvest sites, even those using a clearcut harvest type where all the tree boles, tops, and limbs are removed. Instead, it is redistributed in the upper mineral soil layers during harvesting. In addition, it is now known that root decay resupplies the organic matter more quickly than soil erosion or respiration depletes it (Johnson et al., 1991).

Today, a more general concern about soil nutrients in the Northeast deals with the potential loss of soil calcium due to possible impacts from acid deposition and timber harvest. These concerns are based on research such as watershed studies (Federer et al., 1989; Likens et al., 1998; Bailey et al., 2003), experimental watershed acidification (Fernandez et al., 2003), and retrospective soil analysis (Lawrence et al., 1997; Bailey et al., 2005). Calcium is important for plant functions such as growth regulation and disease resistance. Loss of soil calcium raises concerns about possible changes in forest health (dieback or decline), productivity, and forest species composition. The 1986 White Mountain National Forest Land and Resource

Management Plan acknowledged this concern, and since that time the Forest Service has been actively working with the USFS Northeast Research Station, as well as various universities and institutes, to better understand possible impacts and to monitor long-term change. While the peak period of acid deposition was approximately from 1950 to 1970, before passage of the Clean Air Act and its amendments (Likens et al., 1996), the long term effects of this past and continuing lower levels of deposition must be understood.

Analysis Area

The analysis area for soil productivity includes all management areas (MAs) across the White Mountain National Forest. This is primarily because acid deposition, while outside the control of the Forest Service, may potentially affect soil productivity regardless of management area assignment. Special attention is focused on MA 2.1 (and 3.1 under Alternative 1) because it is here that timber harvest may occur, and therefore actions initiated by the Forest Service may additionally contribute to possible impacts on soil productivity. Information concerning impacts on soil productivity appears in this chapter of the FEIS, in Appendix A under Response to Public Comment, and in the Plan revision Administrative Record. The Administrative Record, in particular, contains extensive background information and, in some instances, responses to detailed technical questions.

Consideration of soil productivity is organized into two broad elevation zones: 1) generally above 2,500 feet, with a focus on the red spruce (and balsam fir) forest at higher elevations, and 2) the northern hardwood (and spruce-fir-hemlock forest) at lower elevations. This organization facilitates description of the Affected Environment and disclosure of impacts. It is also useful for discussing the suitability of land for timber management, since this generally occurs below 2,500 feet of elevation. The northern hardwood forest at moderate to low elevations is discussed in the greatest detail because it is here that timber management most often occurs. Forest productivity, forest health (decline and dieback), and potential changes in species composition are the areas described in the most detail.

Higher Elevation Red Spruce Forest

In the White Mountains, soils at higher elevations — generally above 2,500 feet — tend to be shallow or moderately deep and on steep terrain. With few exceptions, these lands are not considered suitable for timber management for reasons that include a high soil erosion hazard related to road construction and low forest productivity. These higher elevations, especially above 3,000 feet, receive levels of atmospheric pollutants that are three to eight times the levels at lower elevations because of greater precipitation and cloud water inputs (Miller et al., 1993). Pollutants, especially SO^4 (sulfate) and NO^3 (nitrate), affect the chemistry of the soil in a way that may lead to loss of important nutrients such as calcium, and mobilization of others such as aluminum, that may affect forest health, productivity, or species composition. High elevation spruce-fir forests in the eastern US are considered sensitive soil systems (NAPAP, 1998), and

forest health is considered at risk (Driscoll et al., 2001; NAPAP, 1998). In addition, high elevation spruce-fir forest productivity has been identified as at risk, possibly related to changes in soil chemistry occurring primarily from acid deposition (Shortle et al., 1988; Eagar et al., 1992; DeHayes et al., 1999). This includes calcium depletion and subsequent aluminum mobilization.

Generally, soils at higher elevations have lower amounts of soil base nutrients. These lower levels are also reflected in the foliage of the trees and in stream chemistry. In comparison, soils on lower-mountain slopes are richer in nutrients such as calcium (Johnson et al., 2000). In general, soils in the White Mountains at all elevations are considered acidic and low in base saturation. However, there is no evidence in peer reviewed literature that there has been a change in soil buffering capacity in the White Mountains due to acid deposition or forest harvest. Long-term data from Hubbard Brook Experimental Forest show that watershed losses of aluminum, sulfate, nitrate, and calcium have been declining for over twenty years. Although the causes of these trends are complex, the aluminum trend levels indicate a degree of soil recovery from the effects of acidification (Palmer et al., 2004). However, one tree species in this zone is of particular concern and may be showing some effects from long-term deposition.

Research at a variety of elevations has shown soil calcium depletion beneath red spruce stands across the Northeast (Lawrence et al., 1997; Likens et al., 1998; Fernandez et al., 2003). In addition, there is evidence of forest decline, primarily of red spruce, at high elevations (Eagar et al., 1992). This decline relates primarily to foliar damage, and has a weak association with low calcium and high aluminum in the soil. Loss of foliar base cations has reduced cold tolerance in red spruce and increased freezing injury leading to dieback and mortality (Schaberg et al., 2000; DeHayes et al., 1999). A regional survey of the montane forest extending from the Catskills of New York to Maine indicates live and total basal area of balsam fir is the greatest in the White Mountains and decreases toward the Adirondacks and Maine (Craig et al., 1991). There is also a greater percentage of intact dead red spruce in the Adirondacks and the Green Mountains than at study sites in New Hampshire and western Maine. Shallow soils, shallow-rooted spruce that rely on the surface soil organic horizons, inorganic aluminum, higher elevations resulting in greater amounts of acidic deposition, and inherent cold tolerance characteristics all support a concern with red spruce at high elevations.

Red spruce has a uniquely low winter cold tolerance relative to other conifers in the Northeast. In fact, it is barely cold tolerant enough to escape injury when typical winter low temperatures occur. Experts have not been able to explain this, although they speculate that the low cold tolerance is a remnant of red spruce's adaptation to the warm maritime environment in the region where it is thought to have existed during the last glaciations. Nonetheless, it has survived and thrived in some of the region's coldest sites for thousands of years. Now it appears that recent, unexplained circumstances have reduced the barely sufficient levels of winter cold tolerance so low that severe or repeated winter injury has occurred. Three factors have been

experimentally shown to reduce red spruce cold tolerance enough to meaningfully increase the risk of severe injury: acid rain exposure, nitrogen saturation, and winter thaws. While initial research had implicated only foliar leaching of calcium (especially membrane-associated calcium), more recent work has found that soil-based disruption produces the same result (Schaberg et al., 2002). This phenomenon is not solely related to elevation (although winter injury does increase with elevation); in severe winter injury years like 2003, injury can also occur at lower elevations.

Reports of apparently unusual winter injury to red spruce in 2003, including at elevations below 2,500 feet on deep soils in the Northeastern US, indicated that 90 percent of the 1,419 trees sampled showed some winter injury (not all severe injury), and that elevation was an important factor in terms of impacts (Lazarus et al., 2004). They conclude that this type of event has the "potential to initiate dramatic changes within the mature red spruce forests in the northeastern US in the years ahead." Preliminary results of artificial application of calcium at red spruce sites at Hubbard Brook Experimental Forest seem to show some impact on winter injury expression; however, it is still not known why red spruce injury in 2003 was so dramatically high. The calcium addition, while not a liming study, was part of an effort to determine the impacts of calcium depletion (from acid deposition) estimated to have occurred over time. This analysis could not exclude other factors as influencing winter injury or its expression (Hawley et al., 2004).

Higher elevations with cold sensitive red spruce vegetation, shallow soils, and atmospheric pollutants at levels three to eight times higher than lower elevations remain areas of concern on the White Mountain National Forest, although it is still unclear why some cold injury is occurring. Land determined suitable for timber management on the Forest generally extends to about 2,500 feet of elevation, so it is separated from the areas of greatest acid deposition. These lower elevations actually receive lower acidic deposition than other areas of the Northeast (http:/nadp.sws.uiuc.edu). It is here that the moderate to low elevation hardwood forests primarily occur.

Moderate to Low Elevation Hardwood Forest

Soils at moderate to low elevations on the White Mountain National Forest are generally deep, well- or moderately-well drained, and support both northern hardwood and spruce-fir-hemlock forest. Northern hardwoods include a variety of species (sugar maple, red maple, white ash, paper and yellow birch, and aspen). Land use, including timber management, has resulted in a variety of tree ages, and these lands are considered suitable for timber management. The hardwoods are mainly on the mountain side-slopes, between 1,000 and 2,500 feet elevation. The softwoods are mainly in the major valley bottoms. The soil is primarily sandy loam till, though there are areas of loamy sands and sands. Historically, these soils have been considered acidic with relatively low base saturation; however, recent work on soil mineralogy is revealing a more complex situation, with a range in the concentration of soil calcium being likely (Bailey et al., 2003). Soil physical

and chemical factors are not the only consideration that may affect soil nutrients and long-term soil productivity.

Land Use History

The White Mountain landscape has a long history of human use — including agriculture, grazing, timber harvest, and fire — which varied in intensity across the landscape from the late 1800s through the early 1900s (Goodale, 1999). This is important because it may affect nutrient cycling and stream chemistry across the Forest (Hornbeck et al., 1992; Goodale, 1999). Only relatively small areas escaped this intensive use of the land. Intense early harvest may have removed one to two percent of the total calcium supply in some forest soils (Federer et al., 1989; Hornbeck et al., 1990; Fay, 1993; 2004). Agriculture may have had similar or greater impacts. Fire was probably more of a factor for nitrogen, which can be lost as a gas ("volatilized"). Despite such early intense land uses, areas below approximately 2,500 feet of elevation on the White Mountain National Forest today support a well-stocked and growing forest with an average age of 80 to 85 years or older (Hagan et al., 2005). Harvest has continued since these early times, but has removed smaller amounts of timber under strict management guidelines, using both even- and uneven-aged harvest prescriptions.

Soil Mineralogy

Soil mineralogy is also an environmental factor affecting soil nutrients. Mineral weathering is the major source of long-term soil calcium to support forest growth, and it also mitigates the impacts of acid deposition (Hyman et al., 1998). Soil calcium used to be supplied through atmospheric deposition and mineral weathering, but the amount of calcium in deposition has become smaller due to changes in agricultural and road building practices (Likens et al., 1996) and particulate emissions (Gbondo-Tugbawa et al., 2003). A glacial till source model is being developed for the White Mountain National Forest to depict the impacts of different mineralogy across the landscape. Based on the flow direction of the glacier that passed through this area about 12,000 years ago, the bedrock composition it crossed, and the chemistry of the bedrock, it appears possible to estimate the soil calcium and magnesium that was present when the soil was originally deposited. The accuracy of the model has some preliminary verification based on work in Vermont and New Hampshire (Hornbeck et al., 1997), and more recently is being verified based on forty till source plots across the White Mountain National Forest (Fay, 2005). The till source model is meant to estimate the calcium concentration in soil parent materials (c-horizon), which may ultimately lead to an estimation of surface soil chemistry where plants root. This will help clarify how much calcium is being added to the soil for use by plants.

Atmospheric Deposition

Atmospheric deposition of acid anions is also a factor affecting soil calcium supply. Acid anions entering the soil via deposition may lead to the displacement of soil calcium and its replacement by aluminum, as well as

loss of soil calcium to streams (Lawrence et al., 2000). Prior to about 1955, calcium lost from soil exchange sites was about equal to that taken up by growing trees, and that lost to streams was about equal to that gained by atmospheric deposition and mineral weathering. Since 1955, however, calcium lost from the soil has surpassed the amount taken up by the forest, and calcium lost to streams has been greater than atmospheric deposition and mineral weathering (Likens et al., 1996). This suggests that there is a net loss of calcium at some sites.

Base cation depletion due to acid deposition has been documented by watershed observations (Federer et al., 1989; Bailey et al., 2003), experimental watershed acidification (Fernandez et al., 2003), and retrospective soil analysis (Lawrence et al., 1997; Bailey et al., 2005). However, scientists have not been able to determine the magnitude of impact because knowledge of soil storage and release mechanisms is not sufficient to estimate the overall size of soil nutrient reserves (Bailey et al., 2003). There is evidence of potential alternative sources of supply besides the traditionally-considered soil exchange pool. These include calcium oxalate (Bailey et al., 2003), direct weathering of minerals by fungal activity (van Breeman et al., 2000; Blum et al., 2002), and diffusion of exchangeable calcium from deep soil zones of higher calcium concentration (Grigle et al., 2005). Verified new sources of calcium would diminish the magnitude of impact currently estimated based on small watershed studies.

Unfortunately, there is little direct measurement of soil calcium to affirm or contradict the results from small watershed mass balance studies. However, research at Hubbard Brook Experimental Forest indicates no short-term loss in exchangeable soil calcium eight years after clearcutting in northern hardwoods (Johnson et al., 1997), and this has now been extended to fifteen years (Johnson, 2004). This is a repeat measurement at sixty soil pits. In this case, 93 percent of the aboveground woody biomass was removed, which represents far more intense harvest than is practiced on the White Mountain National Forest. Similar results have been found elsewhere (Johnson et al., 1997). Research in old growth spruce in the Adirondack Mountains of New York compared measurements between 1930 and 1984 and found no significant changes in soil calcium in the organic layers of the soil after more than fifty years elapsed time (Johnson et al., 1994). Yanai et al. (1995) originally reported a 22 percent decline in forest floor calcium content, but the final publication revealed that the forest floor calcium content did not decline significantly based on samples at seven dates between 1976 and 1997 at Hubbard Brook Experimental Forest (Yanai et al., 1999).

With the exception of high elevations, rates of deposition of sulfuric and nitric acid on the White Mountain National Forest are moderate, compared, for example, to the Catskills and Adirondack Mountains of New York (http://nadp.sws.uiuc.edu). Scientists monitoring long term recovery of ecosystems from acid deposition on soils and streams indicate that, while recovery is slow, the impact is not irreparable (Likens et al., 1996; Kahl et al., 2004; Driscoll et al., 2003; Palmer et al., 2004). Interestingly, it was believed that NO^3 , an important acid anion that has remained constant over time, would lead to nitrogen saturation and impacts on soil base cations; however, that

is now less certain because stream nitrogen was expected to increase, but is declining instead (Goodale et al., 2003).

The effects of low soil nutrient levels on tree growth are even less clear. While low levels of nutrient cations in soils have been shown to cause a nutrient imbalance and reduce the ability of a tree to respond to stresses such as insect infestations and drought in western New York and Pennsylvania, this is not yet known to be true in the White Mountains.

Forest Health and Productivity

Despite concern about soil calcium loss, there is no peer-reviewed evidence demonstrating that acid deposition affects the health or productivity of the northern hardwood forest on the White Mountain National Forest. Long-term biomass accumulation studies in hardwood (and softwood) forest starting in 1931 indicate no observable change in biomass accumulation trends (Nuegsigkapian, 1998). These data are primarily from Bartlett Experimental Forest, with reliance on data from Hubbard Brook Experimental Forest, Bowl Research Natural Area, and Waterville Valley—all in the White Mountains. Biomass measures the weight of the forest, and is considered a good ecological indicator compared to other measures of forest productivity. Other studies in New England, including some specific to the WMNF, reveal similar results for both hardwoods and softwoods (Leak, 1987; Smith et al., 1990; Fay et al., 1997; Smith, 2002; Martin et al., 1989; Reiners et al., 1992; Martin et al., 1999). No published data indicate growth decline in northern hardwoods in the eastern hardwood forest (Adams et al., 2000). Most of these studies include areas where there has been timber harvest, including multiple entries over time and clearcut harvest. Forest cutting experiments at Hubbard Brook Experimental Forest (W4 strip cut in the early 1970s and W2 clearfell in the early 1960s) have resulted in normal or expected regeneration and biomass accumulation (Martin et al., 1989; Reiners, 1992), indicating no harmful impacts on forest productivity associated with calcium leaching losses at Hubbard Brook Experimental Forest. All areas analyzed have been subject to acid deposition.

We received some comments suggesting that biomass accumulation rates at Hubbard Brook Experimental Forest have unexpectedly leveled off. The commenters cited Likens et al., 1996. However, this source does not directly report any biomass data; instead, the authors cite Likens et al. (1994) which notes "total biomass and potassium content of live trees on a per hectare basis ceased to increase after about 1980 (Figure 8)." Figure 8 is not a biomass accumulation curve, but rather relates trends of potassium content in biomass over time. Likens et al. (1996) further cites Federer et al. (1989), who also does not directly report any biomass trend data, but does note that nutrient depletion may lead to a decrease in forest productivity.

Responding to a public comment, the Forest Service reviewed (Siccama's) unpublished biomass data for Hubbard Brook Experimental Forest (see Administrative Record). The graphs appear to show about 208 Mg/ha of biomass in 1980 and 202 Mg/ha in 2002. The overstory declined from 202 to 187 Mg/ha. Sugar maple in the overstory went from 90 to 80 Mg/ha. The

understory increased from 6.5 Mg/ha to 15 Mg/ha. This indicates biomass has declined about 3.1 percent at Hubbard Brook since 1980, and that sugar maple has gone down a bit, and beech up. A major ice storm in 1998 caused stand damage, and likely affected these results.

The fact that species such as sugar maple (or red spruce) may experience episodic dieback does not mean there has been a change in biomass accumulation trends on the White Mountain National Forest. Leak (1982) shows a biomass curve for a wide range of forest habitats (hardwoods, softwoods, hardwood-spruce across a range of soils), yet in all but one case, they follow the same biomass accumulation curve. This demonstrates that shifts in species composition do not lead to changes in biomass accumulation trends. The one exception is enriched forest habitat, where sugar maple and white ash on apparently very rich soils (unusually deep organic horizons) result in slightly higher biomass. However, this habitat type is uncommon on the White Mountain National Forest and occurs mainly as small, isolated areas.

It is not surprising that biomass accumulation ultimately levels off. Leak (1982) published the first biomass curves for even-aged northern hardwoods, which clearly demonstrate a decrease in biomass accumulation starting at about age 80 to 90 years. This is because the Forest has reached maturity, with canopy closure due to competition. More recently, Nuegenkapian (1998) derived biomass accumulation curves for long term data from the Bartlett Experimental Forest. These data similarly indicate that biomass accumulation in even-aged northern hardwood stands reaches a maximum at about age 80 to 100. Reaching a peak in 80 to 100 years does not mean the forest has stopped growing. Nuegenkapian (1998) summarized stands at Bartlett Experimental Forest and compared them to other stands outside it (Hubbard Brook Experimental Forest, Bowl RNA, Waterville Valley) and found no observable change in biomass accumulation trends over time. Martin et al. (1999) resurveyed and examined harvested and unharvested areas in watersheds in and adjoining the Bowl Research Natural Area, where harvested areas were cut around 1888. Their results suggest that within 100 years following heavy forest cutting in northern hardwood forest stands, natural forest regeneration and regrowth produces numbers of stems, basal area, and biomass comparable to the initial old growth forest condition.

Also, with regard to forest productivity, many authors report that observed decreases in forest diameter growth likely reflect stand age and history (Federer et al., 1987; Reams et al., 1993; Hornbeck et al., 1988; Van Deusen et al., 1987). Some of this work includes low elevation spruce-fir forest. An exception to this is some evidence of decreased spruce growth believed to have occurred because mobilized aluminum prevents calcium uptake by roots (Shortle et al., 1988). Others believe growth rates have gone both up and down for centuries (Reams et al., 1993).

Bormann et al. (1979) indicates that the stands at Hubbard Brook Experimental Forest are typical of second-growth forests in northern New England (page 30); stating "some time after 1900, the entire HB watershed was logged"; also, "a scattering of large old culls as well as some smaller

trees was left." Thus, it appears the stands at Hubbard Brook must be predominantly about 90 years old, and, as a result, the leveling off in biomass does not appear inconsistent with published biomass accumulation curves in largely even-aged stands. According to Forest Service research scientists, there is no difference in stand structure between Hubbard Brook and Bartlett experimental forests for stands that have not been experimentally treated. That is, the early 1900s harvesting has resulted in similar stand structure, with the canopy trees at both areas being essentially even-aged — about 80 to 90 years old. Both areas have similar understory characteristics.

On a broader scale, forests of the northeastern US are generally considered healthy. While there is concern about sugar maple, there is no general regional decline (Weeks et al., 1994). A review of sugar maple information indicates that during the past four decades there have been sporadic declines in the northeastern US, in Ontario, and in Quebec. However, because they are ephemeral, the causes have been difficult to determine (Horsley et al., 2002). Temporary increases in mortality are usually followed by a period of recovery and improved health (Horsley et al., 2002). Regional sugar maple study plots identify health and mortality issues on un-glaciated soils in western Pennsylvania, but show little incidence in the glaciated soils of New Hampshire (Hallett et al., 2000). Forty study plots across all mineralogy on the White Mountain National Forest, while measured for purposes other than forest health, nevertheless did not reveal any unusual dieback or decline (Fay, 2003; 2004). Sugar maple grows on a range of sites on the White Mountain National Forest (Leak, 1982), and factors in addition to nutrition seem to determine the long-term occurrence of sugar maple within its geographic range (Horsley et al., 2002).

There are other factors that, in conjunction with acid deposition, may need to be considered in forest productivity. These include regeneration of trees following harvest, insect defoliation, and wildlife browsing.

Detailed studies at Hubbard Brook Experimental Forest of forest regeneration after clearcutting and removal of all tree parts — including tops and limbs which are rich in calcium — indicate successful re-invasion of harvest sites by new forest (Martin et al., 1989). Examination of forest regeneration success at all clearcut and selective cut sites on the White Mountain National Forest since 1986 indicates no instances of failed regeneration; in other words, all sites met the restocking requirements. This is particularly significant because restocking is the first step in re-accumulation of biomass, and is therefore an important first step to indicating that long term soil productivity has not been foregone or irreversibly impacted.

Sugar maple is one of the more sensitive tree species to nutrient depletion, and health problems related to soil nutrient deficiencies only occur on sites where repeated stressors such as drought or defoliation occur. This has been observed in western Pennsylvania and New York (Hallett et al., 2001). Agricultural drought in New Hampshire is believed to occur only every three to five years in the northern part of the state, and it is thought to be very site-specific (Federer, 1980). Severe or repeated insect defoliation is

uncommon. Recent reports of insect infestation in New England are wood borers, not defoliators. Moose browsing has caused some limited instances where the rate of regrowth or species composition has been reduced.

Forest Species Composition

Changes in forest species composition may also be an indicator of change in soil nutrition (Leak, 1992). The idea is that if nutrition changes, some species, such as sugar maple or red spruce, may become less able to successfully regenerate, and this could serve as an ecological indicator. It is already known, for example, that poor vs. rich calcium sites may support low vs. high amounts of sugar maple. Current evidence does not indicate change is occurring in species composition (Leak, 1987; Leak et al., 1996). The available evidence indicates that composition is a successional process based on site (Leak, 1987), and that despite natural and human-caused disturbances at the Bartlett Experimental Forest, natural succession has been the dominant factor affecting species trends (Leak et al., 1996). Currently, even on the potentially least calcium rich soils on the Forest, red spruce is regenerating and increasing in abundance on suitable habitats (Leak, 1987).

In looking for information on species-specific composition changes, unpublished data at Hubbard Brook was reviewed that indicated a decrease in biomass for sugar maple seedlings on a small area of Watershed 6. However, no published report could be found that supported this. Other factors that may be involved (e.g., beech sprouting) were not resolved.

A comment suggested that liming experiments at Hubbard Brook have resulted in increased sugar maple seedling biomass and reduced red spruce winter injury compared to reference sites. However, this was not a liming study. There are no published data for red spruce, and the study was based on a small number (13, 0.1 ha) of plots between 2,282 and 2,667 feet of elevation on soils shallow to ledge. This is not representative of suitable timberland on the White Mountain National Forest.

Environmental Effects

Types of Effects

Current investigations into long-term soil productivity are focusing on soil calcium and forest health. As previously discussed, this is primarily a concern about acid deposition and its impacts on soil calcium, especially at high elevations.

It is generally true that soil acidification, associated with the inputs of acid deposition, results in base cation leaching, elevated aluminum concentrations, and an imbalance of calcium to aluminum ratio. This leads to an imbalance of calcium and aluminum ratios in soil water, and may inhibit calcium and magnesium uptake, reduce fine root growth, alter photosynthetic activity, and lead to nutrient imbalances in forest tree species (Cronan et al., 1995). However, it is important to avoid applying such general concepts to forests as a whole. Pollution effects, including acid deposition, are species- and site-specific. The effects vary even within species depending on the developmental stage of the tree (seedling, sapling, pole), season of

the year (dormant, early active, late active), and genetic variability (white pine, for example, has a huge range of ozone tolerances). The effects vary between sites, with the mix of stressors, duration of stress, and land-use history.

Estimated losses of soil calcium may be attributed to acid deposition, declining contributions of calcium from atmospheric deposition, and forest harvesting. Losses are buffered by mineral weathering in the soil and some continuing calcium deposition. Biogeochemical modeling reveals that atmospheric deposition, especially SO^4, had the greatest effect on estimated soil calcium loss, while forest harvesting led to only a slight decrease in exchangeable soil calcium (Gbondo-Tugbawa et al., 2003). This study was done for the period 1850-2000 for a northern hardwood timber stand. Direct measurements of exchangeable soil calcium indicated no change before and after an intense, whole-tree harvest clearcut after fifteen years of re-measurement at the Hubbard Brook Experimental Forest (Johnson et al., 1997; Johnson, 2004). A study in spruce-fir forest also reveals that acid deposition is a more important factor in soil acid-base relationships than forest harvesting (Hornbeck et al., 1992).

Direct Effects

The direct effect of timber harvesting is the removal of calcium with forest products. The magnitude of this impact depends mainly on the quantity of biomass removed. In general, clearcut harvest that removes the entire aboveground portion of a tree (bole, leaves, and branches) removes the most calcium, while bole-only clearcut, or a thinning or selective harvest, removes incrementally less. In sugar maple trees, for example, the aboveground portion of the tree represents about 83 percent of the calcium in all parts of the tree (including roots). Of this, the tops, limbs, and leaves equal about 35 percent of the calcium in a sugar maple tree, which is roughly equivalent to the amount of exchangeable calcium in the soil (Bailey, 2004). A conventional bole-only clearcut harvest removes about 172 kg/ha of calcium in a northern hardwood forest, while a thinning or selective harvest removes approximately 86 kg/ha (Federer et al., 1989; Hornbeck et al., 1990; Fay, 1993). While these are the impacts of a single harvest, multiple harvests over time, depending on intensity, can lead to a greater cumulative impact from selective harvest than even-aged clearcut harvest silvicultural regimes (Adams et al., 2000). Tree species vary in the amount and distribution of calcium, but sugar maple is one of the most calcium-rich. Very few, if any, northern hardwood forests are all sugar maple, and most include only 10 to 25 percent of their basal area in sugar maple.

Heavily impacted trails, campsites, or other intense use areas are places where the soil has become unproductive. Soils used for trails or campsites can rapidly reach this point through the effects of trampling. Trampling initiates the soil impact cycle (see Hammitt and Cole, 1998), a stepwise process through which recreation users eventually compact soils. Initial users of a trail or campsite scuff away leaf litter and organic matter. Further use of a trail or campsite leads to compaction of the remaining mineral soil, which in turn reduces soil macroporosity and air/water permeability. If compacted

enough (as some heavily used sites on the Forest are), these soils become unproductive, and are increasingly likely to have higher rates of water runoff and soil erosion.

Indirect Effects

Indirect effects from timber harvest include possible changes in available (exchangeable) soil calcium, base saturation, and possible impacts on forest health, productivity, or species composition that are attributed to forest harvest (as compared to acid deposition). Exchangeable calcium means that which is most immediately available for tree (or plant) use. Base saturation means the proportion of soil adsorption sites held by exchangeable cations other than hydrogen or aluminum (e.g., K+, Mg+). Forest health means dieback of forest crowns or unusual mortality that cannot be attributed to a single agent, but instead is a gradual deterioration due to biotic and abiotic factors. Forest productivity means the aboveground growth of woody biomass over time. Species composition means the predominate kinds of trees that occur on a site.

Cumulative Effects

Cumulative effects are the impact of past, present, and foreseeable future actions, which in this case includes consideration of early land use (forestry, agriculture), long-term changes in atmospheric deposition (SO^4, NO^3, particulate matter), and future land uses. Early land use information dates to the late 1800s and early 1900s. Future harvesting can be considered for about a fifty-year time frame. Hopefully, changes in air quality will continue to improve, but the actual future cannot be predicted. Repeated defoliations and droughts must be taken into account, given their role as predisposing or inciting factors to forest health issues in which soil calcium is a component. This points out the complexity and difficulty of measuring environmental change. For example, while elevated levels of CO^2 and NO^2 may increase forest productivity and ozone may decrease it, recent modeling indicates that intact forests may show relatively little evidence of altered growth since pre-industrial times, despite substantial changes in their physical and chemical environment (Ollinger et al., 2002).

Alternative 1

Direct Effects

In MA 2.1 (and 3.1), forest harvest removes calcium that would otherwise be recycled to the forest floor. This direct impact is summarized for different methods of harvest in Table 3-02, based on existing information about forest biomass and nutrient concentrations in hardwood and softwood forest (Fay et al., 1993; Fay, 2005). The purpose of this table is to show the relative magnitude of impact of different harvest methods in anticipation of further discussion by alternative where the mix of harvest methods changes. This table shows that clearcut harvest has the greatest estimated direct impact, and that whole-tree harvest vs. bole-only harvest also increases the magnitude of impact. Further work is taking place at this time to better summarize this kind of information for a wider range of forest species in New England (Pardo, 2003). The table reflects the impacts of a single harvest.

Table 3-02. Estimated Calcium Removal By Harvest Practice (Kg/ha and % Total Estimated Pool).

Forest Type	Conv. Thin[1]	Conv. Clearcut[2]	WTH Thin[3]	WTH Clearcut[4]	Conv. UEA[5]	WTH UEA[6]
Hardwood	44 (<1)	172 (2)	80 (1)	340 (4)	85 (1)	153 (2)
Softwood	124 (<1)	247 (2)	185 (1)	494 (4)	124 (<1)	255 (<1)

[1]Conventional thinning 25% of tree stems or basal area (tops and branches left in woods)
[2] Conventional clearcutting all tree stems or basal area (tops and branches left in woods)
[3] Whole Tree Harvest thinning 25% of tree stems or basal area (including removal of branches and tops from the woods)
[4] Whole Tree clear-cutting all stems or basal area (including removal of branches and tops from the woods)
[5] Conventional uneven aged harvest of 25% of stems or basal area (tops left in the woods)
[6] Whole Tree Harvest uneven aged cut of 25% of stems or basal area (including removal of branches and tops from the woods).

*Table 3-03. Estimated Acres Treated, by Alternative and Harvest Method**

Treatments	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Total Harvest/20 yr	77,800	60,000	66,200	89,900
ASQ(MMBF/yr)	35	24	18	30
Even-aged Regeneration/yr	1,730	1,070	480	1,135
Uneven-Aged/yr	1,000	1,165	2,090	1,835
% Even-aged/yr	74	61	37	59

*Decades 1 and 2 Alternative Descriptions

The acres to which these estimated removals would apply vary by alternative (Table 3-03). For purposes of this analysis, clearcut and thinning are applied mainly to hardwood forest. Uneven-aged treatment is applied to hardwood and softwood forest. Conventional harvest, which removes only the bole of the tree, is the most likely method of harvest; however, to meet site-specific resource needs, such as aesthetics along highways, or in the event that energy demands change, whole-tree harvest may be applied. Specific standards and guidelines are invoked when whole-tree harvest is contemplated. The proportion of harvest in hardwood (and hardwood-spruce) vs. softwood forest is approximately 75/25, based roughly on the land capability of MA 2.1/3.1 lands, though this will gradually change over time as softwood representation increases to meet the softwood habitat goal.

Alternative 1, with the most clearcut acres and the most volume harvested annually, will directly remove the greatest amount of calcium with the harvest products compared to all other alternatives. In the short term, clearcut removes the greatest amount of calcium at an individual site.

This alternative would likely lead to the widest spread of trampling and soil compaction, as demand for recreational use of the backcountry would be accommodated in more and different areas.

Indirect Effects

Based on actual on-site measurements at Hubbard Brook Experimental Forest — over a period of fifteen years at sixty soil pits — soil exchangeable calcium was not lost due to forest harvest (Johnson et al., 1997; Johnson, 2004). This was in a northern hardwood stand following whole-tree clearcut harvest which removed 93 percent of the aboveground biomass. This intensity of harvest is substantially greater than harvest practices on the White Mountain National Forest, especially if whole-tree harvest is avoided. Similar results were found in mixed oak forest when comparing both conventional and whole-tree harvest fifteen years after harvest (Johnson et al., 1998). In fact, at this mixed oak site it is suggested that deep rooting reserves or non-exchangeable reserves probably replenished the exchangeable calcium reserve. This interpretation highlights the significant importance of rooting depth when making observations about possible changes in soil calcium.

Biogeochemical modeling at Hubbard Brook Experimental Forest suggests that there may be a loss of exchangeable calcium over a long period of time (Gbondo-Tugbawa et al., 2003); though plainly, atmospheric deposition is by far the most significant causative factor affecting exchangeable soil calcium. As discussed earlier, research is underway to determine additional sources of calcium not accounted for in existing studies.

It has been suggested that 50 percent of the exchangeable calcium at Hubbard Brook Experimental Forest has been lost since the onset of acid deposition, and this figure has appeared in several publications. However, a search of peer-reviewed literature for data to support this estimate failed to provide substantiation. Likens et al. (1996) does not report a 50 percent loss of exchangeable soil calcium, even though that study also reported on soil loss as compared to ecosystem loss. One of the co-authors confirmed that the data does not exist (Buso, D., 2005, personal communication).

In terms of the alternatives, therefore, direct measurements over a period of one to two decades do not indicate an indirect effect on exchangeable soil calcium, even when clearcut, whole-tree harvest is applied. This alternative is not expected to impact exchangeable soil calcium over the first two decades, particularly in light of the fact that whole-tree harvest is not routinely applied, and is not allowed on soils shallow to ledge or outwash sands in accord with standards and guidelines originating from research guidance (Pierce et al., 1993). Alternative 1 further diminishes the likelihood of possible exchangeable soil calcium loss because 1) the timber harvest program is only about 75 percent of the Forest's biological potential (35 MMBF vs. 47 MMBF) in the first decade of implementation; 2) about 70 percent of the harvest takes place during the winter, when leaves have fallen to the forest floor; and 3) rotation lengths between final harvests are generally long — 120 years for even-aged management. While it was never applied, the 1986 plan would have allowed short-rotation (40-year) biomass (all tree parts removed) forestry to supply fuel for wood-fired energy production; however, the alternatives in this analysis have omitted biomass harvesting.

Change in forest health (decline and dieback), especially as it relates to sugar maple, is a concern because sugar maple is part of the Forest Service's goal

to supply quality northern hardwoods. Over time, there have been multiple incidents of sugar maple decline in the eastern US (Hallett et al., 2003). While dieback of sugar maple has been reported in the Northeast, and there is evidence of a link between soil base cation status and periodic dieback of sugar maple in Pennsylvania (Horsley et al., 2000), there is no published evidence of this link in the White Mountains. Soils in Pennsylvania are significantly older than in the White Mountains (700,000 vs. 12,000 years), providing greater time for acidification by natural or human-caused factors, and amounts of sulfur deposition are significantly greater (http://nadp.sws.uiuc.edu). Also, multiple stressors, namely repeated insect defoliation or drought, are both necessary factors in the dieback and mortality reported by Horsley et al. (2000). As noted (Horsley et al., 2002), foliage consuming insects (defoliators) "have the greatest potential for negative effects on large trees over a wide geographic area." It is worth noting that during the past four decades there have been sporadic declines of sugar maple in the northeastern US, Ontario, and Quebec, but because they are ephemeral, the causes have been difficult to determine (Horsley et al., 2002). Usually, temporary increases in mortality are followed by a period of recovery and improved health.

There is discussion in Lawrence et al. (2000) about sugar maple, climate, and nutrients (page 306-307). This is a review of research, not original data. While no data is cited for the White Mountains, work in Vermont (Wilmot et al., 1994) suggests a strong relationship between soil calcium availability and long-term growth rates. Lawrence concludes that while "fertilization studies showed a strong relationship between sugar maple health and nutrient availability, these studies did not isolate pollution effects from other interacting factors." The debate over the causes of sugar maple decline in the Northeast has continued. Evidence that past declines were generally followed by periods of recovery, and that past management strategies resulted in establishment of sugar maple on marginal sites, may have also contributed to sugar maple declines in the Northeast. "Evidence that both natural and pollution-related processes have been involved in sugar maple declines in the Northeast suggests that research should focus on the multiple interactive factors that control the long-term productivity of sugar maple, rather than single mechanisms that trigger periodic declines." (Lawrence, 2000) Long et al. (1997) concludes that "the cause of sugar maple decline has been difficult to determine because of the ephemeral nature of decline episodes and the fact that decline seems to occur as a result of the interaction of several factors, some of which vary temporarily."

On the White Mountain National Forest, 121 plots from a transect across the Northeast indicate limited dieback of branch tips, one indicator of potential health issues related to soil calcium (Hallett, 2003). Of these plots, 45 reveal foliar calcium concentrations lower than thresholds established for possible concern about sugar maple decline (Hallett, 2003). Review of significant insect defoliations that would predispose sugar maple to decline indicates that only in 1981-85 was insect defoliation significant in New Hampshire (Millers et al., 1989). Recent reports of insect infestation in New England are for wood borers, not defoliators. Drought was only identified as a significant factor in 1915 (Millers et al., 1989). A review of agricultural

drought for New Hampshire (less than 60 mm) indicates that it does occur; however, it is site-specific and not reoccurring in repeated years (Federer, 1980). Application of the Pnet:CN model to the Bartlett Experimental Forest in a way that mimics drought reveals only a few instances where there is a change in the NPP (net primary productivity) of the northern hardwood forest. Given no short term change in exchangeable soil calcium from forest harvesting, little evidence that drought or insect defoliation are likely to be predisposing factors, and little evidence of forest decline, no indirect effect on forest health is expected under this alternative. There is no published evidence of hardwood forest decline on the White Mountain National Forest.

Change in forest productivity is also not anticipated because of important local evidence. Measurements at the Bartlett Experimental Forest since 1931, and therefore pre- and post-industrialization pollution, show no change in observable aboveground biomass accumulation trends in northern hardwood forest across a range of soils on sites that have been harvested by a variety of methods, including clearcut, since the early 1900s. These measurements include data from Hubbard Brook Experimental Forest, the Bowl Research Natural Area, and Waterville Valley. See further discussion in the Affected Environment section with respect to forest productivity.

Stocking surveys of selective and clearcut stands on the White Mountain National Forest, collected since 1986, indicate all stands have adequately restocked in accord with agency requirements (see the Administrative Record). These areas were harvested specifically to regenerate to new forest. Restocking is the first vital step in successful biomass accumulation. These harvest areas occurred on a wide range of elevations, aspects, topographic positions, and land use history, and are spread geographically across the White Mountain National Forest (see the Administrative Record). Successful restocking of timber stands at Hubbard Brook is also reported in the literature there (Martin et al., 1989).

The fact that species such as sugar maple (or red spruce) may experience episodic dieback does not mean there has been a change in biomass accumulation trends on the White Mountain National Forest. Leak (1982) shows a biomass curve for a wide range of forest habitats (hardwoods, softwoods, hardwood-spruce, across a range of soils), yet with one exception, they in all cases follow the same biomass accumulation curve. This demonstrates that shifts in species composition do not lead to changes in biomass accumulation trends. The one exception is enriched forest habitat, where sugar maple and white ash on apparently very rich soils (unusually deep organic horizons) lead to slightly higher biomass; however, this habitat type is uncommon on the White Mountain National Forest and occurs mainly as small, isolated areas.

If there were changes in species composition, say a shift favoring beech over sugar maple, this would not change biomass accumulation. It is, instead, a silvicultural and forest health issue, not unlike an area of diseased or ice-damaged forest, which does not make a forest stand unsuitable. Evidence to date does not indicate that changes are occurring in species composition (Leak, 1987; Leak et al., 1996). Leak (1987) reported on compositional changes based on 29 cruise plots at the Bartlett Experimental Forest. These plots

were measured originally in 1931-32, not harvested since that time, and re-measured in 1986. On a range of soils, this revealed that forest composition is moving toward a predominance of one or two tolerant species, depending mainly on soils (habitat) and to a lesser extent on elevation. This work showed that quality northern hardwood sites were moving toward beech and sugar maple, and that over the years the proportion of beech increased by 13-17 percent in both the overstory and understory. The percent of sugar maple declined by 3 to 6 percent in the understory, and increased or decreased slightly in the overstory. Leak et al. (1996) studied hardwood and softwood stands using data over a 60 year period from permanent plots at the Bartlett Experimental Forest. Their overall conclusion was that natural selection is the dominant factor affecting long term changes in species composition in these forested landscapes. Table 3 of their study shows both sugar maple and beech with slight increases in basal area in unmanaged stands between 1931 and 1992. While it may be that soil acidification is a possible explanation, at this point it is probably not possible to discount other factors, such as beech bark disease or successional trends.

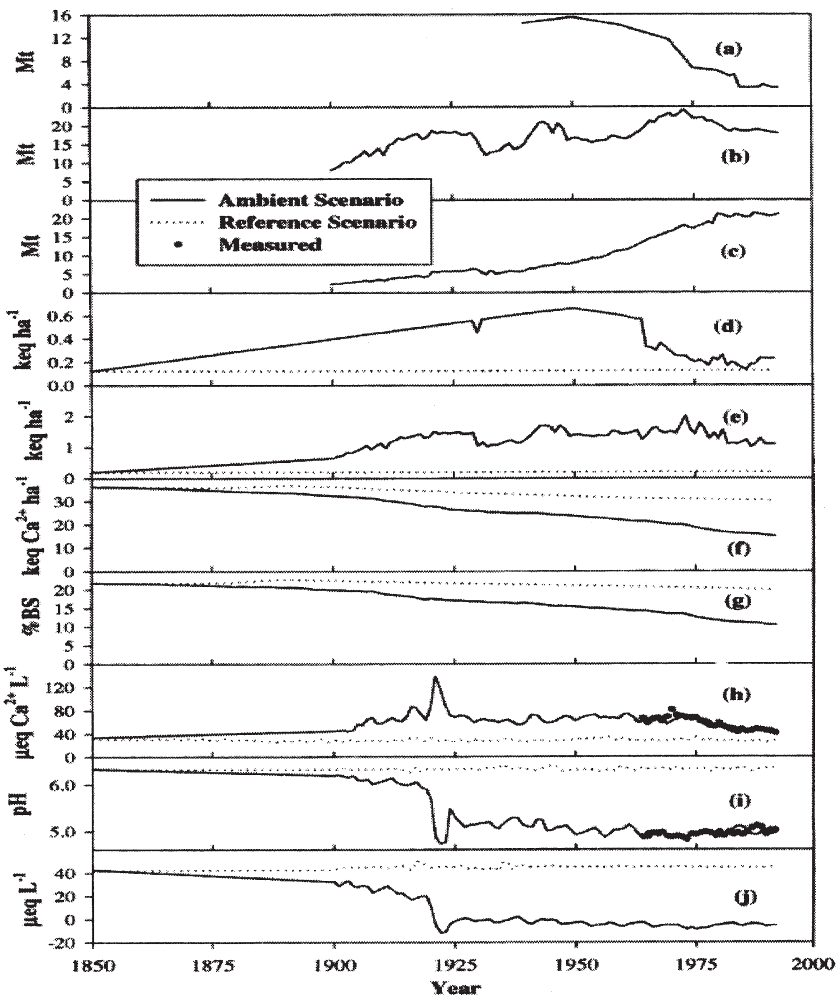
An examination of growth patterns of red oak and red and sugar maple in New England indicates a steady increase in growth between 1900 and 1980 (Hornbeck, 1987). Measurement of forest productivity by remote sensing (Airborne Visible Infrared Spectrometer, AVIRIS) indicates that plots spread across the Forest show similar productivity to those measured at the Bartlett Experimental Forest (Smith, 2002). Given the long history of land use on the Forest, that the apparent peak in acidic deposition is well past, and that harvest has been at 60 to 75 percent of the Forest's biological potential, no indirect impact on forest productivity is expected.

Cumulative Effects

Modeling of soil exchangeable calcium and base saturation has been done for a northern hardwood forest at the Hubbard Brook Experimental Forest (Gbondo-Tugbawa et al., 2003). As noted earlier, atmospheric deposition is a large factor in possible effects on soil calcium. Figure 3-01 illustrates that SO^4 deposition (graph "b") has shown gradual improvement since the 1970s; NO^3 has apparently not improved (graph "c"); and the contribution of calcium deposition from particulate matter has become smaller (graph "d"). This level of atmospheric deposition caused much of the changes shown in Figure 3-02.

In Figure 3-02, (graph "a") and (graph "b") show little effect from forest harvest on exchangeable soil calcium and soil base saturation (Gbondo-Tugbawa et al., 2003). Other research shows no cumulative impact on exchangeable calcium (Johnson et al., 1997; Johnson, 2004). This is demonstrated by the fact that changes in exchangeable soil calcium and soil base saturation are nearly the same line with (Ambient Scenario) and without (No Forest Disturbance Scenario) forest harvesting. The "ambient scenario" is actual atmospheric deposition and forest harvest since the early 1900s, as reported or estimated. "No forest disturbance" means this effect is taken out of the analysis. A cumulative effect is shown for exchangeable soil calcium and base saturation over time from atmospheric deposition (Figure 3-01 (graph "f") and (graph "g")). This is a dynamic modeling effort that

Figure 3-01. SO^4, NO^3, and Calcium Deposition, 1850-2000.

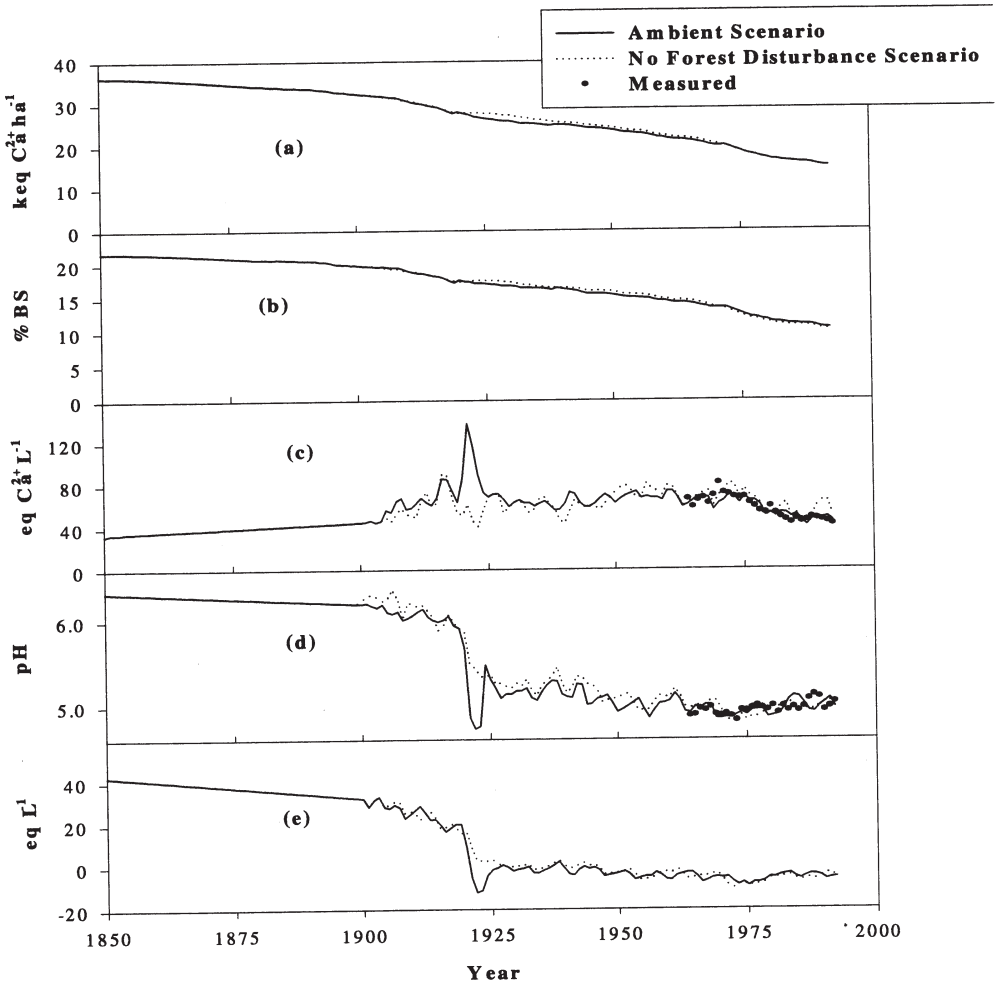


Taken from Solomon, S. Gbondo-Tugbawa and C.T. Driscoll 2003

tries to take into account changing environmental conditions, especially air quality improvements with amendments to the Clean Air Act. It suggests there may be changes in soil calcium that could potentially affect long-term soil productivity. The disparity with on-site measurements probably suggests that factors such as calcium oxalate may need to be incorporated into the accounting for exchangeable calcium and base saturation to better represent actual field conditions.

Also at Hubbard Brook Experimental Forest, small watershed analysis of changes in total soil calcium indicated a long-term concern if clearcut harvest were applied on short rotations of forty years. Estimates show a cumulative loss due to atmospheric deposition alone of 11 percent of the total soil calcium supply over a 120-year period (Federer et al., 1989). This estimate was unable to take into account mineral weathering. Now that this can be done, a revised estimate, using the most current information, suggests the possible change is about 4 percent over 120 years (Bailey, 2004). This modeling is a static view of environmental factors, including atmospheric deposition, so it does

Figure 3-02. Changes in Soil Exchangeable Calcium and Base Saturation, 1850-2000.



Taken from Solomon, S. Gbondo-Tugbawa and C.T. Driscoll 2003

not take into account, for example, improvements in air quality. Past harvest might add less than one to two percent further loss, and current and future harvests might contribute additional losses of a similar magnitude. Like the previous model, this important effort suggests changes in soil calcium that might affect long-term productivity. The loss inferred from small watershed studies, however, is not confirmed by actual soil measurements, and it is believed by some that small watershed studies lead to overestimates of nutrients losses (Fernandez et al., 2003). Rotation periods of 120 years for clearcut harvest on the White Mountain National Forest suggest nutrient depletion due to timber harvest is not likely.

In considering impacts, irreversible effects have to be considered. An irreversible impact refers to factors such as soil productivity that are renewable only over long periods of time. Observations from field studies in northern hardwood forests suggest that intensive timber harvest has not lead to an irreversible impact, as exchangeable soil calcium showed no change fifteen years after an intense, clearcut harvest using whole-tree

removal (Johnson et al., 1997; Johnson, 2004). The same was observed in oak dominated forests (Jonhson and Todd, 1998).

Distinct from the impacts of timber harvest is the possibility of irreversible impacts from acid deposition. Acid deposition, as measured by small watershed mass balance studies, causes detectable impacts on available calcium (Federer et al., 1989; Likens et al., 1996), artificial watershed acidification (Fernandez et al., 2003), and retrospective soil analysis (Lawrence et al., 1997; Bailey et al., 2005). The magnitude of impact continues to be refined because our knowledge of storage and release mechanisms has not yet allowed estimation of the overall size of soil nutrient reserves (Bailey et al., 2003). There is evidence of alternative sources of supply besides the traditionally considered soil exchange pool. These include calcium oxalate (Bailey et al., 2003) and direct weathering of minerals by fungal activity (van Breeman et al., 2000; Blum et al., 2002).

About 35 years have passed since the apparent peak in acid deposition, though lower rates of deposition continue. Concern among scientists persists, especially regarding high elevations, but they also indicate that recovery of soils is occurring. No impact on long-term soil productivity (aside from the trails and facilities described earlier) is expected from Alternative 1 on MA 2.1 (and 3.1) lands, given 1) the available evidence on exchangeable soil calcium impacts from timber harvest; 2) long-term observations about forest productivity; 3) long-term evidence about forest species composition; 4) the absence of inciting factors that affect forest health; 5) no link made on the White Mountain National Forest between forest health and soil calcium,; and, 6) the indications that existing long-term impacts are not irreparable, though it will take time. These are all described in detail in this environmental analysis, as well as in the response to public comment (Appendix A) and replies to detailed technical comments (Administrative Record). Long-term monitoring sites are already in place on the White Mountain National Forest, at Experiment Stations on National Forest System lands.

Scientists believe that recovery from acid deposition impacts is possible. There are indications of recovery in water quality (Likens et al., 1996) and soil solution (Palmer et al., 2004) due primarily to a decrease in sulfur deposition, though it is not accompanied by improvement in base cations in surface water chemistry. The response of surface waters with the lowest pH levels may suggest that "the mechanisms of recovery have not been irreparably damaged," and that "soils in sensitive watersheds are still capable of progress toward surface water recovery in the time frame of years to decades." (Kahl et al., 2004) Modeling at Hubbard Brook Experimental Forest suggest that there have been benefits to soil and stream water from the Clean Air Act and its amendments; that some ecosystem recovery has occurred; that recovery is slow; and that more control on emissions may be necessary (Gbondo-Tugbawa et al., 2002). Modeling has shown some improvement in soil base saturation, but little change in Ca:Al resulting from the 1970 and 1990 CAAA (Gbondo-Tugbawa et al., 2002). Improvements in air quality are occurring, especially sulfur deposition (http://nadp.sws.uiuc.edu). Peer-reviewed journals have not reported that acid deposition has lead to irreparable impact on soil productivity. (See Discussion of soil productivity and land suitability in the Administrative Record.)

Differences among the alternatives, given that acid deposition is by far the paramount factor, are probably not distinguishable.

Alternative 2

Direct Effects

This alternative provides an ASQ of 24 MMBF, and includes estimates of 940 acres of clearcut harvest each year for the first decade and 1,200 acres of clearcut per year during the second decade. The magnitude of estimated direct impact on soil calcium is about one-third smaller than for Alternative 1. Acres available for harvest are essentially the same as for Alternative 1, although the acres harvested are less than Alternative 1 (see Table 3-03). In addition to the smaller timber harvest program, this alternative eliminates the practice of short rotation (40-year) biomass harvest (all tree parts removed); raises the standard for consideration of whole-tree harvest; and also harvests about 70 percent of the timber during the winter months, thereby allowing calcium in leaves to be returned to the forest floor.

Alternatives 2 and 3 would likely lead to the least amount of soil compaction. The application of the Recreation Management Approaches (Recreation section) would force the majority of users into already-impacted areas, rather than spreading use to undisturbed sites.

Indirect Effects

The indirect effects of this alternative are the same as for Alternative 1. No impact is expected on forest health or productivity related to the timber harvest program during the next two decades. Alternative 2 further diminishes the likelihood of possible exchangeable soil calcium loss because the timber harvest program is about 60 percent of the Forest's biological potential (24 MMBF vs. 40 MMBF) in the first decade of implementation.

Cumulative Effects

The cumulative impacts of this alternative for the foreseeable future are the same as for Alternative 1. This is because the driving force in possible change is atmospheric deposition, due to the fact that the best modeling available indicates that harvesting is a small factor.

Alternative 3

Direct Effects

This alternative provides an ASQ of 18 MMBF, with 480 acres harvested annually by clearcut over the next two decades. It has the lowest volume harvested over the first two decades of all the alternatives, and includes the fewest acres of clearcut harvest. Therefore, the magnitude of the estimated impact on soil calcium is the least of all alternatives. The acres proposed for harvest are about 15 percent less than under Alternative 1 (see Table 3-03).

Alternatives 2 and 3 would likely lead to the least amount of soil compaction. The application of the Recreation Management Approaches (Recreation section) would force the majority of users into already-impacted areas, rather than spreading use to undisturbed sites.

Indirect Effects

The indirect effects of this alternative are the same as for Alternative 1. No impact is expected on forest health or productivity related to the timber harvest program over the next two decades. Alternative 3 further diminishes the likelihood of possible exchangeable soil calcium loss because the timber harvest program is about 75 percent of the Forest's biological potential (18 MMBF vs. 24 MMBF) in the first decade of implementation.

Cumulative Effects

The cumulative impacts of this alternative for the foreseeable future are the same as for Alternative 1.

Alternative 4

Direct Effects

This alternative provides an ASQ of 30 MMBF, with 1,135 acres harvested annually by clearcut over the next two decades. It is the highest total acres harvested of any alternative. However, the volume harvested is slightly less than for Alternative 1, and the acres of clearcut are close to Alternative 2 levels (see Table 3-03). The magnitude of the estimated impact on soil calcium, therefore, is about the same as for Alternative 2.

Alternative 4 would lead to less trampling and soil compaction than Alternative 1, but more than Alternatives 2 and 3. The Recreation Management Approaches (Recreation section) would lead to concentration of use at existing sites, but within this alternative, more new concentrated use sites would be created from undisturbed areas in order to accommodate recreational use.

Indirect Effects

The indirect effects of this alternative are the same as Alternative 1. No impact is expected on forest health or productivity related to the timber harvest program during the next two decades. The alternative further diminishes the likelihood of possible exchangeable soil calcium loss because the timber harvest program is about 67 percent of the Forest's biological potential (30 MMBF vs. 45 MMBF) in the first decade of implementation.

Cumulative Effects

The cumulative impacts of this alternative for the foreseeable future are the same as Alternative 1.

Effects on Non-priced Benefits

There are many reasons for maintaining soil productivity, most of which cannot easily have an economic value assigned to them. A productive soil is the medium for regeneration and growth of a wide range of plant species, which in turn provides habitat for wildlife and contributes to maintaining water quality. The value of the soil for plant growth and for maintaining water quality appears to be unchanged in the foreseeable future for all alternatives.

Forest Soil Erosion

Affected Environment

The soil erosion analysis area is all areas of the Forest where trails, roads, timber sales, backcountry facilities, ski areas, or other potential uses such as summer ATVs (in Alternatives 1 and 4 only), mineral prospecting, and cell tower or wind turbine sites may occur. Most erosion is site-specific and affects small or linear areas.

In the White Mountains, soils at higher elevations — generally above 2,500 feet — tend to be moderately deep to shallow and on steep terrain. They are often very bouldery. Use in this vicinity is mainly backcountry camping and hiking, though small portions of alpine ski areas also occur here. The most significant erosion hazard is dry debris slides, or landslides, but the locations of these hazards are well known and easily avoided. Hiking trails do not trigger debris slides. There is ongoing soil erosion on hiking trails, especially those that were built a long time ago on the fall-line; however, persistent effort with water-bars and diversion ditches helps to minimize this impact. In places, there is a backlog of work to be done. Mountain biking at alpine ski areas leads to some soil erosion, but this is not the case on most roads where biking occurs. Alpine ski area trails and lift lines are well-vegetated, fertilized, and limed as necessary, and surface water is diverted off-slope into safe outlets, resulting in little existing soil erosion. Areas of dry debris slides are avoided during alpine ski area development.

Soils at moderate to low elevations — generally less than 2,500 feet — are usually deep, and well- or moderately well-drained sandy loams, fine sandy loams, and sands. It is here that roads, timber sales, possible summer ATV use, and the majority of alpine (and Nordic) ski area development and use occurs. Soil erosion hazards range from low to high; however, research findings and on-the-ground experience for all hazard classes confirm that accelerated soil erosion due to roads and skid trails can be reduced— and its effects on streams largely eliminated — by timely application of well-known best management practices (Stone et al., 1977; Martin et al., 1999; Stafford et al., 1996; Patric et al., 1976). Continuous stream water monitoring in selected public water supplies with timber harvest, road construction, skid trails, and trailhead parking and camping confirms that stream turbidity from soil erosion is not a concern with carefully planned activities. Although the first year following new road construction can be problematic, the Forest's permanent road system is already largely in place. Monitoring at alpine ski areas does not reveal soil erosion on well-maintained slopes. The potentially most significant erosion concern is deep soil slumps on very steep lands along major rivers and streams. These sites have been identified, however, and earth-disturbing activities are avoided at these locations.

Environmental Effects

Alternative 1

Direct Effects

Roads/Trails

Road and trail construction and road reopening are possible sources of soil erosion and stream sedimentation. Road construction and reconstruction planned for the next decade for timber management purposes is estimated at 11 miles per year (Table 3-04). This will be predominately reconstructing existing roads. Intermittent, frozen soil roads are most likely, because about 70 percent of the timber sales will be winter harvest. This alternative may include road improvements for public safety, and road construction for alpine ski areas and, possibly, mineral development, cell towers, and wind turbines. Summer ATV use may occur on existing trails or roads at up to two areas on the Forest. Soil erosion may occur along steeper sections of trail or during wet periods. Proper management of surface water will be a necessity to minimize soil erosion and the potential for stream sedimentation. Limited soil erosion may occur where mountain bikes are used, but it will be site-specific and manageable with proper trail maintenance. There will be soil erosion during construction of up to 40 miles of hiking trails.

Table 3-04. Projected Need for Roads by Alternative.

	Alt 1	Alt 2	Alt 3	Alt 4
Roads Constructed*	1 mi/yr	1 mi/yr	1 mi/yr	1 mi/yr
Roads Reconstructed	10 mi/yr	7 mi/yr	7 mi/yr	11 mi/yr

* Actual new construction will be minimal. The majority of this activity will be major reconstruction of existing travelways.

All roads and trails may incur localized surface soil erosion during construction, reconstruction, reopening, or use. However, oversight by timber sale, ski area, or special use permit administrators and hiking trail maintenance crews minimizes erosion. In addition, generally deep, moderately well-drained soils, road grade limits, and timely installation of drainage structures to manage surface water also help avoid soil erosion. Road use during frozen conditions for the timber sales also minimizes the risk of soil erosion.

Special risks for timber sale or other road construction may include deep soil slumps along major rivers and streams. However, this can be avoided by proper location. In all instances, initial exposure of mineral soil is the period of greatest concern because more fine soil particles are present, culverts and water bars or other measures to manage surface water are being installed, and stabilization, such as revegetation, is still becoming effective.

Miles of skid trail vary by the acres of timber harvest. This mileage increases within each alternative over time as additional harvest occurs. Soil erosion may occur, especially on the main skid trails. However, winter harvest on about 70 percent of the acres treated, plus proper layout and administration

of skid trails, also minimizes soil erosion. Only a small portion of MA 2.1 and 3.1 is affected by timber sale activity at any one time.

Skidding in the snow-free season, however, exposes mineral soil, may lead to rutting, and site-specific soil erosion may occur. Careful skid trail layout, attention to terrain breaks, closure during wet periods, installation of waterbars, and focusing skidding on the better-drained soils will all help to minimize soil erosion. Also, for the most part, skid trails (and roads) are at the lower elevations on the landscape, with deep soils on moderate terrain. In addition, the forest canopy very quickly overtops skid roads, eliminating the impact of raindrop splash that can initiate soil erosion.

Alpine Ski Areas

Alpine ski area development, including trails, lifts, utility corridors, snowmaking ponds, and structures, exposes mineral soil on steeper terrain than other activities. This may include both summer and winter use at alpine ski areas. Surface soil erosion may occur, especially during clearing and grading of trails and lift lines or installation of snowmaking water/air lines. However, standards and guidelines governing how much earth may be exposed at one time, progressive construction and revegetation, installation of broad-based dips and culverts, and season of operation all contribute to the prevention of soil erosion. Recent experience with trail, lift, and utility corridors confirms that soil erosion can be minimized or avoided. Weed-free seeding, mulching, fertilizing, and liming all contribute to prevent soil erosion. Special risks at alpine ski areas may include dry debris slides at high elevations; however, these hazards are well known and such areas can be avoided.

Indirect Effects

Turbidity in streams is the most likely indirect impact from all of the above-mentioned earth disturbing activities. The Water Quality section discusses impacts from road and trail construction, ski area development, and mineral development.

Unsuccessful revegetation of shrubs and forest on skid trails, log landings, and intermittent use roads may be an indirect impact of soil erosion or compaction. Unlike constant service roads that are meant to remain "road-like," intermittent roads and skid trails are meant to return to forest during periods between uses. Studies in Maine and Vermont indicate that soil compaction on log landings and skid trails lasts two to three years after cessation of activity, and that at no time is the oxygen content of the soil inadequate for plant growth. On-Forest experience indicates that skid roads and trails, log landings, and intermittent roads do revegetate naturally. Well-distributed rainfall, abundant seed sources, and favorable seedbeds all contribute to rapid revegetation. On log landings, revegetation is initially to raspberries and other herbaceous species, and then to forest. On skid roads and trails, it returns to forest because sunlight is usually limited.

Cumulative Effects

Past actions potentially contributing to soil erosion include timber sales; public and private highway construction; utility corridors; ski areas; parking

lots; hiking and mountain biking trails. Current actions would include all of these except, possibly, major utility corridors. Future actions would probably include current actions plus possible wind turbines, cell towers, utility corridors, summer ATV use, and hard rock mineral prospecting and development. Past actions date from the late 1800s and early 1900s. Future foreseeable actions go out five decades, with an emphasis on the next two decades.

Actions in the late 1800s and early 1900s, which predate forest practices, standards and guidelines, or best management practices, probably led to substantial soil erosion. Early actions, such as logging and road building, occurred at many elevations and across much of the landscape, including soils with low and high erosion hazards. Trail construction occurred on steep and modest terrain. Early harvesting and road building was substantial, but by 1950/1960, the pace of harvest on National Forest lands was far less intensive and regulations were being formulated and applied. Hiking trail miles were reduced on the Forest during the post-World War II era. More limited harvesting and fewer hiking trails led to less surface soil erosion.

Regional Planning Guides for the National Forests of New England (1972), subsequent Unit Plans (1970-1980), and Forest Plans (1986) all led to sustainable timber harvests, more improvements in road management, greater management of ski area and hiking trail expansion, and the focusing of most earth-disturbing activity at lower elevations on more modest terrain. As a result, a forest that was once heavily harvested is now completely forested and growing productively. Given well-distributed rainfall, reseeding of disturbed areas, and improved administration of earth-disturbing activities, the magnitude of soil erosion has become substantially less. Activities off National Forest System lands but within the proclamation boundary are subject to regulation through alteration of terrain permits, with the result that soil erosion is generally well managed in those places as well. Utility corridors and ski area development may be on the steepest and most erosive terrain, providing the greatest potential risk of soil erosion. However, evidence does not indicate current soil erosion issues at these locations.

The White Mountain National Forest has approximately 578 miles of classified Forest System roads, comprising a mix of constant service roads and intermittent service roads, used for a variety of purposes. The constant service roads, whether available for public use or not, are routinely maintained by grading, culvert cleaning, and brushing for safety. Grading, in particular, prevents ruts and, in turn, allows the ditches and culverts to provide safe outlets for surface water. As a result of this maintenance, along with successful stabilization of road banks, surface soil erosion is uncommon on constant service roads.

Foreseeable future uses that may contribute to changes in soil erosion include cell towers and wind turbines, which may require constant service roads on steeper terrain than ordinarily used; summer ATV use on designed trails; and mineral prospecting and development, the nature of which is not well known. There will also often be some off-trail hiking use as hikers seek out

a view or other location of interest, and off-trail mountain bike use, which is permitted under this alternative. These activities may also lead to on-site soil erosion; however, given good location, design, and mitigation measures would lessen the impact. The actual locations of these uses are not known at this time.

Cumulative soil erosion impact, therefore, is likely to remain local and can be mitigated with soil erosion standards and guidelines. Overall, activities of all kinds are widely spread across the landscape, generally affecting only a small part of it at one time, and closely coordinated and regulated when multiple activities occur in a small area.

Alternative 2

Direct Effects

Roads/Trails

The kinds of direct effects that may occur in this alternative are similar to those in Alternative 1, except that summer ATV use is not permitted. A smaller timber sale program, less road construction/reconstruction (8 miles) and road reopening, and fewer acres impacted by skid roads and skid trails will lead to a reduced potential for soil erosion impacts compared to Alternative 1. There will be some erosion generated by hikers going off-trail, as well as from the construction of up to 25 miles of new hiking trails. This alternative, and its land allocation, do not introduce or eliminate lands that would raise or lower the general soil erosion hazards across the Forest. The same standards and guidelines to minimize soil erosion from all sources remain in effect.

Alpine Ski Areas

Alpine ski area impacts are the same as for Alternative 1, because existing and potential expansion opportunities are unchanged in this alternative.

Indirect Effects

Turbidity in streams is the most likely indirect impact from all of the above-mentioned earth-disturbing activities. The Water Quality section discusses impacts from road and trail construction, ski area development, and mineral development.

Indirect effects from skid trails, log landings, and intermittent use roads are the same kinds as for Alternative 1. However, the potential magnitude is less because fewer acres of timber harvest will occur, fewer intermittent roads are likely to be necessary, and less acreage will need to be accessed by skidders.

Cumulative Effects

Past actions potentially contributing to soil erosion include timber sales; public and private highway construction; utility corridors; ski areas; parking lots; and hiking trails; and second home development. Current actions would include all of these, with the possible exception of new major utility corridors. Future actions would probably include current actions plus possible wind turbines, cell towers, and utility corridors. Past actions date from the late

1800s and early 1900s. Future foreseeable actions go out five decades, with an emphasis on the next two decades.

Cumulative soil erosion impact is likely to remain localized and manageable with the revised standards and guidelines. Overall, activities of all kinds are widely spread across the landscape, generally affecting only a small part of it at one time, and closely coordinated and regulated when multiple activities occur in a small area. The potential cumulative soil erosion impacts are likely to be smaller in magnitude than in Alternative 1, because fewer acres are affected by harvest and intermittent roads and skid trails, plus there is no summer ATV activity.

Alternative 3

Direct Effects

Roads/Trails

The kinds of direct effects that may occur in this alternative are similar to those for Alternative 2. Fewer roads constructed or reconstructed (8 miles), fewer miles of skid trails, and fewer acres harvested than for Alternative 1 will all lead to a reduced potential for soil erosion impacts generally similar to Alternative 2. This alternative has the fewest miles of possible new hiking trail construction (10 miles), thus the least erosion impact from construction. The change in land allocation does not introduce or eliminate lands that would raise or lower the general soil erosion hazards across the Forest. The same standards and guidelines to minimize soil erosion from all sources remain in effect.

Alpine Ski Areas

Alpine ski area impacts are the same as for Alternative 1, because existing and potential expansion opportunities are unchanged in this alternative.

Indirect Effects

Turbidity in streams is the most likely indirect impact from all of the above-mentioned earth-disturbing activities. The Water Quality section discusses impacts from road and trail construction, ski area development, and mineral development.

Indirect effects from skid trails, log landings, and intermittent use roads are the same kinds as in Alternative 1. However, the potential magnitude is less because fewer acres of timber harvest will occur, fewer intermittent roads are likely to be necessary, and less acreage will need to be accessed by skidders.

Cumulative Effects

Past actions potentially contributing to soil erosion include timber sales, public and private highway construction, utility corridors, ski areas, parking lots, and hiking trails, and second home development. Current actions would include all of these, with the possible exception of major utility corridors. Future actions would probably include current actions plus possible wind turbines, cell towers, and new major utility corridors. The cumulative effects analysis area for soil erosion includes all National Forest System lands and

private in-holdings. Past actions date from the late 1800s and early 1900s. Future foreseeable actions go out five decades, with an emphasis on the next two decades.

Cumulative soil erosion impact is likely to remain localized and manageable with the revised standards and guidelines. Overall, activities of all kinds are widely spread across the landscape, generally affecting only a small part of it at one time, and closely coordinated and regulated when multiple activities occur in a small area. The potential cumulative soil erosion impacts are likely to be smaller in magnitude than for Alternative 1, but similar to Alternative 2 because fewer acres are affected by harvest and intermittent roads and skid trails, and there is no summer ATV activity.

Alternative 4

Direct Effects

Roads/Trails

The kinds of direct effects that may occur in this alternative are similar to those in Alternative 1. The magnitude of impact would be slightly greater than Alternative 1 because the acres of timber harvest are larger, miles of road constructed or reconstructed are slightly larger (12 miles), and miles of skid trails are somewhat larger. It has the most miles of potential new hiking trail construction (100 miles). Trail construction for summer ATV use would be considered at Moat Mountain and Landaff, two potential experimental areas for this use. While, overall, the effects of ATV development would be similar to other potential sites that might arise in Alternative 1, soil information indicates Landaff may present some erosion hazards based on soils with compacted silts and soils shallow to ledge. Careful layout and design may minimize or avoid these hazards. Moat Mountain, while there may be localized soil erosion, presents no unusual soil erosion hazards. Soil erosion from illegal off-trail use may occasionally occur. Overall, Landaff presents more soil erosion hazard than Moat Mountain.

Alpine Ski Areas

Alpine ski area impacts are the same as for Alternative 1, because existing and potential expansion opportunities are unchanged in this alternative.

Indirect Effects

Turbidity in streams is the most likely indirect impact from all of the above-mentioned earth-disturbing activities. The Water Quality section discusses impacts from road and trail construction, ski area development, and mineral development.

Indirect effects on skid trails, log landings and intermittent use roads are similar to Alternative 1. However, the potential magnitude is less because fewer acres of timber harvest will occur, fewer intermittent roads are likely to be necessary, and less acreage will need to be accessed by skidders.

Cumulative Effects

Past actions potentially contributing to soil erosion include timber sales, public and private highway construction, utility corridors, ski areas, parking

lots, and hiking trails, and second home development. Current actions would include all of these, with the possible exception of major utility corridors. Future actions would probably include current actions plus possible wind turbines, cell towers, and new major utility corridors. The cumulative effects analysis area for soil erosion is all the National Forest System lands and private in-holdings. Past actions date from the late 1800s and early 1900s. Future foreseeable actions go out five decades, with an emphasis on the next two decades.

Cumulative soil erosion impact is likely to remain localized and manageable with the revised standards and guidelines. Overall, activities of all kinds are widely spread across the landscape, generally affecting only a small part of it at one time, and closely coordinated and regulated when multiple activities occur in a small area. The potential cumulative soil erosion impacts are likely to be greater in magnitude than in Alternative 1, because of more acres accessed for timber management purposes and more roads constructed or reconstructed.

Summary

Productive soils have the ability to support healthy and growing forests. The main concern with soil productivity on the White Mountain National Forest is possible long-term changes in soil calcium, primarily due to acid deposition. This concern is mostly at high elevations, where deposition is greatest. Monitoring of forest growth since 1931 at a range of elevations indicates no change in growth trends. All areas of timber harvest in the past 23 years are successfully regenerating into new forest. There is very little evidence of change in forest health.

The primary concern with soil erosion is the effect eroded materials have on streams. Road construction is the main possible source, although there may be soil erosion on hiking trails, alpine ski trails, and summer ATV trails. Standards and guidelines applied over many years on the Forest's generally deep and well-drained soils have minimized or eliminated soil erosion, and either prevented soil transport to streams or directed it to a safe outlet. Water quality monitoring has rarely indicated stream turbidity from soil erosion generated from management activities. Summer ATV use may generate some soil erosion, but well-maintained trails and stream crossings should minimize this effect.

Water Resources

The affected environment section discusses the current condition of water resource features, including a larger-scale discussion of watersheds, and then includes information about water uses on the Forest. The effects section discusses the activities that could affect these features.

Affected Environment

Water Resource Features

Water is a major feature on the White Mountain National Forest. Surface water features, such as lakes, wetlands, rivers, and streams, provide important habitat for waterfowl, fish, amphibians, and fur-bearing animals, as well as water to sustain all life. Groundwater recharges within the forestlands, while some discharge occurs on the Forest at springs, seeps, wetlands, and along streams to provide water during dry periods. Near-surface groundwater provides water for plants by storing it in the soil between periods of precipitation. Other water-dependent water resources include riparian areas, floodplains, and wetlands. In addition, water that originates on the Forest provides drinking water for numerous people, is used in snowmaking, and provides for recreational uses.

Water resources include water both on the surface and in the ground, and the features that have their origins in the fact that they hold, transmit, and store water. For surface waters, these topographic features include:

- Lakes.
- Streams.
- Watersheds.
- Riparian Areas.

Riparian areas are discussed in the Riparian and Aquatic Habitats section; soil, bedrock, and other surficial materials are described in the Soils section. Groundwater will be discussed briefly here, and lakes, streams, wetlands, and watersheds are also part of this report. The analysis areas for each water resource type and rationale are shown in Table 3-05.

Table 3-05. Water Resource Analysis Areas.

Water Resource	Analysis Area	Rationale
Lakes	All lakes on the WMNF	Encompasses the features
Streams	All streams on the WMNF	Encompasses the features.
Watersheds	All watersheds which include WMNF lands (12 digits)	Includes the drainage areas (watersheds) of all lands on the WMNF above a single outlet thereby integrating effects at this point.
Groundwater	All of the WMNF	Includes all the area where water could infiltrate into the ground from lands on the WMNF.

Surface Water Features

Lakes

The current Forest data show 335 water bodies, or their shores, either entirely or partially on the White Mountain National Forest. They range from .02 acres to more than 300 acres (Lake Tarleton), with most 10 acres or less in size. The lakes are diverse, with distinctive attributes related principally to each lake's origin and location.

Water bodies on the White Mountain National Forest can be natural or artificial. Natural water bodies are related to glacial age features and processes. Some, such as Lakes of the Clouds, are found in depressions gouged into bedrock by glacial ice. Many such water bodies are located at the headwaters of streams. Some ponds were formed in depressions left in the unsorted glacial deposits, called till, that were dropped as the glaciers retreated. "Kettle ponds" were formed where large blocks of ice melted, leaving steep-walled depressions. Many of the water bodies filled with sediment, evolved into wetlands, and eventually became forested.

Artificial ponds and reservoirs were created for a variety of reasons. Man-made dams were built for flood control, recreational purposes, and hydroelectric generation. At least sixteen lakes are associated with dams, some of which are maintained for wildlife purposes. Another type of water body on the Forest resulted from the dams crafted by beavers. Some areas have extensive systems of beaver ponds, especially where the gradient is low.

Lakes on the White Mountain National Forest are managed in different ways. Russell Pond, South Pond, and Crocker Pond feature swimming. Other lakes also have developed recreation sites for various purposes, including fishing and camping. Most lakes, however, are not associated with developed facilities. Some are "destination" lakes, with trails leading to or near to them, and they may have dispersed or backcountry developed sites close by. Still others are undeveloped and well off any beaten path. Backcountry water bodies associated with wetlands tend to be the least visited, whereas lakes near roads are the most popular. The larger lakes on the Forest are the most developed, and often have parking areas and picnic facilities. Long Lake and Russell Pond are examples of this type of management. Larger lakes or ponds, such as Sawyer Pond and Mountain Pond, may be developed for backcountry use. All lakes share some common desired conditions, such as meeting water quality regulations.

Water quality in many lakes is affected by atmospheric deposition and the presence of natural organic acids that impair water chemistry (NH, 2002 and ME, 2002). In both Maine and New Hampshire, elevated levels of mercury in fish tissues from atmospheric deposition cause all freshwater water bodies to be listed as impaired, with related concerns about fish consumption. Eighteen lakes on the White Mountain National Forest are included on New Hampshire's list of waters where designated uses are threatened or not supported for reasons of atmospheric deposition and natural organic acids. In Maine, no water bodies on the Forest are listed as

not supporting designated uses, other than for mercury related to atmospheric deposition. Neither Maine nor New Hampshire have fully assessed all their water bodies.

Overall, most lakes are in a proper functioning condition (PFC) based on a review of available data. This means that adequate vegetation, landform, or woody material is present to dissipate energies, filter pollutants, and prevent shoreline erosion (Prichard et al., 1999). Lakeshore development, changes to hydrology, runoff and pollution, human use, and non-native invasive species are the primary potential impacting factors for lakes and ponds.

Some lakes may have small portions of the shoreline where PFC is at risk. This is where lakeshore development has occurred, including lakes such as South Pond with private ownership along the shoreline, and where developed recreation activities occur, such as Russell Pond. No lake is non-functional in terms of this definition, however. In addition, as discussed in the Rare and Unique Features and Riparian and Aquatic Habitats sections, higher ecological functions, such as habitat for fish and other aquatic life, are present on most lakes. Water quality may be a limiting factor in some, but this is not related to physical condition or Forest activities; rather it is a result of atmospheric deposition.

The main non-native invasive species that threatens water bodies, Eurasian water milfoil (*Myriophyllum spicatum*) has not been found on the White Mountain National Forest, although it occurs in lakes and rivers to the south (see the Vegetation section).

Streams

The current data show 2,410 miles of mapped streams on the Forest, of which 1,086 miles are perennial (45 percent), 1,267 are intermittent (53 percent), and 57 miles (2 percent) have not been classified. Numerous ephemeral channels are also part of the stream network, but these have not been inventoried.

The channel form of streams on the Forest largely depends on the position of the stream in the topography and the type of material it is flowing across and must adjust to. Bedrock or glacial deposits influence many stream reaches. In addition, there are streams that have unstable slopes in the headwaters that lead to a high bed load. Usually, this instability is natural and related to steep slopes.

Unless associated with a lake or wetland, surface water on the White Mountain National Forest is usually cold, fast moving, and clear. These waters tend to be chemically dilute, with biological processes at low levels (Hornbeck et al., 2001).

Under State of New Hampshire anti-degradation provisions, all waters of the National Forest are designated as "Outstanding Resource Waters" and shall be maintained and protected (NHDES, 2002). The State of Maine has a similar provision (State of Maine, 2003) that protects all waters of the National Forest. Some limited point and nonpoint source discharges may be allowed, providing that they are of limited activity that results in no more than temporary and short-term changes in water quality. This means that

degradation is limited to the shortest possible time, and is only allowed after all practical means of minimizing it are implemented.

There are a few stream segments on the Forest that are not supporting, or have threatened, designated uses, as evaluated by the State of New Hampshire (NHDES, 2002). Bacterial pollution, mine drainage, hydrologic modification, and atmospheric deposition are listed as probable causes. The State of Maine (2002) has not yet inventoried any streams on the White Mountain National Forest.

Bacterial pollution from *Escherichia coli* is listed as the cause for nonsupport, or threatened nonsupport, for swimming or wading on two small reaches of streams on the Forest, but the source is unknown. One stream section (.5 of 5.87 miles) is located at the north end of the Forest, on the west side of the Kilkenny on Bone Brook. The .5 mile section is located on the upper end of this reach, and may be above the actual location where impairment was measured. The other site is on the east side of the Forest, on the East Branch of the Saco (.25 of 2.7 miles). The report states the possibility that recreational water activities could be contributing factors at both sites (NHDES, 2002).

Another site that does not meet water quality standards is Ore Hill Brook, where 5.25 miles are listed for aluminum, copper, lead, zinc, and pH due to acid mine drainage. While the 5.25 miles are not entirely on the Forest, the pollution originates at the Ore Hill mine (which is on National Forest land) and is responsible for the listing of the total 5.25 miles. This mine has been receiving funding for clean up through CERCLA, and actions are underway to improve water quality and other resource conditions at this site.

Campton Dam, on the Mad River, is listed as the probable source of flow regime alterations that do not support aquatic life, including fish, in 3.12 miles of the Mad River. The dam, on National Forest land, is operated by a third party under permit and Federal Energy Regulatory Commission (FERC) license to produce hydroelectric power.

In New Hampshire and Maine, fish consumption advisories due to mercury are in effect for all surface waters (NHDES, 2002; State of Maine, 2002). Elevated mercury levels in fish tissue result from atmospheric deposition.

A further effect from air pollution is acid rain. Where streams are vulnerable due lack of buffering, pH levels can become so acidic that they either threaten or do not support aquatic life. New Hampshire has assessed this condition in several small streams that drain into Stinson Lake. The streams have their headwaters on the Forest. The source of impairment is listed as unknown, but in Stinson Lake, atmospheric disposition and acidity are probable reasons for the nonsupport of aquatic life.

Forest-wide water quality monitoring has resulted in some characterizations. For the Swift River, the highest turbidity measurement was associated with short-term construction activity; the highest bacterial measurements were associated with areas with high recreation use, and possibly from residential areas; and effects of road salting were detected, as shown by concentrations of chloride and sodium. The lower segments of both the Wildcat and Swift rivers have high conductivity values that could reflect the influence of development in these watersheds. Aluminum levels are a concern, since

concentrations are frequently above the criterion for freshwater aquatic life chronic exposure in the Swift, Wildcat, and Upper Ammonoosuc rivers. This likely results from acid rain, which dissolves aluminum compounds from the soil and bedrock.

Streams on the White Mountain National Forest generally meet water quality standards while experiencing widespread effects from atmospheric deposition. Some localized areas related to high use, adjacent development, and past mining activity have resulted in elevated levels of pollutants. Stream condition continues to recover from the loss of diverse channel characteristics due to land use in the 1800s and early 1900s.

Watersheds

The White Mountain National Forest comprises a portion of the headwaters of nine hydrologic units at the 8-digit Hydrologic Unit Code scale known as sub-basins. These are the Upper and Lower sub-basins of the Androscoggin River, the Saco River, the Pemigewasset River, the Presumpscot River/Casco Bay, and four different sub-basins of the upper Connecticut River. These sub-basins span multiple townships, five states, and an international boundary with Canada. Within them are twenty-four ten-digit hydrologic unit codes, known as watersheds, that contain some portion of White Mountain National Forest lands. These watersheds range in size from 75 square miles to 308 square miles. Eight watersheds contain less than 10 percent of Forest lands; six watersheds have 50 percent or more within the Forest. These are listed in Table 3-06, along with the percentage of each watershed comprised of White Mountain National Forest lands. (See also Map 3-01.)

The hydrologic unit chosen for Forest Plan analysis is the ten-digit watershed scale, which allows discussion of larger scale ecosystem processes and capabilities, distribution patterns, and disturbance levels (Bohn and Kershner, 2002).

Watershed Analysis

Watershed assessments have occurred at four locations on the White Mountain National Forest. The Wild, Peabody, and Mad rivers watershed assessments used the Ecosystem Analysis at the Watershed Scale method (USDA Forest Service, 1995). Another assessment, completed earlier in the Eastman Brook watershed, used the Watershed Resource Inventory method (USDA Forest Service, FSH, 2509.16) and led to the restoration of impacted riparian areas along Eastman Brook.

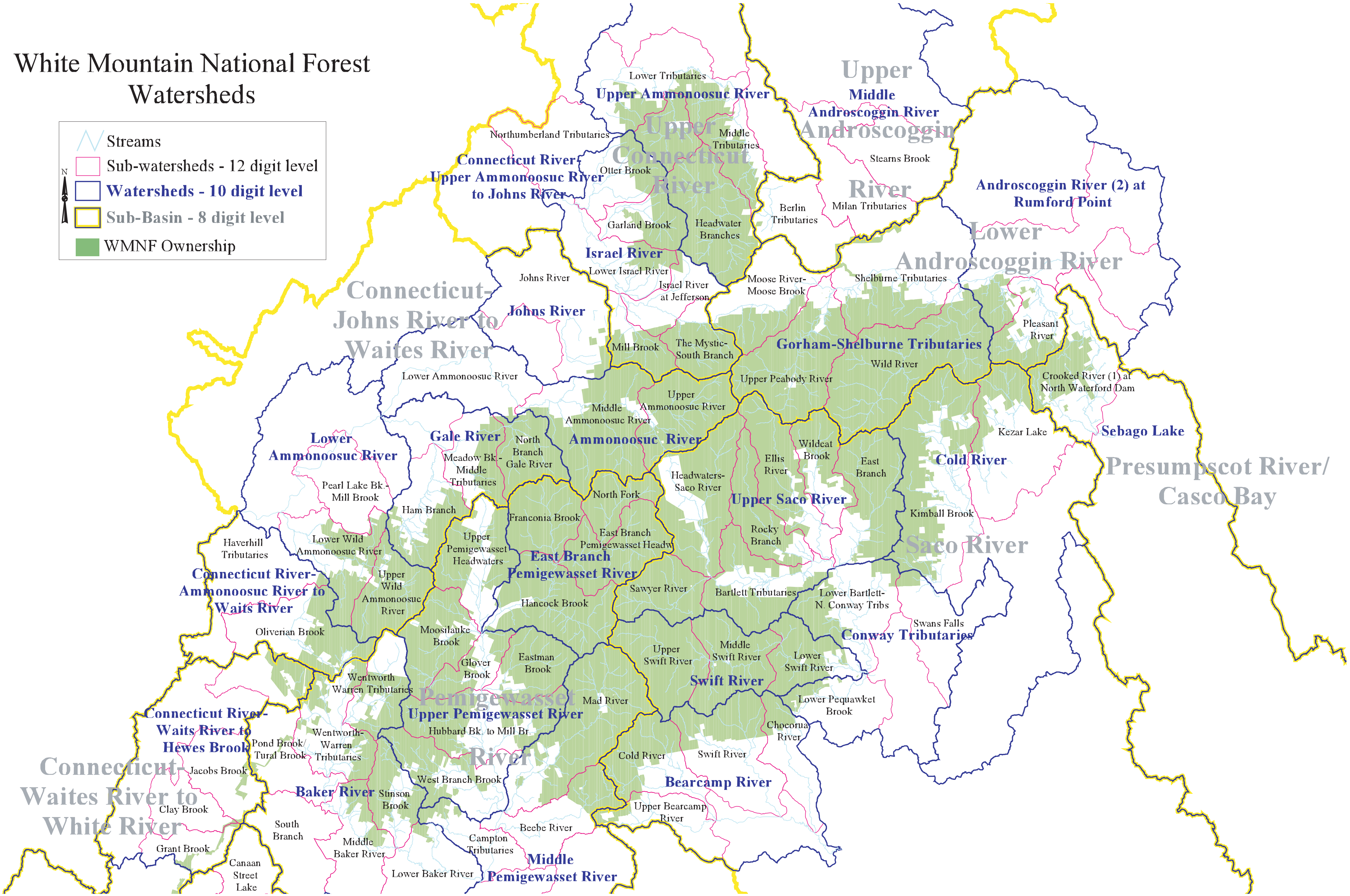
Watersheds were largely assessed through an integration of numerous data sources, following a watershed analysis procedure designed to integrate watersheds into forest planning in 2000. These include field observation, review of existing inventories and data, review of site-specific literature, and discussion with local Forest Service professionals. The 2000 assessment drew several conclusions about watershed health on the White Mountain National Forest.

- Hydrologic modification occurs in all the watersheds, largely due to road construction and dams. The greatest modifications occur in

Table 3-06. Sub-Basin, Watersheds and Acres, and percent WMNF lands within each.

Sub-Basin Name (8 digit)	Watershed Name (Ten digit)	Watershed Code (Ten Digit)	Square Miles	% WMNF
1. Upper Androscoggin River	Upper Androscoggin R.	0104000106	269	0.5
2. Lower Androscoggin River	Gorham-Shelburne Tributaries	0104000201	225	64.0
	Androscoggin R. at Rumford Point	0104000202	308	6.0
3. Presumpscot River/ Casco Bay	Sebago Lake	0106000101	212	7.0
4. Saco River	Upper Saco River	0106000201	230	78.0
	Swift River	0106000202	87	95.0
	Conway Tributaries	0106000203	127	14.0
	Cold River/Saco River Lovewell Pond	0106000204	206	29.0
	Bearcamp River	0106000206	152	29.0
5. Pemigewasset River	East Branch Pemigewasset River	0107000101	117	98.0
	Upper Pemigewasset R.	0107000102	179	67.0
	Middle Pemigewasset R.	0107000103	200	31.0
	Baker River	0107000104	213	21
6. Upper Connecticut River	Upper Ammonoosuc R.	0108010107	252	34.0
	Israel River	0108010108	135	41.0
	Connecticut River—	0108010109	88	0.04
	Upper Ammonoosuc River to Johns River			
7. Connecticut River—Johns River to Waites River	Johns River	0108010301	75	4.0
	Gale River	0108010303	93	48.0
	Ammonoosuc River	0108010304	144	53.0
	Wild Ammonoosuc R.	0108010305	166	26.0
	Connecticut River— Johns R. to Waites R.	0108010307	90	19.0
8. Connecticut River—Waites River to White River	Connecticut R.—Waites R. to Hewes Brook	0108010402	142	7.0
	Connecticut River— Ompompanoosuc River to White River	0108010404	82	3.0
9. Connecticut River-White River to Cold River	Mascoma River	0108010601	195.0	0.7

Map 3-01. Watersheds on the White Mountain National Forest.



watersheds containing the largest amount of non-Forest lands. These are also the watersheds with the greatest populations, development, and point sources of pollution.

- Recreation pressure is highest in watersheds that include Wilderness and those with the greatest amount of Forest ownership.
- Water quality is high, with all waters on the Forest designated as "Outstanding Resource Waters" by the New Hampshire Department of Environmental Services. The State of Maine has a similar designation for waters on the Forest.
- Atmospheric deposition is the main cause of non-attainment when water quality standards are not met.
- Watersheds are well forested, with the lowest percentage of forestland at 76 percent. The highest amounts of forested land are on the Forest.

Watershed Improvements

Watershed improvement activities are implemented on a site-specific basis to prevent damage to or restore aquatic health, riparian, and wetland ecosystems. Current management strategies used to implement watershed goals incorporate accomplishments that are integrated with those of other resources. Watershed improvement work has been accomplished through cooperative projects with recreation, engineering, fisheries.

Consumptive Water Uses

Consumptive uses are those that remove water from the ecosystem. High quality water resources also provide high quality water for use by people in a variety of ways. Water is used primarily for drinking and snowmaking.

Drinking Water

Many people drink water that comes from the rain and snow on the lands of the White Mountain National Forest. From the water purifier in the pack of a hiker to the municipal water supply serving thousands, water from the Forest has quenched many thirsts. Water use by single homes, from springs or streams, is managed through special use permits. Other small-scale water uses include water rights to springs that were reserved at the time land was conveyed to the Forest Service. Housing developments, ski areas, campgrounds, and towns use larger amounts of water and serve large numbers of people. These uses are regulated by EPA and the states as public water supplies.

Public Water Supply

Public water supply systems are those drinking water systems, publicly or privately owned, that serve at least twenty-five people or fifteen service connections for at least sixty days per year. Data in this report came from public water supply databases for the states of New Hampshire and Maine. Smaller systems that do not meet the definition above are not tracked on this inventory. There are sixty-seven public water supply intakes on the White Mountain National Forest that serve over 39,000 people with high

quality drinking water; 67 percent are for use at Forest Service campgrounds, picnic areas, or vistas. Many others are under special use permit, such as ski areas, towns, and huts. Only 6 percent are surface water sources.

Municipal Supply Watershed

A municipal supply watershed is the area which contributes water to a public water supply system, as defined in FSM 2542.05. Not included are communities served by a well or confined ground water unaffected by Forest Service activities. When an effect to a groundwater-based public water supply is possible from actions proposed by the Forest Service, an assessment would be made as part of the NEPA process.

Seven surface public water supplies on the Forest meet the definition in FSM 2542.05 (Table 3-07). All but Lancaster withdraw water from inside the Forest boundary and have some type of permit or agreement that authorizes use and maintenance.

Table 3-07. Municipal Water Supply Watersheds on the WMNF.

Littleton	South Branch Gale River
Berlin	Upper Ammonoosuc River
Lincoln	Loon Pond
Bethlehem	Zealand River / Gale River
Bartlett	Albany Brook / Louisville Brook
Woodstock	Gordon Brook
Lancaster	Garland Brook

Quality of Drinking Water

There are different kinds of monitoring that assess drinking water. Monitoring within the stream assesses the water before it enters the intake and water supply system. Monitoring that occurs after the water is in the system is usually done at the outtake. The federal Environmental Protection Agency (EPA) and the states of New Hampshire and Maine regulate the monitoring of water supply systems, and assessment of the data shows that water from the WMNF usually meets water quality standards except for intermittent occurrences of bacterial pollution. Although not well documented, it is thought much of this pollution is from contamination in the water system itself and not the incoming water. Water from groundwater wells can have high concentrations of trace elements, and may require treatment or be suitable for transient use only.

Monitoring the quality of stream water is part of the Forest Service's water quality monitoring program. Data are collected at designated locations, integrated with preexisting data, and combined with other parameters. In general, water quality is high Forest-wide.

Snowmaking

Alpine ski areas make snow to supplement natural snow, and the water used is often withdrawn from surface water sources. On the National Forest, water withdrawal levels must be approved by the US Fish and Wildlife Service, State of New Hampshire, and the US Army Corps of Engineers. Based on the February Median Flow (FMF) they are incorporated into the Forest Service's Special Use Permits as minimum flow requirements. These flows are considered adequate to maintain designated uses, sustain aquatic life, and maintain channel integrity.

Groundwater

The groundwater resource is largely affected by supply and demand. Supply is governed by the recharge of water to aquifers, such as by precipitation. As populations increase, the Forest's role as a recharge area will increase. Drought also has the potential to affect both the supply and demand of groundwater in the future. It is unlikely that Forest management uses of groundwater have impacted the resource. Over forty ground water sources of water are located on the White Mountain National Forest. Many of these are groundwater wells for campgrounds.

In 1911 and 1912, the US Geological Survey studied the results of the intensive logging on streamflow in what is now the WMNF. The report's positive conclusions helped in establishing the Forest. At left is a USGS camp. Below is the Burnt Brook Gaging Station. Note the countryside denuded of trees. The same site looks very different today. (WMNF photos)

Environmental Effects

Environmental effects to water resource features from Forest activities are discussed in this section. These include changes to water quality and water quantity. None of the Forest Plan revision issues directly involves water resources; however, each issue does have a relationship to water resources as, described in Table 3-08.

Table 3-08. Issues and Relation to Water Resources

Issue	What it Means Relative to Water Resources
Management Emphasis through Land Allocation	Management area allocation is the division of the forest into areas with different purposes and desired conditions. The different emphasis in the different management areas results in the potential for different impacts to water resources.
Timber Management and Wildlife Habitat	This issues addresses how much timber is harvested, where it is harvested, and the type of treatment used. The way timber is managed within lands allocated as appropriate to this use can result in water resource effects.
Recreation Management	This issue addresses how recreational use is managed across the forest and its effect on recreational experiences and ecological conditions. In addition this issue addresses how to incorporate new recreational uses such as mountain bike use and ATV use. The type of recreational uses and the way these are managed can have impacts on water resources. The presence of high use areas means more potential for water resource impacts. In addition, some new recreational uses can have impacts to water resources as well.

Best Management Practices

All alternatives have common goals and objectives that provide a focus for water resource management. These include watershed improvement, protection of water quality, providing favorable conditions of stream flow, and coordination with outside groups and entities. Standards and guidelines, part of each alternative, provide direction for planning and implementing proposed activities. Regulations and policies also apply, including the use of Best Management Practices (BMPs). These are a combination of practices designated as the most effective, practicable means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals (Forest Service, 1980). BMPs mitigate impacts to water resources so that they are short-term and recoverable. They can include proper drainage on roads, revegetation of disturbed areas, and restoration of stream crossings, and are prescribed during project planning on a site-specific basis regardless of the alternative chosen. These practices constitute "all practicable means" for maintaining "outstanding resource waters" on Forest lands, often known as the anti-degradation part of the Clean Water Act.

Forest-wide standards and guidelines and project level BMPs are the basis for determining which activities are planned and implemented on the Forest. Because of this, when there is no difference in the magnitude of activities and management direction between alternatives it is expected that there would also be no differences in the magnitude of the effects and consequences caused by those activities. This is true for several categories of activities. For example, potential effects to water resources related to snowmobiles are not expected to vary by alternative, since management direction for snowmobile trails is the same for all alternatives. The effectiveness of the mitigation for this activity does not vary by alternative.

Water Quality

Effects Common to All Alternatives

Direct and Indirect Effects

Water quality can be affected by proposed Forest activities, including snowmobiling, ski areas, fire, backcountry facilities, dispersed camping and hiking, and timber harvest. Effects common to all alternatives are those that have been mitigated through the use of BMPs or other Forest direction. As a result, they are short-term and recoverable, or are unlikely to affect water quality or resources dependent on clean water.

Snowmobiles

Snowmobiles have the potential for producing pollution from components of their exhaust emissions, especially in high use areas (Hagemann and VanMouwerik, 1999). The concern is that components of the emissions are deposited on the snow and may eventually reach surface or groundwater when the snow melts. The emissions include organic compounds: benzene, toluene, ethyl benzene, and xylenes (BTEX), methyl tertiary buthyl ether (MTBE), and polycyclic aromatic hydrocarbons (PAHs); and inorganics: sulfate and ammonium. Little research on this topic is available; however, Ingersoll (1999) discovered organic and inorganic compounds in the snowpack and in snowmelt runoff in Yellowstone National Park, where 54,000 visitors per season snowmobile on a single corridor. Levels of pollutants appeared to be related to traffic volume, and concentrations in the snowpack decreased away from the trails. None of the chemicals studied exceeded, or even came close to exceeding, water quality standards. Based on these use levels in comparison with expected lower use on trails on the White Mountain National Forest, it is unlikely that snowmobile use would result in water quality exceedances or impacts to water dependent resources. Forest Plan monitoring would periodically assess the potential for impacts due to this use through the water quality and BMP assessment.

Ski Areas

While ski areas do contribute to effects on water quality and quantity, there is no difference between alternatives in number or size of ski areas, ski area management, or water withdrawals associated with ski areas. The effects include loss of vegetation, concentrated runoff, waste products, water use,

and channel morphology changes. Riparian areas, water quality, and instream uses can be affected by these changes. These effects, and the mitigations (BMPs) to reduce them, have been documented in the NEPA analysis for each ski area. A ski area operating plan is approved each year, and includes the mitigations to prevent these effects and their consequences. The ski area administrator makes sure the mitigations are implemented, and monitors effectiveness.

Fire

There is no difference by alternative in the strategy or amount of wildland fire use, prescribed fire, or wildfire that could occur on the Forest. Wildland fire use results in small patches of mostly low intensity burn; moderate and intense fires are unusual on the Forest. Increased and concentrated runoff could occur over these small areas. Water chemistry changes are not likely to occur due to the small size of this activity. These effects can temporarily cause sedimentation and loss of woody material. Parameters set in the Burn Plan that is prepared for every managed fire ensures that conditions do not reach a magnitude that would cause a concern to water quality.

Backcountry AMC Huts

All alternatives prohibit new hut construction or increasing capacity of existing huts. Huts may be expanded only to address safety, health, or resource issues. This limits the effects of the huts to their current footprint and impacts. Monitoring shows that improved waste disposal systems at these sites are working to maintain clean water adjacent to them. Waste disposal system upgrades would continue as planned. Other effects, such as compaction, loss of vegetation, waste/pollution, water use, concentrated runoff, and related consequences would continue to require mitigation at these sites. The AMC Hut Permit EIS and operating plans include BMPs to reduce these impacts.

Dispersed Camping

All alternatives allow dispersed camping across the Forest unless closed, so the area of impact is the same. Much dispersed camping occurs adjacent to water. Loss of vegetation and compacted surfaces cause concentrated runoff and erosion, allowing sediment and other pollutants to enter the water. Streamside camping can also alter the morphology of streambanks and riparian areas. Fecal waste from campers is often deposited in close proximity to water. These effects would result in water quality impacts as well as changes in the proper functioning of the riparian area. All alternatives minimize impacts to water resource features through management and restrictions. Backcountry rules and Forest Protection Areas are used to address impacts from this resource when identified.

Vegetation Management

Temperature Increase: When forest harvest reduces canopy shading along streams, the potential exists to increase stream water temperatures. Such increases can be prevented or greatly reduced through the use of buffers with uncut trees along the edges of streams (Davies, 1984; Stafford et al., 1996) and the harvesting of portions of watersheds rather than entire

watersheds. Standards and guidelines, coupled with project level BMPs, prevent this effect from occurring, since riparian buffers are left on all perennial streams and watersheds are not completely treated.

Water Chemistry: Changes in vegetation composition, age, and amount affect the chemistry of water. Because of this, timber harvesting has the potential to alter stream chemistry. After timber harvest, changes in water chemistry have been observed in studies done on the White Mountain National Forest and elsewhere (Martin, Noel, and Federer, 1981; Davies, K., 1984; and Stafford, Leathers, and Briggs, 1996). However, watersheds that were treated with the methods currently used on the Forest did not exceed water quality standards for nitrate (Hornbeck et al., 1973). Stream water from watersheds with uncut portions tends to dilute this effect of increased nitrate concentrations from clearcut areas within a watershed. Standards and guidelines in the revised Forest Plan address this effect and include the use of buffer strips, less cutting in the upper portions of watersheds, and staggered harvest.

Use of the Existing Transportation System

This section discusses the day-to-day roads system that is used by employees for administrative purposes, and by visitors to access the Forest. Roads used for vegetation management are discussed later in this report. All alternatives include upgrading roads to safety standards appropriate to level. This involves reconstruction and improvements such as widening. Decommissioning of roads will also continue. Effects of roads on the landscape include landform changes, impervious and compacted surfaces, loss of vegetation, concentrated runoff, sediment transport, and motor vehicle related pollutants. Landform changes from cut and fill slopes can alter water flow patterns — often capturing small channels and subsurface water. Stream crossings may constrict channels, causing scour and deposition. Increased runoff from impervious surfaces concentrates and carries sediment into roadside ditches, where it is sometimes transported into a stream. Forest-wide standards and guidelines, coupled with project level BMPs, work to reduce and prevent this effect from occurring. In addition, annual road maintenance and the forest road management plan are used to manage and monitor roads and to identify and address problem areas.

Cumulative Effects

Atmospheric Deposition

Cumulative effects related to atmospheric deposition are present in water resource features. These effects appear as water chemistry changes, resulting in a change in water quality. There are some lakes on the Forest that do not meet state water quality standards as a result of atmospheric deposition. During certain times of the year, streams also do not meet some of the state water quality standards, again due to atmospheric deposition changing the way water reacts with the soil, resulting in higher concentrations of sulfate and aluminum. There is a fish consumption advisory in both New Hampshire and Maine due to elevated mercury levels from atmospheric deposition.

The cumulative effects area for atmospheric deposition is all the surface waters within the White Mountain National Forest. All are experiencing some form of effect due to atmospheric deposition. The processes which result in effects are discussed in the Air Quality section.

None of the alternatives would add to the atmospheric deposition cumulative effects. Of the proposed activities, vegetation management and watershed improvement have the potential to influence this cumulative effect. It has been discussed that water chemistry can change because of timber harvesting. However, watersheds treated with methods similar to those proposed in the alternatives do not exceed water quality standards for nitrate (Hornbeck et al., 1973), a good indicator to use to detect atmospheric deposition effects since it is often the first chemical change observed. Other chemicals exhibit lesser variations as a result of timber harvest. In addition, stream water from untreated areas dilutes the effect of increased nitrate and other chemical concentrations, and because of this, timber harvest activities are not expected to contribute to the effects of atmospheric deposition. Watershed improvement activities that increase organic material in streams may help remove mercury and other chemical constituents from water, thereby reducing the impact of atmospheric deposition on water resource features. The effectiveness of this is not fully understood and will need further research and monitoring.

It is likely that atmospheric deposition will continue, with various components exhibiting different trends as discussed in the Air section. The time frame is unknown due to this continuing trend.

Alternative 1

Direct and Indirect Effects

Recreation

Recreational uses can affect water quality in several ways. The 1982 report "Nonpoint source pollution of water by recreation: research assessment and research needs" (Gosz, 1982) documents effects to water resource features from recreational developments such as campgrounds, tent platforms, parking lots, and trails. Direct effects were related to loss of vegetation, concentrated runoff, and human waste. Indirect effects included concentration of runoff, erosion, and transport of pollutants into water resource features. Erosion is discussed in the Soils section. This type of pollution can result in elevated bacterial levels and increased health risks. Water quality standards could be violated and water-dependent resources affected.

Addition of bacteria to the stream from land surfaces during short duration summer rainstorms is the most important cause of variation in bacteria numbers in the stream studied (summarized in Aukerman and Springer, 1976). Many bacteria do not travel far in the soil and go dormant in the cold. Bacterial pollution is most likely when the source of the pollution is near a water feature, especially if it is along a pathway of overland flow. Therefore, the potential for pollution from bacterial sources increases with proximity to the water feature (Aukerman and Springer, 1976), which is where many

recreational activities occur. In addition, motorized campgrounds have been found to have higher levels than non-motorized or backcountry areas (Aukerman and Springer, 1976). Backcountry and dispersed camping areas can also have higher intermittent bacterial levels than areas without camping facilities. Monitoring in the White Mountain National Forest shows that, while bacterial levels may be elevated in localized areas in relation to recreational activities, these levels seldom exceed water quality standards.

Surfaces related to development usually have reduced permeability and more water runoff. These include roads, trails, buildings, parking lots, campgrounds, and backcountry campsites. This also includes the activities that use these facilities, such as mountain biking and ATV riding. The activities are grouped together under developed surfaces because of their commonality — the direct effect of removing vegetation and reducing the ability of a surface to absorb water, thereby increasing runoff. Surface runoff can become concentrated, increasing its ability to carry soil and other potential pollutants. How much is transported and how far it goes depends on factors such as rain intensity, size, slope, and the use of soil and water conservation practices (BMPs).

Based on current monitoring, it is unlikely that any increases in developed sites, backcountry sites, trails, and parking lots proposed under Alternative 1 would lead to a violation of water quality standards. Standards and guidelines, coupled with BMPs, are expected to be effective in meeting water quality standards and protecting water-dependent uses.

Vegetation Management

The removal of trees increases temperature, reduces transpiration, increases soil moisture and streamflow, increases decomposition of organic matter, increases mineralization and nitrification, and increases the exchange of ions in the soil (Martin et al., 1986). Temperature changes, water quantity effects, and water chemistry have been discussed previously. It is the effect from the loss of the canopy, disturbed areas from skid trails, landings, and stream crossings which are discussed here. The combination of loss of cover and exposure of bare surfaces with compaction increases the potential for concentrated flows, sediment transport, and sedimentation in streams. Sediment can affect aquatic life, although the brown trout on the Forest are not limited by sediment, but by other factors, such as habitat.

In general, the greater the number of acres disturbed, the greater the amount of sediment mobilized. Whether or not this sediment reaches a stream depends on proximity and pathway. Stream crossings are the most likely location for this to happen. There is no way to calculate how many stream crossing are expected each year, but they are roughly related to the acres of road and skid trail disturbance. Therefore, the magnitude of effects is related to the amount of ground disturbed: more sediment is likely to be mobilized and reach a water resource feature as more acres are disturbed. Mitigations can substantially lower impacts to water quality and reduce risks, but they are not always effective. Common measures used to protect water resource from sediment include riparian buffers, designated stream crossings, and proper drainage on skid trails, roads, and landings.

Based on current monitoring, it is unlikely that any increases in roads and skid trails for vegetative management proposed under Alternative 1 would lead to a violation of water quality standards. Standards and guidelines, coupled with BMPs, are expected to be effective in meeting water quality standards and protecting water-dependent uses.

Alternatives 2 and 3

Direct and Indirect Effects

Recreation

The same type of effects described under Alternative 1 apply to Alternatives 2 and 3, although Alternatives 2 and 3 propose the smallest increases in developed sites, backcountry sites, trails, and parking lots, and prohibit summer motorized trails. Based on current monitoring, any increases under these alternatives would be even less likely to lead to a violation of water quality standards or an impact on water-dependent uses.

Vegetation Management

The same type of effects described under Alternative 1 apply to Alternatives 2 and 3, although Alternatives 2 and 3 propose the smallest increases in roads and skid trails for vegetation management. Based on current monitoring, any increases under these alternatives would be even less likely to lead to a violation of water quality standards or an impact on water-dependent uses.

Alternative 4

Direct and Indirect Effects

Recreation

The same type of effects described under Alternative 1 apply to Alternative 4. Alternative 4 proposes the largest increase in the number of developed sites, backcountry sites, trails, and parking lots, nearly double that of Alternative 1. Therefore, this alternative has the potential to have the greatest recreation-related effects to water quality, perhaps leading to impacts on other resources as well.

Vegetation Management

The same type of effects described under Alternative 1 apply to Alternative 4. This alternative proposes the largest increase in the number of roads and skid trails for vegetation management, greater than all the other alternatives. Therefore, this alternative has the potential to have the greatest vegetation management-related effects to water quality.

Table 3-09 shows that Alternative 4 disturbs the most acres per year (550), with Alternative 1 at 477, and Alternatives 2 and 3 at 410 acres each.

Table 3-09. Potential Vegetation Management Acres of Disturbance by Alternative

Activity	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Roads*	97	70	70	100
Skid Trails*	380	340	340	450
Total	477	410	410	550

*Skid trails – 10% of area, Road disturbance areas are assumed to be 25 feet wide. 1st decade only.

Cumulative Effects

All Alternatives

Recreation

The potential for water quality cumulative effects exists from residential and commercial development occurring outside the Forest boundary. However, these are predominately located downstream , and therefore are not anticipated to contribute to reduced water quality on the Forest.

Vegetation Management

There are no past or foreseeable future actions, or activities outside the Forest boundary that would contribute to cumulative impacts on Forest water quality. Activities are predominantly downstream of Forest water resources.

Winter on the Peabody River (WMNF photo by Ken Allen)

Water Quantity

Effects Common to All Alternatives

Direct and Indirect Effects

Vegetation Management

Changes to vegetation result in changes to streamflow during low flow periods in the summer, and the magnitude depends on the extent of change to the vegetation (Hornbeck et al., 1993). Hornbeck, Martin, and Eagar (1997) summarize that at least 20-30 percent of the basal area must be cut within a single watershed to generate detectable increases in annual water yield, that water yield increases usually diminish within 3-10 years, and that peak flows are often increased during the growing season immediately after cutting but not of an extent to cause flooding. The amount of timber harvest in 12 digit watersheds within the planning cycle will not result in measurable changes in water yields, since less than 20-30 percent is harvested in these watersheds. Where smaller watersheds are cut at levels above this threshold, standards and guidelines are used to mitigate related localized effects. Effects on flows from timber harvest tend to be localized and are unlikely to extend beyond first or second order streams in well-managed forests, where relatively small portions of the watershed are being harvested at a given time. This is because such increases lose their identity as they join stormflow from the larger surrounding rivers (Neary and Hornbeck, 1994). May and others (1997) summarized several studies to suggest that impairment related to elevated peak flows begins when percent total impervious area in a watershed reaches 10 percent. Management policies and guidelines prevent watersheds from exceeding this threshold.

Fire

There is no difference by alternative in the strategy or amount of wildland fire use, prescribed fires, or wildfire that could occur on the White Mountain National Forest. These fires result in small patches of mostly low intensity burn. Moderate and intense fires are unusual on the Forest. Increased and concentrated runoff could occur over these small areas. Parameters set in the Burn Plan that is prepared for every managed fire ensure that conditions do not reach a magnitude that would cause a concern to water quantity.

Cumulative Effects

Watershed Processes

Watersheds are also experiencing cumulative effects. Historically, several watersheds were heavily cut, some experiencing subsequent fire. The map in the Fire section is a good visual depiction of this impact, showing areas where early fires occurred. Logging often took place first along streams in those early years, resulting in the removal of large woody material from the streams, their riparian areas, and across the watershed in general. This altered water balances and increased energy in surface flows. Streams adjusted to this in a variety of ways, including straightening and incising. These altered

stream patterns are still adjusting as woody material grows back and accumulates, allowing for sediment storage and re-connection with floodplains. The Riparian and Aquatic Habitats section has more detail on woody material, stream channel form, and riparian areas. These changes to watersheds also occurred off the Forest on private lands.

The cumulative effects area for the change in watershed processes includes the ten digit watersheds, as shown in Table 3-06. At this scale, effects related to changes in watershed processes are integrated and often are not evident. However, since all watersheds did not experience the same levels of alteration during this period, some may exhibit more change than others.

Standards and guidelines related to riparian areas and watersheds were developed with this cumulative effect in mind, and all Forest management activities will follow them. Riparian guidelines, in particular, will allow streams to regain woody material. This results in sediment storage, increased organic material and chemicals, nutrient storage, protection from ice scour, and dissipation of streamflow energies. This in turn provides higher ecological functions such as habitat for aquatic species. Increased organics could also reduce the effects of atmospheric deposition. This is a long-term process that could take over a hundred years.

Effects on Non-priced Benefits

There are many reasons for protecting water resources, many of which cannot easily have an economic value assigned to them. Water resources include the water as well as the features that have their origins from water. Water occurs as precipitation, surface water, and ground water.

Water resource features include wetlands, streams, lakes and ponds, and springs. Water resources provide a basis for biological life by providing for their sustenance through consumption and contributing to conditions which create habitat for animals and plants. Water resource features also have physical benefits such as water conveyance, aquifer recharge, erosion control, and pollution control. Together, these features combine and are encapsulated by the watershed concept. Water features are contained within watersheds, which integrate these elements. In addition to the benefits provided individually by water resource features, these features combine within watersheds to provide non-priced benefits as well. Non-priced benefits associated with water resource features and watersheds are listed in the table below.

The non-priced benefits associated with each of these features are not expected to vary by alternative since standards and guidelines associated with each alternative are the same. These standards and guidelines are expected to maintain the quality and quantity of these features, except for some short term localized impacts associated with various activities as described in the effects section (see Table 3-09a).

Table 3-09a. Water Resource Features and Associated Non-priced Benefits

Water Resource Feature	Non-priced Benefit	Indicator
Wetlands (lentic system)	Wildlife and plant habitat Drinking water for wildlife Part of drainage network Flood control Aquifer recharge Water quality 'Knowing it's out there' = Existence Landscape value	**Wetland quantity and quality** is not expected to change by alternative. Except for short term localized impacts, S&Gs protect wetland values. Wetlands are managed for "no net loss."
Streams and associated riparian areas (lotic systems)	Wildlife and plant habitats Drinking water for wildlife Part of drainage network Flood control Aquifer recharge Water quality Recreational uses 'Knowing it's out there' = Existence Landscape value	**Streams quantity and condition** are not expected to change by alternative. Except for short term localized impacts, S&Gs protect streams, their water quality, and condition.
Waterbodies and associated riparian areas (lentic systems)	Wildlife and plant habitat Drinking water for wildlife Part of drainage network Flood control Water quality Water storage Recreational uses 'Knowing its out there' = Existence Landscape value	**The amount and quality of waterbodies** are not expected to change by alternative. Except for short term localized impacts, S&Gs protect streams, their water quality, and condition.
Springs	Wildlife and plant habitat Water quality Water source 'Knowing its out there' = Existence Landscape value	**The amount and quality of springs** are not expected to change by alternative. Except for short term localized impacts, S&Gs protect springs, their water quality, and condition.
Groundwater	Storage for water Water quality	**The amount and quality of groundwater is** not expected to change by alternative. S&Gs protect groundwater, including water quality and condition.
Watersheds	Stormwater management Groundwater recharge Water quality Stream discharge Erosion control	**The health of watersheds** is not expected to change by alternative. Except for short term localized impacts, S&Gs protect streams, their water quality, and condition.

Riparian and Aquatic Habitats

This section discusses how management activities and uses on the White Mountain National Forest affect stream habitats and their associated riparian areas. Direct and indirect effects focus on the habitat structure and function at the stream reach scale (hundreds of feet to miles) and cumulative effects focus on how conditions on the Forest compare with non-federal lands adjacent to it. Smaller scale effects that could harm rare species are addressed in the Rare and Unique Features section; water quality effects, other than water temperature, are addressed in the Water Resources section.

Affected Environment

All streams in the White Mountain National Forest are limited to four major basins flowing into the Atlantic Ocean: the Connecticut River, the Merrimack River, the Saco River, and the Androscoggin River. As discussed in more detail in the Water Resources section, there are twenty-four watersheds (10 digit hydrologic unit code) within these major river basins that contain some portion of the Forest. The analysis area for riparian and stream habitats in this analysis includes all rivers and their tributaries within these twenty-four watersheds. Approximately 31 percent of the lands within the watersheds is managed by the Forest Service.

Mapped perennial streams within the Forest boundary total 1,432 miles, with approximately 1,100 miles managed by the Forest Service and the remainder owned by state, town, or private entities. The majority of high elevation, steep-gradient brooks are in federal ownership, while larger valley-bottom rivers tend to be a mix of private and public ownership. Miles of perennial streams outside of the National Forest are unavailable, but they can be estimated. Assuming 1,100 miles of stream for 31 percent of the land within the twenty-four watersheds, this equates to 3,500 miles for the entire analysis area. Given that drainage densities are not equal, the actual number is probably between 3,000 and 4,000 miles.

Stream riparian areas are transition areas between stream habitats and upland habitats. Riparian areas are highly variable in width due to changing valley widths, valley slopes, and stream size (Ilhardt et al., 2000). A riparian classification system has been developed for the White Mountain National Forest to consider the diverse valley features, variable stream substrate size, and substrate transport processes. Although some riparian areas have been classified on the Forest, total riparian area has not been mapped or measured. Acres of riparian area can be estimated using a variety of methods, two of which resulted in estimates of 26,000 and 36,000 acres. Actual acres of riparian area are more likely to be a figure between these two estimates. Riparian acreage of perennial streams would then comprise approximately 4 percent of the total 796,700 acre Forest.

Biodiversity of aquatic ecosystems (species, communities, and ecological processes) is primarily controlled by climate, geology, and geomorphology. Past and current human influences may modify biodiversity and productivity of aquatic ecosystems. The extent of modification depends on the temporal and spatial alteration of chemical and physical parameters.

Historic human influences on the Forest altered water temperatures, sediment storage, nutrient storage, stream channel form, and habitat diversity.

Water temperature is a major factor controlling the distribution of fish species. Riparian vegetation and mountain elevations control the water temperatures of White Mountain streams. Much of the riparian forest was cut during the late 19th and early 20th centuries, and warming of streams certainly must have occurred at that time. Today, riparian vegetation has returned and is approaching its maximum shading potential. High water temperatures on Forest streams under 30 feet wide averaged 65 degrees (F) during mid-summer in the 1990s. This indicates that the majority of these streams can be classified as coldwater streams, and that they have returned to their ecological potential. Streams over 30 feet wide had average high temperatures of 75 degrees (F), indicating that some of the larger rivers on the Forest may provide warm water habitat. Even with old growth riparian forest, solar radiation may influence water temperatures on some of these larger rivers during the longer days of mid-summer. In general, management during the first planning decade has maintained desirable stream water temperatures across the Forest.

Coldwater streams inherently have lower species diversity than warm water streams, although species found in coldwater streams are generally rare in warmwater systems. Brook trout are a key indicator of coldwater aquatic ecosystems, and are typically the only fish species found in the high elevations of eastern mountain streams. Fish species richness of coldwater streams on the White Mountain National Forest ranges between one and five, with wild brook trout dominating the fish community. Larger rivers generally are inhabited by five to ten fish species, with brook trout being an uncommon species due to the warmer water temperatures experienced in mid-summer. A large percentage of coldwater streams in New Hampshire occur within the National Forest. According to the New Hampshire Department of Environmental Service fish surveys from 1997 to 2001, brook trout were absent or rare in nearly 70 percent of 160 sample sites across the state. By comparison, brook trout composed more than 50 percent of fish collected at over 40 percent of sample sites within the Forest.

Riparian areas within the Forest are predominately forested with long-lived tree species such as spruce, fir, northern hardwoods, hemlock, and white pine. These second growth forests, although mature, have not, as a whole, reached ages when mortality exceeds growth. Fudge (1998) found 28 percent of pools in twelve streams flowing through second growth forests of the White Mountains were formed by large woody debris. Flebbe and Dolloff (1995) found large wood loadings in old growth forest streams at least three times greater than in streams flowing through second growth forests in the mountains of North Carolina. Data collected on the White Mountain National Forest found average loadings were also lower than those documented in eastern US old growth forest streams. Forest Service ecologists estimate that hemlock and hardwood stands transition from mature to old growth forest sometime between 170 and 250 years (Lorimer et al., 2001). Over-mature forests typically produce the most large woody debris of sizes that

dramatically influence the hydrologic processes that create instream habitat diversity (Bryant and Sedell, 1995). Since the majority of riparian forests in the White Mountain National Forest are at least 50 years away from reaching old growth conditions, loadings of larger sized trees are expected to rise over time and to influence larger streams (Likens and Bilby, 1982).

Key studies have shown that large woody debris is an integral component of stream corridors, positively affecting nutrient retention, habitat quality, and stream productivity (Naiman et al., 2002). These studies also have shown that the density and form of accumulation varies greatly, depending on forest species and age composition, landscape topography, and stream flow regimes. Bisson et al. (1987) found that timber management activities that reduce the amount of wood to stream channels in the Pacific Northwest increased habitat conditions that benefited younger salmonid fish species at the expense of fish older than age one. Silvicultural prescriptions that reduce tree diameters near streams can ultimately alter the woody debris characteristics of the stream (Palik et al., 2001). Managed second growth hardwood stands over 100 years old have been shown to be almost devoid of large diameter (greater than 25 inches) dead and downed trees where commercial thinnings are used (McCarthy and Bailey, 1994). Studies in the White Mountains during the 1950s, when wood loadings were probably very low in perennial streams, found high numbers of small brook trout but extremely high mortality rates for adult brook trout. These findings were the basis for maintaining an intensive trout hatchery program to sustain recreational fishing in New Hampshire that still exists today. Little research is available examining how the potential increase in large woody debris in White Mountain streams may change the characteristics of stream invertebrate and wild trout populations at the watershed scale.

Downed wood can also change the entire character of stream valleys through its role in sediment storage and transport. Faustini and Jones (2003) found that steep, boulder-rich mountain streams with high wood densities store significantly more sediment at higher elevations than those stream reaches with low wood densities. Other research has shown that wood can force bedrock and boulder streams into alluvial streams by reducing local gradients, dissipating energy of 25 year flood events, and storing finer grained sediments (Montgomery et al., 1995; Montgomery et al., 1996). This would suggest that wood loadings within the higher elevations of the White Mountains could affect the quality of stream habitat in downstream areas by preventing the transport of large quantities of sediment (Megahan, 1982).

Rivers, roads, trails, and recreation facilities have shared the same valleys for over a century in New England. Most major roads in the White Mountains were more easily constructed in the flat-bottom river valleys. Trails are also commonly located along streams. Currently, 115 miles of roads and 120 miles of trails lie within 100 feet of the 1,100 miles of perennial streams on the Forest. Total acreage of campgrounds, dispersed campsites, and other recreational facilities is not available. All of these types of developments generally replace forest when located within the riparian area, and therefore have the potential to alter stream temperatures, water storage capacity, and loadings of trees, twigs, and leaf litter to the stream at some threshold of development.

Woody debris that promotes floodplain expansion, or is transported downstream to lower gradient stream reaches, has been viewed negatively in terms of potential impacts to expensive facilities and transportation infrastructure (Froehlich, 1970; Diehl and Bryan, 1993). Existing roads and facilities located within flood-prone areas of streams are at risk. Rip-rapping river banks, dredging river channels, straightening stream channels, removing woody debris, and constructing rock berms have been common prescriptions for protecting infrastructure in New England. Bridges and culverts may cause channel adjustments above and below the crossing, due to either poor crossing designs or poor crossing locations. Channel adjustments caused by poor crossing designs can result in barriers to the movement of fish and other aquatic organisms.

To summarize, stream habitat conditions are influenced by watershed processes as well as by riparian conditions. Stream channel stability and the availability of riparian forest appear to determine both the current and future quality of habitat structure in White Mountain streams. Stream temperatures, water quality, and riparian conditions are considered not to be degraded on the vast majority of Forest streams. Continued succession of forested riparian areas would allow more complex ecological functions to develop along stream reaches. Human activities that could reverse this trend toward more complex ecological function are timber harvesting that reduces availability of largest diameter trees in the streamside riparian area; improperly placed roads, trails, facilities, and stream crossings; removal of forest canopy over a stream; removal of dead and down wood from the streams and riparian areas; and unmanaged recreation. Activities that can enhance the trend include restoration of softwood species in riparian areas; addition of large woody debris to streams; and relocation of roads, trails, and other infrastructure.

Fisheries biologist Mark Prout describes a stream improvement project at Great Brook to federal and state officials. (WMNF photo by Richard Alan Dow)

Environmental Effects

Alternative 1

Direct and Indirect Effects

Land Allocation

Lands allocated to Management Areas 2.1 and 3.1 account for 61 percent of the perennial streams on the Forest. Estimates of riparian area range from 16,000 to 24,000 acres in these two MAs. Alternative 1 would allocate the fewest miles of perennial streams to Wilderness designation (13 percent) and the most miles of perennial streams to semi-primitive areas (19 percent) compared to the other three alternatives.

A broader range of multiple use activities occurs in MAs 2.1 and 3.1, with many of these activities occurring in and around streams and their riparian areas. A variety of mitigations or standards and guidelines are in place to minimize negative effects on these resources. Efforts to restore stream habitats and riparian function will occur almost exclusively in MAs 2.1 and 3.1, although limited opportunities occur in semi-primitive areas. No active management of stream habitats would occur in perennial streams within Wilderness areas, where natural changes in forest composition and mortality dictate change in habitat conditions.

Recreation

Existing campgrounds, picnic areas, and information centers near or within riparian areas would remain at their locations. Use may increase at these sites over the next two decades. Impacts to riparian areas have occurred at these sites in the form of reduced forested area, site compaction, and user-created paths along streams, as well as a probable reduction in local accumulations of dead wood. Existing campsites could be relocated if resource degradation is occurring in the riparian area. Overall, the existing facilities occupy a very small percentage of the total area of riparian areas on the Forest.

New campgrounds or additional developed campsites could be built to meet increased demand. Guidelines would be in place to discourage construction of these facilities within 100 feet of a stream. Given the small percent of increase in additional campsites, along with new guidelines, there would be no change in riparian forest cover over streams, thereby maintaining the coldwater status of Forest waters. Indirect effects of increased use in the vicinity of these sites may occur, although the overall impact across the Forest would be small. If new facilities are constructed in currently low use areas of the Forest, these indirect effects could begin to impact riparian conditions within small watersheds. Again, over the first two decades these effects would not represent a large increase in total miles of perennial stream or acres of associated riparian areas, given that the facilities would be constructed on the existing transportation system.

Dispersed camping could occur throughout the Forest. The majority of permanent sites are user-generated, and many of them occur within the riparian area of both small brooks and large rivers. In high use areas, these dispersed sites would continue to be used within riparian areas. Guidelines

prevent any Forest Service-created sites from occurring within 100 feet of a stream. User-created sites may occur within the riparian area, although in high use areas it would be discouraged through active management. The effects of existing high use dispersed camping areas (e.g., Tripoli road along Eastman Brook and tributaries) have not altered the coldwater quality of adjacent rivers, as sufficient forest canopy remains throughout the watershed. Indirect effects of dispersed campsites on riparian areas are not well studied, but it is believed that dead wood accumulations within both the riparian area and stream channel are reduced from the collection of firewood. The effect from low use areas, where campsites are more isolated, is probably quite low. In highly concentrated dispersed camping areas, the collection of firewood may actually prevent accumulations of dead wood in streams to the point where habitat complexity and sediment storage capability is maintained at a low level.

The effect of existing and new backcountry facilities on riparian areas and stream habitats is expected to be minimal. Generally, these areas are not as concentrated as roadside use, thereby reducing the effect on stream canopy cover and dead wood accumulations.

Approximately 120 miles of hiking trail currently lie within 100 feet of perennial streams on the Forest. Roughly 8 to 10 percent of the perennial streams on the Forest have trails within 100 feet. Although trails may reduce the tree density within the trail corridor, they have not reduced shading of streams to the point that water temperatures increase. Trail maintenance, then, would have no effect on water temperatures. Trail maintenance may involve moving dead and downed trees along the trail, as well as hazard trees that could fall and injure trail users. Limited research in hardwood riparian areas indicate that 80 percent of the wood input into stream channels occurs from within 30 feet of the stream (McDade et al., 1990). Maintenance crews can fell trees in ways to prevent any substantial loss of large downed wood in riparian or stream habitats and water bars are installed to provide the function of downed trees. Forest Plan guidelines would recommend the relocation of trails within 100 feet of a perennial stream if riparian or stream degradation is occurring.

Up to sixty miles of new summer motorized trails are allowed in either one or two areas in this alternative. Guidelines discourage the creation of any new trails within 100 feet of a perennial stream, with the exception of designated stream crossings. The addition of any new motorized trails would not affect stream shading or wood inputs to any measurable level.

Increases in illegal or unplanned recreation use, such as hiking, biking, ATV, or snowmobile trails that are created adjacent to streams, could have negative effects to riparian and stream habitats. Trails within floodplains maintained by users can alter the way flood energies are dissipated. Removing both large wood and small debris could create new stream channels if waterbars are not in place. The potential for 90 miles of new snowmobile and ATV trails in this alternative provides more opportunity for illegal connector trails to off-Forest areas. If these user-developed trail systems become large enough, they can begin to affect water runoff patterns that could increase in-stream channel erosion within the drainage area.

Vegetation Management

Approximately 76,800 acres, of 357,200 acres of Forest, could be harvested for timber products in the first two decades from MAs 2.1 and 3.1 in this alternative. A portion of this harvest could occur within certain riparian types of the estimated 16,000-24,000 acres of riparian, although it would be restricted to uneven-aged prescriptions. Forest Plan guidelines would discourage harvest within 25 feet of a perennial stream, and recommend using uneven-aged silvicultural practices within the remaining portion of the riparian area. Exceptions would be made for treatments that improve riparian values. Along some narrow valley streams, steep slopes would prevent any type of commercial harvesting within the riparian area. Approximately 70 percent of harvest on the Forest occurs during the winter months, which would minimize disturbances to wet habitats within riparian areas of perennial streams.

Decisions to commercially harvest in riparian areas would be made at the project level, as total volume estimates (35 MMBF per year) may be possible without entering riparian areas. Some prescriptions may be appropriate in riparian areas to meet forest composition objectives sooner, such as promoting softwood species in the valley bottom areas. Limited opportunities may also be available, with harvesting, to promote beaver habitat along some small brooks. Monitoring on the Forest has shown that isolated reaches of beaver activity along moderate gradient brooks has not converted coldwater streams into warm water streams. These beaver-influenced areas do provide a rare habitat feature, used by a variety of both aquatic and terrestrial species, which is not commonly found in the White Mountains.

Overall, small portions of riparian areas are expected to be harvested for resource enhancement in this alternative. Guidelines would insure that coldwater stream temperatures are maintained and dead wood recruitment to streams and floodplains continues to increase across the Forest over the next two decades.

Roads

The transportation network used by the general public that currently exists on the Forest will be maintained over the first two decades. Many of these major roads have been in existence for many decades and their impact on riparian and stream habitats occurred many years ago. Some measures to protect roads from the erosive power of large rivers may occur during the first two decades, although there should be little effect of these measures on stream shading or wood inputs. Road corridors in riparian areas that would be at risk would have already removed stream shade and the potential for wood inputs at the local site. Stream crossings on this existing transportation system may have some effect on stream channel adjustments and aquatic species movements within watersheds across the Forest. Guidelines would be in place to minimize these effects at the time the crossing needed to be replaced.

The majority of roads needed for commercial timber harvesting would consist of the reconstruction of old road beds in the Forest rather than new

construction. Most of these roads would occur outside riparian areas, as described in management guidelines, with the exception of perennial stream crossings. Some localized reduction in forested riparian would occur at new crossings, but the overall effect on stream shading and water temperatures would be minimal. Crossings can cause barriers to aquatic species movement. Guidelines would minimize the occurrence of barriers at new crossings and resolve barriers, if necessary, when existing crossings are replaced.

Alternative 2

Direct and Indirect Effects

Land Allocation

Lands allocated to Management Area 2.1 contain 657 miles, or 61 percent of the perennial streams on the Forest. Estimates of riparian area range from 16,000 to 24,000 acres in this MA. Perennial streams allocated to Wilderness designation total 181 miles (17 percent), up 4 percent from Alternative 1. The majority of this increase comes from streams that were allocated to semi-primitive areas, which dropped by 41 miles to 16 percent of the Forest total.

The effects of allocation to MA 2.1 are the same as listed for Alternative 1. Over the next 20 years there would be no effect on streams and riparian areas from the proposed change in allocation of some perennial streams from semi-primitive non-motorized areas to Wilderness.

Recreation

Management of existing recreation facilities on riparian and stream habitats will be the same as discussed for Alternative 1. Although levels of new campsite development would be lower in this alternative, compared to Alternatives 1 and 4, guidelines would be in place to protect this resource from campground expansions adjacent to streams. One exception would be the possibility of user-created roadside sites near streams if campground capacity was reached.

The effects of existing dispersed recreation sites and backcountry facilities would be the same as for Alternative 1.

Fewer non-motorized trails would be added in this alternative, compared to Alternatives 1 and 4. Management guidelines would protect riparian and stream habitats from planned new trails. See Alternative 1 for the effects of existing trails.

Summer motorized trails would be prohibited in this alternative, so there would be no effect on riparian areas or stream habitats.

The effects of illegal trail development would be similar to Alternative 1; however, the potential for illegal connector trails may be much lower in this alternative. Fewer miles of potential new snowmobile trails, and prohibited ATV summer trail use, may reduce the opportunities for connector trails that could impact riparian and stream habitats.

Vegetation Management

Approximately 60,000 acres of 358,200 acres of forest could be harvested in the first two decades from MA 2.1 in this alternative. A portion of this harvest could occur within certain riparian types of the estimated 16,000 to 24,000 acres of riparian area. The effects would be similar to those described for Alternative 1, although fewer management controls would need to be implemented.

Roads

The effects would be similar to those described for Alternative 1, although fewer management controls would need to be implemented.

Alternative 3

Direct and Indirect Effects

Land Allocation

Lands allocated to Management Area 2.1 contain 567 miles, or 52 percent of the perennial streams on the Forest. This is a 9 to 10 percent reduction from the other alternatives. Riparian area estimates range from 14,000 to 21,000 acres in this MA, resulting in a decrease of approximately 3,000 acres from other alternatives. Perennial streams allocated to Wilderness designation total 251 miles (23 percent), up 10 percent from Alternative 1. The majority of this increase comes from streams that were allocated to General Forest Management areas and semi-primitive areas. A larger portion of perennial streams would be allocated to areas with the lowest potential for direct effects of human activities, as compared to all other alternatives. This alternative would also have the smallest portion of streams where active stream restoration could be implemented. Exactly how many of these streams could be considered for active management over the next two decades is currently unknown.

Recreation

The effects of recreation management on riparian areas and stream habitats would be the same as for Alternative 2.

Summer motorized trails would be prohibited in this alternative, so there would be no effect on riparian areas or stream habitats.

The effects of illegal trail development would be similar to Alternative 2. This alternative proposes the fewest miles of potential new snowmobile trails, and prohibits ATV summer trail use, thus reducing opportunities for connector trails that could impact riparian and stream habitats.

Vegetation Management

Approximately 66,200 acres of 296,100 acres of forest could be harvested in the first two decades from MA 2.1 in this alternative. A portion of this harvest could occur within certain riparian types of the estimated 14,000 to 21,000 acres of riparian area, although it would be restricted to uneven-aged prescriptions.

Roads

The effects would be similar to those described for Alternative 1, although fewer management controls would need to be implemented.

Alternative 4

Direct and Indirect Effects

Land Allocation

Lands allocated to Management Area 2.1 contain 668 miles, or 62 percent, of the perennial streams on the Forest. Estimates of riparian area range from 16,000 to 24,000 acres in this MA. Perennial streams allocated to Wilderness designation total 165 miles (15 percent), up 2 percent from Alternative 1. The majority of this increase comes from streams that were allocated to semi-primitive areas, which dropped by 36 miles to 16 percent of the Forest total.

The effects of land allocation to MA 2.1 are the same as listed for Alternative 1. Over the next 20 years there would be no effect on streams and riparian areas from the proposed change in allocation of some perennial streams from semi-primitive non-motorized areas to Wilderness.

Recreation

Management of existing recreation facilities near riparian and stream habitats will be the same as discussed for Alternative 1. The effects of new facilities would be similar to Alternative 1, except they would not occur in low use areas of the Forest. Riparian areas of these low use areas would not experience the localized indirect effects of developed facilities, as discussed in Alternative 1.

The effects of dispersed recreation would be similar to those described for Alternative 1, with the exception of the location and intensity of effects. In this alternative, the Forest Service would not provide new opportunities in low use areas. If demand for recreation use increases, indirect effects may intensify in areas currently used for dispersed recreation, such as firewood collection and compaction of soils within riparian areas. An increase in user-created sites could occur, but the Forest Service can implement Forest Protection Areas to mitigate the effects of rapidly increased use in riparian areas.

The effect of backcountry facilities, non-motorized trails, and motorized trails is similar to that described for Alternative 1. Although more facilities and hiking trails could occur in Alternative 4, guidelines for the location of new facilities and trails would protect riparian areas.

The effects of illegal trail development is also similar to Alternative 1. The potential development of connector trails from new ATV trails is limited to the Landaff and Moat Mountain areas, where a total of 12 miles of perennial streams exist. The two areas are similar in miles of perennial stream per acre. It is not known if illegal connector trails would cross into other watersheds from these areas.

Vegetation Management

Approximately 89,900 acres of 365,900 acres of forest could be harvested in the first two decades from MA 2.1 in this alternative. A portion of this harvest could occur within certain riparian types of the estimated 16,000 to 24,000 acres of riparian area, although it would be restricted to uneven-aged prescriptions. The effects of timber harvest are similar to those discussed for Alternative 1. In this alternative, there is more emphasis on uneven-age management, resulting in more total acres treated over the first two decades. Some project level decisions may focus a variety of treatments in the riparian area (outside the 25 foot no-cut zone) to meet uneven-age objectives. These treatments could be used effectively to increase softwood species within the valley bottoms, thereby moving toward desired forest composition objectives.

Roads

The effects of roads are the same as described for Alternative 1.

Cumulative Effects

There is much evidence that rivers and brooks in New England were altered by large scale removal of forest during the 18th and 19th centuries. These landscape level changes altered both the timing and rate of runoff during both rain and snowmelt events. This caused erosion of stream banks, especially on those where trees were also removed, as higher volumes of water were released in shorter time periods, causing stream channels to enlarge. Streams have been slowly recovering as forest canopy has been restored at the landscape level over the last 60 to 100 years. Habitat structure, therefore, has also been on a slow recovery path.

Stream habitats on the White Mountain National Forest will become ecologically more complex over time in all alternatives. Differences in cumulative effects between the alternatives are not evident. Goals, objectives, and management controls will ensure that the coldwater nature of mountain streams will be maintained. They also will ensure an upward trend in the accumulation of large woody debris in the majority of streams on the Forest. Wood accumulations in some streams may reduce the amount of gravel and cobble bedload transported down to valley bottom areas where it tends to cause river widening. This may be very beneficial in areas where infrastructure is common. In other cases, wood may be highly mobile and need to be removed from rivers where either public or private infrastructure is at risk from the effect of debris dams. This risk may be higher in private lands adjacent to the Forest where infrastructure within floodplains and riparian lands is more dense.

Perennial streams on the Forest represent approximately a third of the streams in the analysis area. Although quantitative data is not available, the human activities that influence stream habitat conditions are much more common on private lands adjacent to the National Forest. With a major emphasis on recreation-based tourism in the White Mountains, vacation home communities, services, and transportation systems that accompany

these uses may cause a greater divergence in ecological function of stream reaches on private lands as compared to those on public lands. While much of the past research has focused on the effects of timber harvest on stream habitats on public lands, less research has been conducted on the effects of growing recreation-based tourism on stream habitats adjacent to public lands. For instance, New Hampshire state law requires commercial logging efforts to retain 50 percent of the forest basal area within 150 feet of a river; however, land clearing for community developments has less stringent restrictions. Reduced shading of streams, reduced large wood inputs, and more frequent stream crossings are likely to increase in stream riparian areas off the National Forest over the next 50 years. Conservation strategies and new technologies may be able to minimize these effects if adapted at local planning levels. If not, structural habitat conditions from wood loadings are expected to increase on the White Mountain National Forest while habitat conditions in the remainder of the analysis area are expected to decrease.

While the potential impacts to stream ecosystems adjacent to the Forest are expected to increase over the next 50 years, potential indirect effects may occur in the headwater streams of the White Mountains. Although substantial negative effects in the White Mountains have not yet been documented, the potential effects of acid deposition on the Forest are still of concern. Coldwater invertebrate and fish communities that will find refuge from direct human development pressures in the valley bottoms may be affected by changes in stream chemistry at higher mountain elevations. Although none of the alternatives has any influence on factors controlling acid deposition, the potential effects of acid deposition could have a greater impact on aquatic life than any direct effects of National Forest management.

Effects on Non-priced Benefits

There are many reasons for maintaining biodiversity and protecting wildlife and plant species, most of which cannot easily have an economic value assigned to them. Some species have the potential to provide food, medicine, or other commodities. These values are universally understood, but they apply to very few species or ecological communities on the White Mountain National Forest. Game species provide both recreational and food returns to hunters and anglers. All four alternatives would increase even-aged regeneration harvest, which provides important habitat for many terrestrial game species, over what has occurred in recent years. Alternative 1 would provide the most of this habitat. All alternatives also encourage development of softwood winter cover for many species, retention of aspen-birch habitat that is important to several game species, and protection of water quality and riparian conditions essential to fish species. All alternatives will maintain or improve habitat for species that many people value for fishing and hunting, and thereby contribute to the net public benefit afforded by the Forest.

Other non-priced benefits from managing for species and natural communities are more subjective and not agreed to by everyone. Many people believe that all communities and species have value in their own

right, stemming simply from their existence. These are often referred to as intrinsic values (Sagoff, 1997). Many people support conservation of biodiversity because they believe it is the right thing to do and knowing that wildlife, fish, and plant species will remain in existence is of value to them, even if they never see or use these species. They believe that public benefit is gained from conservation of biodiversity.

For many of the visitors to the White Mountain National Forest, seeing wildlife, wildflowers, and communities such as wetlands, clean streams, rock outcrops, and alpine habitats is an essential part of their trip to the Forest. Much of the input gathered during the Forest Plan revision effort indicates that members of the public place a high value on knowing that common and rare species and communities will be maintained on the WMNF. All four alternatives would conserve all plant and animal species and all natural communities on the Forest into the future. Each alternative would favor a slightly different set of species through habitat management, which could meet the desires of some members of the public more than others. However goals, objectives, standards, and guidelines ensure that no alternative would result in a substantially different compliment of species and communities on the Forest. Therefore all would have a similar net public benefit derived from maintenance of biodiversity.

Fishing at the Falls at Rocky Gorge (WMNF photo by Terry Miller)

Scaur Ridge (also known as Scar Ridge) in the Sandwich Range, viewed from the Discovery Trail (WMNF photo by Richard Alan Dow)

Vegetation

Terrestrial vegetation includes trees, shrubs, and grasses and other non-woody plants (herbs, forbs, ferns, etc.). They form forests, thickets, meadows, wetlands, and alpine habitats. The Forest Service is responsible for managing all types of vegetation to meet its desired future condition and as part of the coarse filter to maintain biodiversity.

This section deals with three key components of the terrestrial vegetation topic on the Forest:

- Wildlife and Plant Habitat.
- Timber Resource.
- Non-Native Invasive Species.

The Affected Environment for the Habitat subsection starts by providing an ecological context for the habitat discussion. It describes ecological units on the Forest, potential natural vegetation, natural disturbance patterns, and human-caused disturbance. The rest of the Habitat Affected Environment focuses on the abundance and distribution of three broad habitat components: habitat types; age class; and snags, cavities, and coarse woody debris. The potential for alternatives to affect these components is discussed under Environmental Effects.

The current condition of, and potential effects on, indicator species and migratory birds are described in the Wildlife section, as is the topic of fragmentation. The current condition of, and potential effects on, species of potential viability concern, and the communities on which they depend, are discussed in the Rare and Unique Features section. Wetland and aquatic habitats are addressed in the Stream Habitat and Water Resources sections of this document.

The Timber Resource subsection discusses some of the same subjects as the Habitat subsection, such as natural disturbance and forest age, but with a focus on how these affect the quality or production of a timber commodity. It also describes products supplied by the Forest, demand for these products, and timber management techniques used on the Forest.

The Non-Native Invasive Species subsection focuses on plant species that did not originally occur in the United States and that may be altering local terrestrial and aquatic ecosystems.

Wildlife and Plant Habitat

Affected Environment

The type and amount of vegetation on the landscape represents the habitat available to wildlife species. This subsection describes the current vegetative condition of the White Mountain National Forest and the surrounding landscape using broad habitat types. The analysis area for overall vegetation and habitat condition is the ecological sections (see below for description) in which the Forest is located: M212A and M212B (Map 3-02a). This area encompasses the entire White Mountain National Forest plus surrounding areas in New Hampshire and Maine with similar environmental and

biological traits. It is larger than the analysis area used for most species and management activities, and was selected because it encompasses all the analysis areas used for other components of terrestrial biodiversity.

Ecological Units

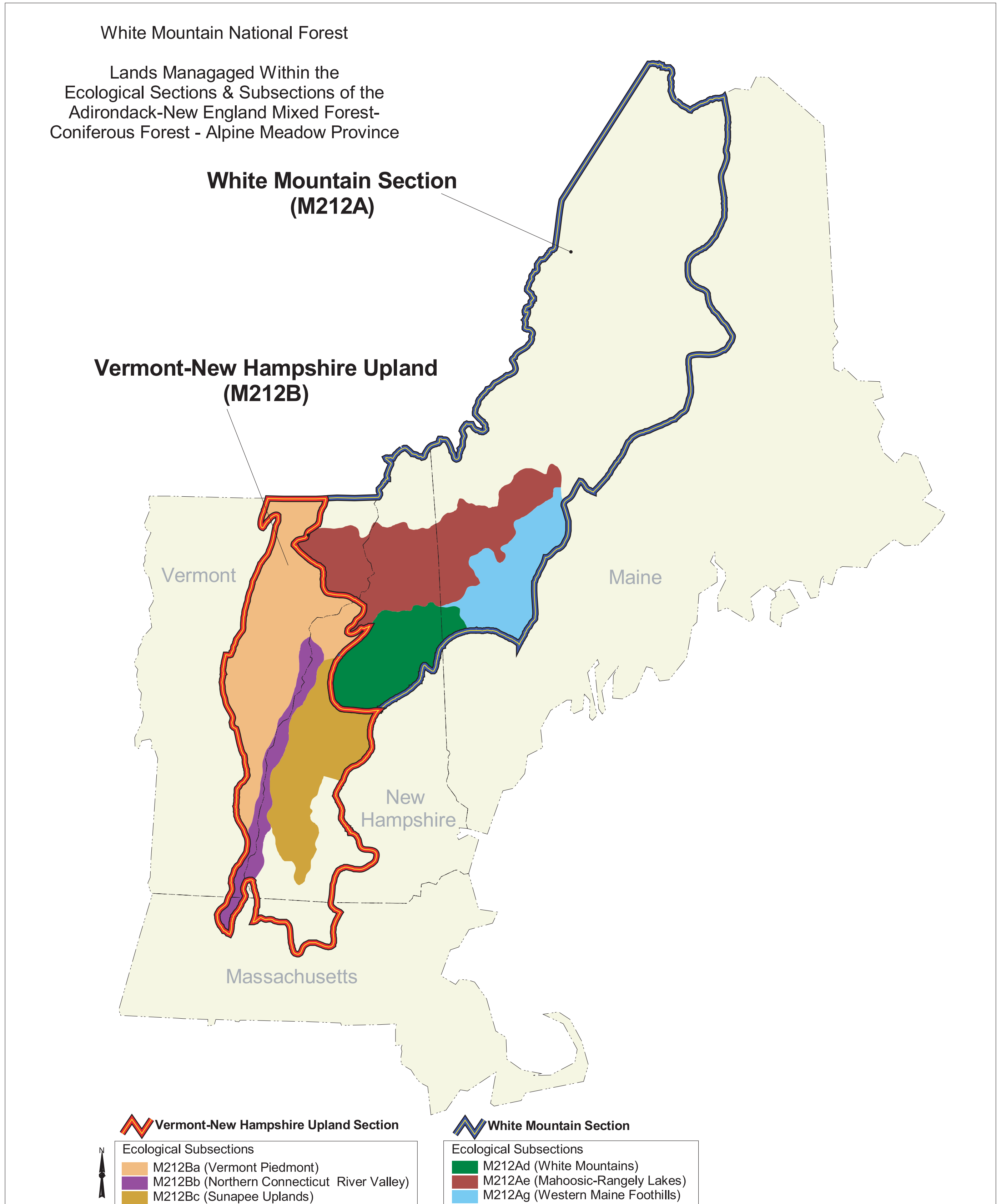
In 1993, the Forest Service adopted the National Hierarchical Framework of Ecological Units, a system that classifies land at several scales by identifying areas with similar biological and environmental conditions. From largest to smallest, these classification layers are Domain, Division, Province, Section, Subsection, Land Type Association, and Ecological Land Type (McNab and Avers, 1994).

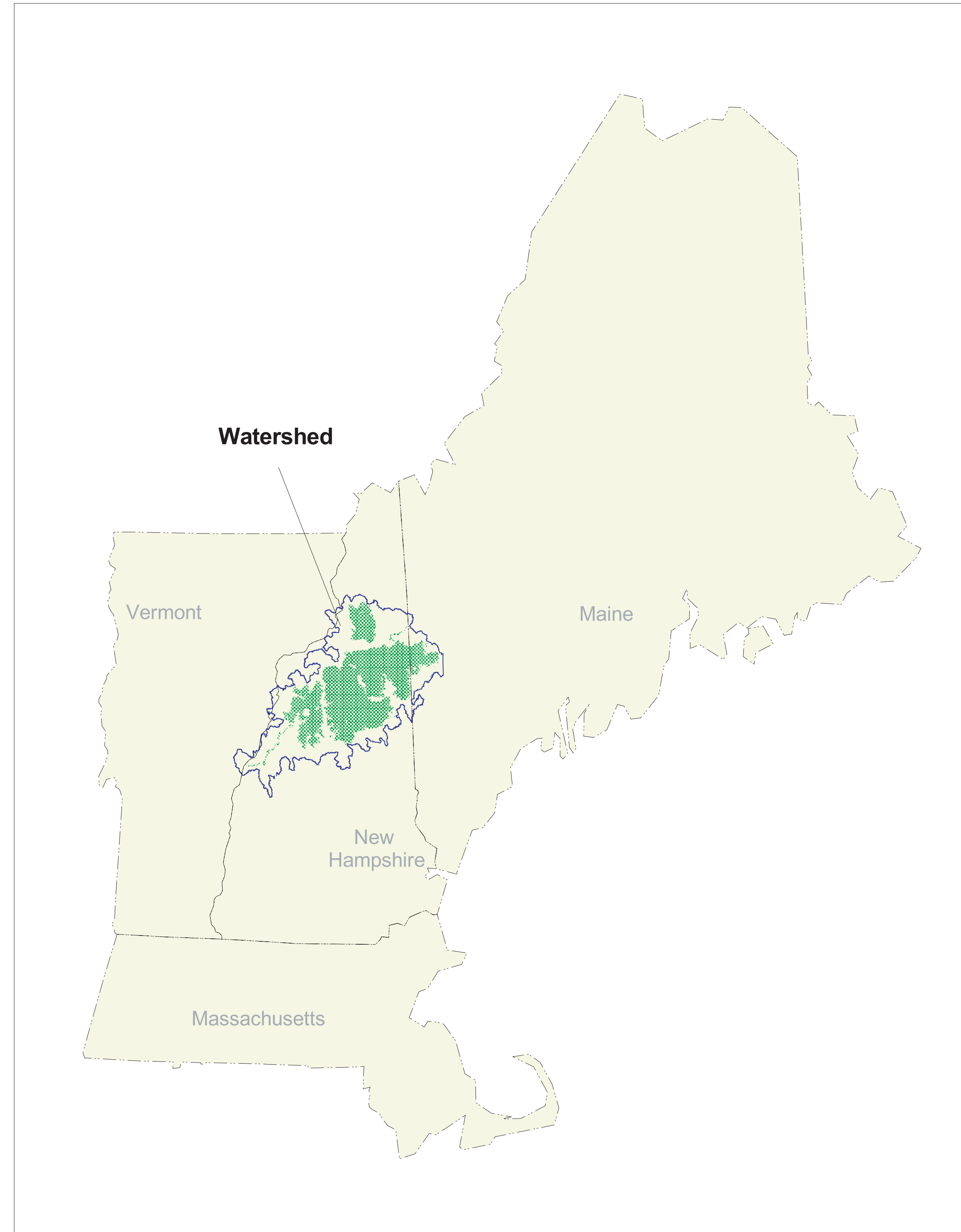
The White Mountain National Forest is in the Humid Temperate Domain, Warm Continental Regime Mountains Division, and Adirondack-New England Mixed Forest-Coniferous Forest-Alpine Meadow Province. The Forest includes land in two sections: White Mountain Section (M212A) and Vermont-New Hampshire Upland (also known as the New England Piedmont, M212B) Section. In the White Mountain Section, land is managed in the White Mountain (M212Ad), Mahoosic-Rangely Lakes (M212Ae), and Western Maine Foothills (M212Ag) subsections. In the Vermont-New Hampshire Upland Section, the Forest Service manages land in the Vermont Piedmont (M212Ba) and Sunapee Uplands (M212Bc) subsections (Keys et al., 1995). (Map 3-02a)

The Forest is further divided into four land type associations (LTAs): Valley Bottom, Mountain Slope, Upper Mountain Slope, and Mountaintop. LTAs are broad ecological categories that reflect differences in geomorphology, elevation, and climax forest composition. Although elevational bands have been used in the past to describe LTAs, relative position on the landscape and natural vegetation are more definitive. The Valley Bottom landtype association primarily encompasses the lowest elevations in the valleys on the Forest, which typically contain land with strong spruce-fir tendencies. It consists mostly of red spruce, balsam fir, hemlock, and mixed hardwood forests. The Mountain Slope LTA takes in the lower to mid slopes of the Forest, where northern hardwood and northern hardwood-spruce forest dominate. The Upper Mountain Slope LTA consists mainly of red spruce and balsam fir on steep, rocky land along mid to upper slopes. Paper birch often occurs where disturbance has impacted the vegetation. The Mountaintop LTA is primarily balsam fir forest, with black and red spruce in places, at relatively high elevations (often above 2,900 feet), and along some lower ridges. The Mountaintop LTA includes the alpine zone, which is mostly herbaceous and ericaceous vegetation, not trees. Each LTA is hundreds of thousands of acres in size, well-distributed across the Forest, and comprised of a fairly unique set of ecological land types (ELTs).

An ELT ranges in size from a few hundred to a few thousand acres on unique soil materials with well-known vegetative succession patterns. The basis for ELT classification is a combination of geomorphic history, climax forest, and nature of the soil substrata. For example, a rich northern hardwood forest of sugar maple, beech, and white ash on basal till soil is an ecological land type.

Map 3-02. Ecological Analysis Areas in the WMNF Region.



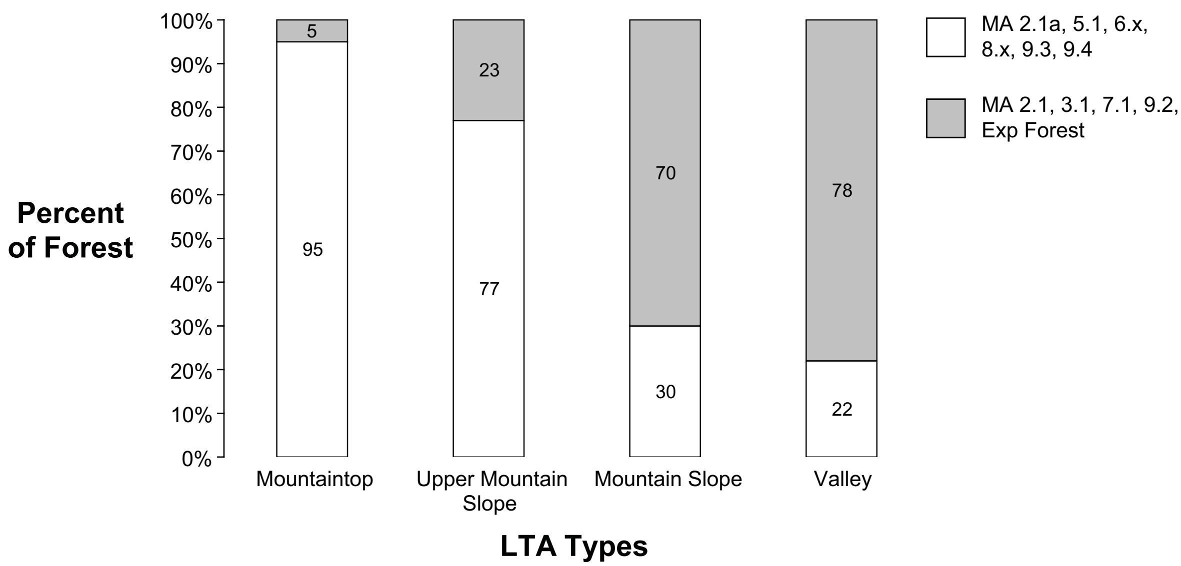


As discussed in the Biodiversity introduction, the coarse filter approach involves maintaining all the broad habitat components on the landscape. One aspect of this is ensuring that some of each LTA is available for vegetation management and that some of each is in land allocations that do not allow much alteration of habitat.

Management areas (MAs) can be grouped according to how intensively vegetation can be managed. Experimental forests and Management Areas 2.1, 3.1, 7.1, and 9.2 allow commercial timber harvest, creation of wildlife openings, and, in MA 7.1, removal of trees for ski runs. In Management Areas 2.1a, 5.1, 6.1, 6.2, 6.3, 8.1 (excluding experimental forests), 9.1, 9.3, and 9.4, vegetation is altered primarily through natural processes and for recreation facilities (an exception is allowance of salvage activities in MA 6.1).

Figure 3-03 shows that at least 20 percent of each LTA is in management areas in which vegetation changes primarily through natural processes. The majority of high elevation lands are in these MAs. This distribution of LTAs across MAs increases the likelihood that ecological communities of all types will be maintained on the Forest.

Figure 3-03. Current Land Type Association Distribution by Management Area.



Potential Natural Vegetation

As mentioned above, ELTs reflect climax forest, geomorphic history, and soil conditions. Climax forest reflects the plant community that would naturally develop on a given piece of ground if the land were left in a relatively undisturbed state. This is known as potential natural vegetation (PNV) or land capability. In evaluating land capability, ELTs were categorized as tending toward softwood, mixedwood, or hardwood forest, or non-forest conditions. Table 3-10 shows that softwood forest is less abundant on the

White Mountain National Forest than PNV predicts, and northern hardwood and mixedwood forest are more abundant. Some of this difference may be because ELTs are mapped at a broad scale and do not always recognize inclusions of tens or hundreds of acres, while current habitats are mapped at a stand scale that acknowledges small variations. However, much of the difference between current and expected condition is because of the historic activities that predate the establishment of the National Forest.

After substantial disturbance, such as fire or clearcutting, some softwood ELTs regenerate as northern hardwood or mixedwood forest. Over time, a softwood understory develops and gradually grows into and replaces the overstory until the stand becomes a climax softwood habitat. The intensive harvesting of the White Mountains in the late 1800s and early 1900s resulted in large areas of hardwood, mixedwood, and aspen-birch forest where softwood forest had previously occurred.

Oak-pine is not a climax forest type this far north except on a few dry, shallow ridge sites; it is a mid-successional habitat type that is replaced by other forest habitats over time unless disturbance, such as fire, regenerates it (Sperduto and Nichols, 2004; Bill Leak, pers. comm.). Aspen-birch also is not a climax forest type (Perala, 1990; Safford et al., 1990); it is an early-successional habitat that is replaced by other forest habitats if disturbance does not regenerate it. Therefore, land capability would not predict any oak-pine or aspen-birch habitat. These habitats occur on many ELTs with different capabilities, so they cannot be grouped into one of the three forest land capability categories.

Some of the ELTs that are identified as tending toward non-forest conditions typically occur in small patches within a forested landscape. When lands were classified on the National Forest, many of these small patches were not identified as separate entities, so they are classified above as part of the adjacent forest type for existing condition. Therefore, non-forest land on the White Mountain National Forest most likely exceeds the 25,000 acres shown in Table 3-10.

Table 3-10. Existing Habitat Abundance and Land Capability on the WMNF.

Habitat Type	Existing Acres	Land Capability Acres
Northern hardwood	331,000	253,500
Mixedwood	153,000	65,500
Softwood*	203,500	441,000
Aspen-Birch	73,000	0
Oak-Pine	9,000	0
Non-forest	25,000	25,000

* For land capability, spruce-fir and hemlock forest habitat were grouped into a softwood category because both of these softwood forest types are climax habitats and ecological landtypes may not properly determine which habitat type will eventually dominate a site.

Natural Disturbance

Natural disturbance in the analysis area includes wind, insect and disease infestations, ice storms, and fire. All of these types of disturbance have an important role to play in local ecosystems when they occur naturally. All forms of disturbance influence local site conditions (e.g., dead wood abundance), making areas more or less suitable for a variety of plant and animal species. Large-scale disturbances can alter habitat development, changing the vegetative community on a site. For some species and communities (e.g., jack pine or pitch pine – scrub oak woodlands), disturbance is essential for their long-term persistence.

In the Northeast, small partial disturbances occur regularly, and large stand-replacing disturbances occur at much longer intervals (Lorimer and White, 2003). Wind is the most common natural disturbance type in all LTAs and habitats (Lee et al., 1993; Leak et al., 1994). It results in both stand-altering events (i.e., broken tops and small areas of blow-down) and stand-replacing events (all trees blown down in a large enough area to be recognized as a "stand" with a new regenerating forest). Insects and disease are discussed in the Timber Resources subsection. Fire disturbance is discussed in the Wildland Fire section.

Most disturbances of all types are very small in size, usually less than 0.2 acres (Lee et al., 1993). Hurricane events occur in New England approximately every 15 years. However, they are typically focused well south of the analysis area and do not usually regenerate large areas near the Forest. In the 1938 hurricane, for example, only 10 percent of the hardwood forest and 35 percent of the softwood forest at Bartlett Experimental Forest was damaged, and most of this was not stand-replacing (Leak et al., 1994). On rare occasions, hurricanes will blow down large areas of forest, but these are exceptions.

In general, disturbances are smallest in the hardwood portion of the Forest, and relatively larger in spruce-fir at both low and high elevations (Leak et al., 1994). Based on data for the Northeast, it is estimated that stand-replacing natural disturbance would place 3 to 6 percent of the spruce-fir landscape in seedling or sapling conditions (Lorimer and White, 2003). The size of openings from wind events is larger in high elevation spruce-fir forest than in the hardwood forest immediately down-slope, and may also be larger than in the low elevation spruce-fir (Lee et al., 1993).

Northern hardwood forest is considered a "gap-phase dynamic" community, meaning that most disturbances result in small openings in the forest canopy (gaps) that are re-invaded by early-successional species such as paper birch, yellow birch, or aspen. Northern hardwood forest is the least likely to endure large, catastrophic natural disturbances, with an estimated 1 to 3 percent in seedling or sapling stages at any one time as a result of natural disturbance (Lorimer and White, 2003).

Disturbance estimates apply equally to lands in the White Mountain National Forest, and across much of the analysis area.

Some types of natural disturbance, such as hurricanes and localized windstorms, affect all forest habitats in their path, regardless of age or condition. Smaller wind events, insects, disease, ice storms, etc., are more likely to impact old and damaged stands (Frank and Bjorkbom, 1973; Hornbeck and Leak, 1992). Historic clearing of a majority of the Forest has resulted in a landscape that is mostly 80 to 120 years old. Spruce-fir and aspen-birch stands of these ages are considered old, with trees that are starting to decay, and are therefore more susceptible to insects, disease, and windthrow. As a result, the potential for natural disturbance to impact these habitats now is probably similar to what it was historically. Hardwood and mixedwood stands are mature and still healthy, so may be just starting to develop decay. These would be susceptible to some types of natural disturbance, such as windthrow and damage from ice storms. However, their healthy condition makes them less susceptible than historically to insects and disease, except where other disturbance (e.g., ice storms) has damaged trees. As stands and trees continue aging, the potential for natural disturbance increases.

Human-caused Disturbance

Goodale (1999) summarizes the condition of about 450,000 acres of land at the time it was purchased to be part of the White Mountain National Forest, based on survey records from the early to mid-1900s. While it is well known that large parts of what is now the Forest were subject to harvest and fire in the late 1800s and early 1900s, the details reveal that there was great variety in land use and condition.

For example, about 160,000 acres were lightly harvested. Often, only the most valuable species were taken, leaving trees of low quality or value behind. About 115,000 acres were intensively harvested through clearcutting, leaving almost no trees behind. There were about 70,000 acres of second growth forest, with trees roughly 30 to 80 years old. It is estimated that about 10,000 acres were heavily burned as a result of logging slash being ignited. About 30,000 acres were identified as old growth, although this term was not defined. The patchwork condition of lands acquired over almost 100 years indicates that habitat conditions changed substantially in the late 1800s and early 1900s, which would have altered wildlife and plant populations (see Management Indicator Species (MIS) discussion in Wildlife section). These changes are still reflected today in the variety of habitat types and age classes on the Forest.

The effects of human use on an area are as varied as the types of use. Currently, the White Mountain National Forest has areas where non-motorized activities and little or no development are the rule, and others where timber harvest, road construction, and motorized and developed recreation also can occur. As shown in Table 3-11, about 46 percent of the Forest is currently in MAs where timber harvest, recreation use and development, permanent road construction, or similar management is allowed (MAs 2.1, 3.1, 7.1, 9.2, and experimental forests); 54 percent is in MAs in which these activities are usually not allowed (MAs 2.1a, 5.1, 6.1, 6.2, 6.3, 8.1, 9.1, 9.3, and 9.4). As a result, current allocations provide areas

Table 3-11. Summary of Habitat Types and Management Area Groups.

Habitat Type*	Totals: Acres/ % of Forest	Acres in 2.1a, 5.1, 6.1, 6.2, 6.2, 6.3, 8.1, 9.3, 9.4	% of Habitat	Acres in 2.1, 3.1, 7.1, 9.2, Experimental Forests	% of Habitat
Northern hardwood	326,000 / 42	125,000	38	201,000	62
Mixedwood	150,000 / 20	71,000	47	79,000	53
Spruce-Fir	185,000 / 25	138,000	75	47,000	25
Aspen-birch	71,000 / 9	54,000	76	17,000	24
Oak-pine	9,000 / 1	2,500	28	6,500	72
Hemlock	11,000 / 1	1,500	14	9,500	86
Wildlife openings	14,000 / 2	11,500	82	2,500	18
Totals*	766,000	404,000	53	362,000	47

* These habitat types encompass a majority of the Forest, but do not include most wetlands, water bodies, or recently acquired lands, and some alpine and other open habitat. In addition, habitat information is not available for the portions of the AT MA outside the proclamation boundary that are managed by the WMNF. Therefore the totals in this table may not match the totals in other tables.

for species that prefer larger blocks of either actively managed or relatively undisturbed habitat.

In New Hampshire, the amount of developed land increased by 37 percent from 1982 to 1992, while non-federal forestland decreased by just over three percent. Farmland decreased by 20 percent from 1974 to 1997 (Sundquist and Stevens, 1999). These changes have been most intense in the southeastern part of the state, which is outside the analysis area for this project. However, predictions are for decreasing forestland and increasing populations over the next 20 years in all of the state except Coos County.

Timber harvest on the Forest in recent decades is discussed in the Timber Resources subsection. In the New Hampshire portion of the analysis area, nearly 60 percent of harvests are individual tree selection cuts. Almost 10 percent are even-aged regeneration harvests for timber, and another 10 percent are land clearance for development (Thorne and Sundquist, 2001).

Figures in High et al. (2004) indicate that total harvest in New Hampshire and Maine decreased slightly between 1997 and 2001. Since forestland decreased over this time period due to development, a decrease in harvest is not surprising. Forestland is expected to continue declining in the southern part of the analysis area (Thorne and Sundquist, 2001). Development and forestland conversion are slower, but still occurring, in the northern part of the analysis area (Thorne and Sundquist, 2001; High et al., 2004). Because conversion is expected to continue reducing forest land across the analysis area, less land will be available for harvest.

Disturbance from recreation activities also affects Forest vegetation. See the Recreation Affected Environment section for details on specific management activities occurring on and off the Forest.

Habitat Composition

The majority of terrestrial ecological communities on the White Mountain National Forest can be grouped into seven broad habitats for coarse-filter biodiversity discussions: spruce-fir, mixedwood, northern hardwood, aspen-birch, oak-pine, hemlock, and wildlife openings. The distribution of these habitats is the result of land capability, natural disturbance, and past management practices.

The differences between softwood, mixedwood, and northern hardwood habitats are not always distinct. Most spruce-fir habitats have a small component of hardwood species, and most northern hardwood habitats have a small spruce-fir component. The mixedwood habitat is predominantly northern hardwood forest, but with a substantial softwood component. Once the majority of trees in a stand are softwoods, it is considered softwood habitat regardless of the hardwood component.

Softwood, mixedwood, and hardwood forests are all abundant (Table 3-11) and well-distributed on the Forest. Softwoods occur at both low and high elevations. Low elevation habitats are usually small stands, while spruce-fir forest above 2,500 feet is often extensive. In the analysis area, softwood habitat is concentrated on the White Mountain National Forest and more northern areas. Mixedwood and hardwood habitats occur in large and small patches at mid-elevations across both the Forest and the analysis area.

Forest Inventory and Analysis (FIA) data (Northeastern Forest Research Station, 1995; 1997) for the counties encompassing the Forest and most of the analysis area show a universal decline in the amount of spruce-fir forest between the inventory in the early 1980s and the inventory in the late 1990s, and an increase in northern hardwood and mixedwood habitats. The softwood forest decline is likely the result of land clearing for development and even-aged timber harvest, which often results in conversion to mixedwood or hardwood habitat. The increase in hardwoods and mixedwoods is smaller than the softwood decrease, but it exists even in counties where total forested land has decreased.

At the higher elevations, paper birch is a common early-successional species, while at the lower elevations, paper birch and aspen both fill this role. Both species are shade-intolerant and result from moderate to large gap-forming disturbance or stand-replacing events. As described in the MIS discussion in the Wildlife section, aspen-birch habitats are important to some wildlife species. These habitats are distributed in small amounts (Table 3-11) across the Forest. The majority of the larger blocks of aspen-birch habitat on the Forest are high elevation paper birch stands. At lower elevations, aspen-birch habitat is typically found in small, isolated patches or in areas where harvest has been more intensive. In the analysis area, most of this habitat is at lower elevations, where it is widely scattered.

Based on FIA data, the recent trend for aspen-birch habitat in the analysis area is variable. In northern New Hampshire, it declined by more than 40 percent in 14 years. This is presumably due to a lack of even-aged management in this habitat, perhaps because of the low market value of the

timber. Northwestern Maine also saw a decline, though only of about three to five percent. Northern Vermont, however, saw an increase in aspen-birch forest of about 15 percent in a similar timeframe.

Oak and pine stands were not abundant in most parts of New Hampshire, Vermont, and northern New York prior to European settlement (Cogbill, 2000). They occurred most often in southern and lowland valleys, and were uncommon in the uplands and mountains that now make up the White Mountain National Forest. Currently, oak-pine and hemlock forests are limited, but important, habitats on the Forest (Table 3-11). Oak-pine forest occurs primarily along the southern, eastern, and western edges of the Forest. It is limited to lower elevations in the southern parts of the analysis area, where agriculture altered habitat composition in the past. Oak and pine trees are also components of some hardwood and mixedwood forests in parts of the Forest and the analysis area.

Hemlock forest also is a limited habitat that is important to some wildlife species as cover or breeding habitat (Table 3-11). Hemlock habitat on the White Mountain National Forest is most abundant near its eastern and western edges, though small stands are scattered throughout. It is similarly dispersed in the analysis area, with more in southern areas but small stands throughout. Like oak-pine, hemlock also is an important component of hardwood and mixedwood forests.

Wildlife openings are upland areas dominated by grasses, forbs (e.g., goldenrod, ferns, meadowsweet), or shrubs (e.g., raspberries, blueberries, alder) that are maintained in a non-forested condition naturally or through management. Roughly half of this habitat on the Forest (about 7,000 acres) is alpine habitat. Outside the alpine zone, most openings are small (less than 4 acres) and they are widely distributed across the Forest. In the analysis area, agricultural land is fairly abundant in the Connecticut River Valley, and provides large and small wildlife openings. Wildlife openings elsewhere are few, small, and widely scattered.

Age Classes

One aspect of the Timber Management and Wildlife Habitat issue is the role of the WMNF in providing young forest habitat within the larger landscape. This question is identified as an issue because there is substantial disagreement among the public and wildlife professionals concerning how much regeneration-age forest habitat is appropriate on the Forest and where and why it should be created. There is similar, related disagreement about how much aspen-birch forest habitat the Forest should provide.

A large number of wildlife species in northern New England benefit from these habitats and populations of several of these species are declining substantially as habitat decreases due to development and changes in disturbance (Hunter et al., 2001; Litvaitis, 2001; Thorne and Sundquist, 2001; Thompson and DeGraaf, 2001). Many people believe that the Forest Service has a responsibility to provide high quality aspen-birch habitat and regeneration-age forest of all types to counteract, or at least soften, the habitat and species declines occurring in northern New England.

Historic disturbance regimes indicate that regenerating forest and aspen-birch habitats were naturally rare or uncommon (Lorimer and White, 2003, Seymour et al., 2002) in northern New Hampshire and Maine. Limited habitat availability makes it likely that species needing these habitats also would have been limited in the area. Therefore many people argue that recent declines in species and habitats are returns to historic conditions and not something to be worried about or countered through management. They contend that habitat losses to development are more prevalent in southern New Hampshire and Maine (Sundquist and Stevens, 1999) and therefore do not need to be counteracted by the WMNF.

The Forest Service must look through all this conflicting science and public and professional opinion, and balance it with the needs of other resources, to determine the most appropriate approach to managing the Forest. Tracking this topic as an issue in Forest Plan revision enabled the Forest Service to evaluate different levels and types of harvest during alternative development and within the four proposed alternatives.

For the purposes of this analysis, forest habitats on the White Mountain National Forest have been divided into four broad age classes: regeneration, young, mature, and old. Regeneration forest is typically zero to nine years old, following a stand-replacing natural disturbance or harvest. Young forest starts at age 10 and lasts 30 to 60 years, depending on the forest type. Mature forest encompasses the ages at which harvest is most desirable for each forest habitat type, while old forest starts after the traditional rotation age for each habitat type (Appendix F).

Old growth forest is a subset of the old age class that is important to some species and many people. There is no single, universally accepted definition of old growth. It varies depending on geographic location, forest types, land use history, and management objectives or desired values (Tyrell et al., 1998). Most of the WMNF is mature or old, aging forest that already contains several components that many people attribute to old growth (e.g., large trees, late-successional species, multiple canopy layers). To ensure that protection focuses on the rarer components that are more unique to old growth, the Forest Service definition of old growth describes stands that closely resemble the generally accepted core concept of old growth: interconnected stands of old, uneven-aged forest with large trees, large dead wood, and little or no evidence of past harvest (Tyrell et al., 1998). On the WMNF, old growth conditions currently exist in a few small, isolated stands. Most known old growth stands are in Research Natural Areas or Candidate Research Natural Areas.

Age class data are most reliable in MAs 2.1 and 3.1. Elsewhere on the Forest, forest age is estimated at a broad scale. This information is sufficiently accurate for large-scale analysis and was used to evaluate conditions Forest-wide (Table 3-12a and Table 3-12b), but is not at the same level of precision as in MAs 2.1 and 3.1.

Timber harvest around the turn-of-the-century resulted in extensive areas of regeneration forest. Since then, most lands that are now in MAs 5.1, 6.1, 6.2, 6.3, 8.1, 9.1, and 9.3 have been growing and aging; most are currently 80

Table 3-12a. Forest-wide Summary of Current Age Class (acres/% of habitat) by Forest Habitat Type.

Habitat Type*	**Regeneration**	**Young**	**Mature**	**Old**
Northern Hardwood	2,500 / <1	58,300 / 18	205,000 / 63	59,800 / 18
Mixedwood	525 / <1	10,400 / 7	99,800 / 67	38,000 / 25
Spruce-Fir	300 / <1	3,100 / 2	61,000 / 33	120,200 / 65
Aspen-Birch	425 / 1	4,700 / 7	4,300 / 6	61,800 / 87
Oak-Pine	30 / <1	700 / 8	3,400 / 39	4,600 / 53
Hemlock	25 / <1	450 / 4	9,000 / 78	2,100 / 18
Total Acres	**3,805 / <1**	**77,650 / 10**	**382,500 / 51**	**286,500 / 38**

* These habitat communities do not include most wetlands, water bodies, or recently acquired lands. Therefore the totals in this table do not match those in other tables.

Table 3-12b. Forest-wide Summary of Current Age Class by Forest Habitat and MA Group (% of habitat).

Habitat	**Total Acres**	**Regeneration Age**		**Young**		**Mature**		**Old**	
		MAs 2.1, 7.1, 8.2, 9.2	**All Other MAs**	**MAs 2.1, 7.1, 8.2, 9.2**	**All Other MAs**	**MAs 2.1, 7.1, 8.2, 9.2**	**All Other MAs**	**MAs 2.1, 7.1, 8.2, 9.2**	**All Other MAs**
Northern Hardwood	326,000	0.7	<0.1	15	3.0	38	25	8	11
Mixedwood	150,000	<0.1	<0.1	6	1.0	38	29	8	18
Spruce-Fir	185,000	0.2	<0.1	1	0.3	17	16	7	58
Aspen-Birch	71,000	0.6	<0.1	6	0.4	5	1	13	74
Oak-Pine	9,000	0.4	0.0	7	0.4	32	7	32	21
Hemlock	11,000	0.2	0.0	4	<0.1	71	5	11	8

* Numbers rounded to nearest whole except those less than 1 percent.

to 120 years old, placing them in the mature or old age classes. As a result, regeneration forest habitat now typically occurs in small patches, and is primarily in MAs 2.1 and 3.1. In the other MAs, it is usually created by stand-replacing natural disturbance, which is expected on 1 to 6 percent of the Forest (Lorimer and White, 2003). Young forest habitat is distributed similarly to regeneration forest because young forest develops with the aging of regeneration forest habitat. Mature and old forests occur in large blocks across the National Forest.

Forest Inventory and Analysis (FIA) data (Northeastern Forest Research Station, 1995; 1997) for the counties encompassing most of the analysis area show that the amount of seedling and sapling habitat (which encompasses the Forest's regeneration age class and some of the young age class) increased across the analysis area between the early 1980s and mid 1990s. This increase ranged from 20 to 88 percent in New Hampshire, Maine, and Vermont, with the greatest increase in northern New Hampshire. After these increases, seedling and sapling habitat represented about 15 percent of existing forestland across the analysis area. Despite increases in regeneration and young forest, the majority of forested land in the analysis area remains in the mature or old age classes (Northeastern Forest Research Station, 1995; 1997). However given on-going loss of forested land and gradually decreasing parcel size in much of the analysis area (Sundquist and Stevens, 2001), areas of mature and old forest are probably being reduced in size and fragmented by houses, roads, and other activities.

Snags, Cavities, and Coarse Woody Debris

Dozens of amphibian, reptile, bird, and mammal species on the Forest require snags, cavities, or down logs for some aspect of their life. They use these habitat components for nesting, denning, foraging, perching, roosting, cover, and basking. In addition, many plants and an unknown number of insects and other life-forms reside in or on snags and down logs.

What species can use specific snags and trees with cavities depends on many things, including the diameter and height of the snag or tree, size and height of the cavity, level of decay, surrounding habitat, and other factors. Larger, taller snags and trees are likely to provide habitat to a wider array of species. Minimum tree size for cavity users ranges from six to greater than 24 inches DBH (Tubbs et al., 1987). Estimates of the number and size of snags and cavity trees needed to maintain wildlife diversity varies by location, forest habitat, and researcher. In the northeastern United States, two sources indicate a need for at least one large (greater than 18 inches DBH) snag or cavity tree for every four acres (cited in Tubbs et al., 1987). Additional smaller snags and trees are needed to meet all the life history needs of all species.

While down logs are used by many species, the number, size, and decay class needed to maintain species diversity and abundance is not documented. As with snags, larger logs of species that decay slowly are likely to provide more habitat for a range of species over time.

Environmental Effects

Ecological Units

Land allocation varies among the alternatives, with differing amounts assigned to MA 2.1 (and 3.1 in Alternative 1). As mentioned in the Affected Environment, ensuring that some of each LTA is available for vegetation management and some is in management areas that do not allow much habitat alteration is part of the coarse filter approach for maintaining biological diversity. Table 3-15 shows how the distribution of LTAs across MAs varies by alternative.

Alternative 1

Direct and Indirect Effects

This alternative would result in few land allocation changes from the current condition. Therefore, the distribution of LTAs between MAs allowing vegetation management and those where vegetation changes are primarily the result of natural disturbance and recreation use would not change from what is described in the Affected Environment (Figure 3-01). More than two-thirds of the lower elevation LTAs would remain in MAs allowing vegetation management (Table 3-15). A majority of the upper elevation LTAs would remain in MAs with almost no vegetation management.

The emphasis on low elevation lands in management areas that allow timber harvest is because these lands tend to be of more moderate slope and more readily accessible, making timber harvest more ecologically appropriate and more economically feasible than on higher elevation lands. However, more than 25 percent of the lands in the Valley Bottom and Mountain Slope LTAs (well over 100,000 acres) would remain in management areas that do not allow commercial timber harvest except possibly salvage. This distribution would result in a number of low elevation areas in which aspects of biodiversity that are best conserved without active vegetative management could thrive. Much of the remaining low elevation areas would be available for management to meet habitat and harvest objectives.

Cumulative Effects

Land type associations are only delineated on and adjacent to the Forest, so they cannot be evaluated throughout the analysis area. However it is reasonable to assume that lower elevation lands are more likely to be affected by urban and rural development, timber harvest, and other management activities because they are more accessible and population densities tend to be higher. In some areas, higher elevation areas also are being impacted as people build homes with panoramic views and as demand for cell and wind towers increases. This trend is likely to continue as populations increase and available low elevation land becomes more scarce.

The allocation of a majority of the Forest's low elevation lands in management areas that allow timber harvest adds to impacts to these lands in the analysis area. As a result, the retention of more than twenty percent of the Forest's low elevation lands in management areas that do not allow intensive

vegetation management or development, and the moderate harvest proposed on other lands, is essential to maintaining biodiversity across the landscape.

Alternative 2

Direct and Indirect Effects

Land allocation in this alternative would result in little change in distribution of LTAs across management areas (Table 3-15) compared to either the current condition or Alternative 1. Most of the LTAs would shift by one percent or less. The largest change is a three percent increase in the portion of the Mountain Slope LTA that would be in MAs that allow vegetation management. Such a small shift, when more than two-thirds of this LTA is in these MAs, would not noticeably affect habitat protection or management.

Cumulative Effects

The minimal change in distribution of land type associations across management areas means that the cumulative effects would be similar to those described for Alternative 1.

Alternative 3

Direct and Indirect Effects

Land allocation in this alternative would result in the greatest change in distribution of LTAs across management areas (Table 3-15). The portions of the Upper Mountain Slope, Mountain Slope, and Valley Bottom LTAs that would be in MAs that allow intensive vegetation management would each decrease by nearly 10 percent compared to the current condition. The distribution of the Mountaintop LTA among MAs would remain essentially the same. The increase in Mountain Slope and Valley Bottom lands in management areas that prohibit most timber harvest would increase the amount of low elevation land on which natural processes would be the primary factor affecting communities and species. The shift of lands in all three LTAs toward management areas that do not allow commercial harvest would reduce the ability of the Forest Service to manage habitat in each of these LTA. Overall, different aspects of biodiversity could be benefited by this allocation of lands compared to the other alternatives, but the differences would be subtle because the majority of lands in each LTA would remain in the same MA group as in other alternatives (Table 3-15).

Cumulative Effects

The allocation of more low elevation lands to management areas that prohibit most timber harvest and intensive development would reduce the amount of lowlands on which these activities would occur across the analysis area, which could be important to a few species or communities. The landscape scale effects of changes in the Forest Service's ability to manage certain habitats are addressed under habitat composition.

Alternative 4

Direct and Indirect Effects

Distribution of LTAs across management areas (Table 3-15) would be essentially the same as for Alternative 2, and would not noticeably affect habitat protection or management from what is described for Alternative 1.

Cumulative Effects

The minimal change in distribution of land type associations across management areas means that the cumulative effects would be similar to those described for Alternative 1.

Habitat Composition

Land capability indicates how habitat composition will change over time on National Forest lands in most management areas. However, in MA 2.1 (and 3.1 in Alternative 1), vegetation management could alter habitat composition. To help guide vegetation management on these lands, habitat composition objectives were developed for each alternative. Timber harvest and other management activities would be designed to move the Forest toward these objectives. Using potential natural vegetation to determine the appropriate levels and distribution of ecosystems on the landscape increases the likelihood that biological diversity will be maintained over time (Aplet and Keeton, 1999). Therefore, habitat composition objectives in all alternatives were based, in part, on land capability. However, aspen-birch, oak-pine, and permanent opening habitats would occur in very limited amounts without management. These habitats support many wildlife species that the public likes to see or hunt (e.g., several butterflies, songbirds, moose, and grouse). Therefore habitat composition objectives also provide for specific levels of these habitats in MA 2.1 (and 3.1 in Alternative 1) to provide habitat for these species.

Current habitat composition and desired composition objectives for Management Area 2.1 (and 3.1 in Alternative 1) are different among the alternatives (Table 3-13). As a result, different amounts of some habitats would be expected on the Forest 20 years from now and 150 years from now, depending on which alternative is implemented. Table 3-14a shows whether each habitat type will be increasing, decreasing, or remaining stable across the Forest in the short-term and Table 3-14b shows expected trends if proposed management continues for 150 years. Table 3-14a and Table 3-14b include habitats for which there are not specific composition objectives in MAs 2.1 and 3.1 to show the full habitat picture for the Forest. See the effects analysis for each alternative for more information on differences and reasons for expected trends.

As mentioned in the Affected Environment, ensuring that some of each habitat is available for vegetation management and some is in management areas that do not allow much habitat alteration is part of the coarse filter approach for maintaining biological diversity. Table 3-16 tracks how habitat types are distributed across MAs with each alternative.

Table 3-13. Long-term Habitat Composition Objectives for MA 2.1 (and 3.1) (% of MA).

	Northern Hardwood	Mixed-wood	Spruce-Fir	Aspen-Birch	Permanent Opening	Other*
Alternative 1						
Current**	53	22	12	5	1	7
Objective	51	10	21	8	3	7
Alternative 2						
Current**	54	21	12	5	1	7
Objective	45	11	32	5	1	6
Alternative 3						
Current**	54	21	12	4	1	8
Objective	45	11	32	5	1	6
Alternative 4						
Current**	54	21	12	5	1	7
Objective	45	11	32	5	1	6

* Includes oak-pine and hemlock forest, wetlands, rock, and non-vegetated areas such as roads and gravel pits.

** Current condition changes between alternatives because landbase allocated to MA 2.1 (and 3.1 in Alternative 1) changes between alternatives.

Table 3-14a. Current Habitat Composition of the WMNF and Expected Trends for the Next 20 Years, by Alternative (Direct and Indirect Effects).

Habitat Type	Current Condition (Acres)	Alternative 1		Alternatives 2-4	
		MAs 2.1 and 3.1	Forest-wide	MA 2.1	Forest-wide
Northern Hardwoods	331,000	Decreasing	Increasing	Stable	Increasing
Mixedwood	153,000	Stable	Increasing	Stable	Increasing
Spruce-Fir	192,000	Decreasing	Increasing	Stable	Increasing
Aspen/Birch	73,000	Increasing	Decreasing	Stable	Decreasing
Hemlock	11,500	Stable	Stable	Stable	Stable
Oak/Pine	9,000	Stable	Stable	Stable	Stable
Permanent Opening	14,500	Increasing	Increasing	Stable	Stable
Other*	11,000	Stable	Stable	Stable	Stable

*Includes waterbodies, wetlands, and non-vegetated areas.

Table 3-14b. Expected Trends in Habitat Composition on the WMNF for 20-150 Years after start of implementation, by Alternative (Cumulative Effects).

Habitat Type	Alternative 1		Alternatives 2-4	
	MAs 2.1 and 3.1	Forest-wide	MA 2.1	Forest-wide
Northern Hardwoods	Decreasing	Decreasing	Decreasing	Decreasing
Mixedwood	Decreasing	Decreasing	Decreasing	Decreasing
Spruce-Fir	Increasing	Increasing	Increasing	Increasing
Aspen-Birch	Increasing	Decreasing until Stable	Stable	Decreasing until Stable
Hemlock	Stable	Stable	Stable	Stable
Oak-Pine	Stable	Decreasing	Stable	Decreasing
Permanent Opening	Increasing	Increasing	Stable	Stable
Other*	Stable	Stable	Stable	Stable

* Includes waterbodies, wetlands, and non-vegetated areas.

Effects Common to All Alternatives

Direct and Indirect Effects

Although oak-pine forests will gradually convert to other habitat types if natural disturbance or management does not maintain them, that conversion takes centuries. Therefore, outside MAs 2.1 and 3.1, oak-pine forests would remain stable for the next 20 years. In MAs 2.1 and 3.1, standards and guidelines would ensure that oak-pine habitats would be maintained or enhanced in all alternatives.

Hemlock forest remains hemlock habitat as it ages unless disturbance alters it. In addition, in MAs 2.1 and 3.1, standards and guidelines would ensure that hemlock habitats would be maintained or enhanced. Therefore hemlock forest abundance would remain the same across the Forest in all alternatives.

Development often results in the conversion of forested habitats into non-forested conditions. On the Forest, development would include construction of developed recreation facilities, backcountry recreation facilities, motorized and non-motorized trails, ski area facilities, wind turbines, and communication facilities. Most of these types of facilities are small enough that they are still considered part of the surrounding habitat. Therefore, on-Forest development would not alter habitat composition at the landscape scale with any alternative. However, it could reduce habitat suitability at the local scale for some species. This should not be a concern for most species, but could impact individuals of some rare species (see the Rare and Unique Features section and the Biological Evaluation in Appendix G).

Development and habitat alteration at ski areas can impact larger areas than other recreational development. The MA 7.1 and 9.2 allocations would remain the same in all alternatives, so ski areas would not be allowed to

Table 3-15. Percentage of Each Land Type Association in Management Area Groups, by Alternative.

LTA	Total Forest (Acres)	Alternative 1*		Alternative 2		Alternative 3		Alternative 4	
		MAs 2.1, 3.1, 7.1, 9.2, Exp. Forests	MAs 2.1a, 5.1, 6.1, 6.2, 6.3, 8.1, 9.3, 9.4	MAs 2.1, 7.1, 8.2, 9.2	MAs 5.1, 6.1, 6.2, 6.3, 8.1, 8.3-8.6, 9.3	MAs 2.1, 7.1, 8.2, 9.2	MAs 5.1, 6.1, 6.2, 6.3, 8.1, 8.3-8.6, 9.3	MAs 2.1, 7.1, 8.2, 9.2	MAs 5.1, 6.1, 6.2, 6.3, 8.1, 8.3-8.6, 9.3
Mountaintop	179,500	5	95	6	94	5	95	6	94
Upper Mountain Slope	162,000	23	77	22	78	15	85	23	77
Mountain Slope	277,000	70	30	72	28	60	40	74	26
Valley Bottom	166,500	78	22	76	24	67	33	78	22

* The current allocation of lands among MAs is essentially the same as Alternative 1.

Table 3-16. Percentage of Each Habitat Type in Management Area Groups, by Alternative.

Habitat Type*	Total Forest (Acres)	Alternative 1**		Alternative 2		Alternative 3		Alternative 4	
		MAs 2.1, 3.1, 7.1, 9.2, Exp. Forests	MAs 2.1a, 5.1, 6.1, 6.2, 6.3, 8.1, 9.3, 9.4	MAs 2.1, 7.1, 9.2, Exp. Forests	MAs 5.1, 6.1, 6.2, 6.3, 8.1, 9.3	MAs 2.1, 7.1, 9.2, Exp. Forests	MAs 5.1, 6.1, 6.2, 6.3, 8.1, 9.3	MAs 2.1, 7.1, 9.2, Exp. Forests	MAs 5.1, 6.1, 6.2, 6.3, 8.1, 9.3
Northern Hardwoods	326,000	62	38	63	37	53	47	65	35
Mixedwood	150,000	53	47	51	49	42	58	52	48
Spruce-Fir	185,000	25	75	25	75	20	80	25	75
Aspen-birch	71,000	24	76	25	75	18	82	25	75
Oak-pine	9,000	72	28	73	27	71	29	73	27
Hemlock	11,000	86	14	87	13	79	21	87	13
Permanent Openings	14,000	18	82	20	80	20	80	20	80

* These habitat types encompass a majority of the Forest, but do not include some alpine or other open habitat or most wetlands, waterbodies, recently acquired lands, or portions of the AT MA that are outside the proclamation boundary.
** The current allocation of lands among MAs is essentially the same as Alternative 1.

expand beyond the management areas currently allocated to them. However, there could be new or expanded facilities within those areas to allow new uses and increased use. Buildings, parking lots, ski lift corridors, ski runs, and summer trails could convert forest habitat in these areas to opening habitat and non-vegetated conditions. All alternatives would designate three new communication sites at existing ski areas. Because MAs 7.1 and 9.2 only consist of just over 6,000 acres, changes to habitat composition in this MA should not alter populations of most species.

Cumulative Effects

Over the next 150 years, several hundred acres of oak-pine habitat outside MA 2.1 (and 3.1 in Alternative 1) would naturally convert to softwood or hardwood forest. On the Forest, oak-pine forest would eventually only occur in MA 2.1 (and 3.1) or areas of large natural disturbance. Hemlock forest should remain stable into the future.

Since on-Forest development would not alter habitat composition at the landscape scale, there are no cumulative effects from those activities to discuss.

All of the discussion of expected changes to habitat composition on and off of the Forest is predicated on the assumption that climate change will not happen rapidly enough to result in dramatic shifts in vegetative composition in the next few decades. Even among scientists who agree that global climate change is occurring, there is substantial uncertainty about what types of changes are expected, how dramatic changes will be, how quickly they will occur, and what effect they will have on biodiversity (Hansen et al., 2001; Edmonds and Rosenberg, 2005). Some models predict significant shifts in habitat suitability for various forest types in the northeast (Hansen et al., 2001; Prasad and Iverson, 1999-ongoing; Iverson and Prasad, 2001). If these models prove correct and changes occur quickly, the WMNF could look quite different 150, or even 50, years from now regardless of management actions. Efforts to increase spruce-fir forest could be immaterial, and concerns for maintaining oak-pine forest would be unnecessary. Nothing in the four alternatives would alter climate change or its effects noticeably. Given the uncertainties associated with climate change and resulting changes to local ecology, potential effects of the four alternatives are based on continuation of climatic conditions that are not dramatically different from current.

Alternative 1

Direct and Indirect Effects

This alternative would result in few land allocation changes from the current condition. Therefore, the distribution of habitats between MAs allowing vegetation management and those where vegetation changes are primarily the result of natural disturbance and recreation use would not change from what is described in the Affected Environment (Figure 3-01). A majority of the hardwood, mixedwood, hemlock, and oak-pine habitat would be in MAs allowing vegetative management (Table 3-16). A majority of the softwood, aspen-birch, and open habitats, which includes much of the alpine habitat, would remain in MAs with almost no vegetation management.

In MAs 2.1 and 3.1, timber harvest and other management actions would move the Forest toward habitat composition objectives (Table 3-13) over the long-term. In other MAs, habitat types would change even more gradually, as stands age and move toward their climax conditions.

Across the Forest, as mixedwood and hardwood stands on softwood ELTs age over the next 20 years, the number of spruce, fir, and hemlock trees in them will increase. Outside MAs 2.1 and 3.1, this is a very slow process. Within MAs 2.1 and 3.1, some mixedwood stands on softwood ELTs would be managed through uneven-aged treatments to encourage the softwood component. This management could speed the conversion toward softwood habitat, but it would still take many decades. Meanwhile, most of the existing softwood habitat would be left to age or, in MAs 2.1 and 3.1, be managed through uneven-aged treatments to maintain it as softwood forest. A small amount would be regenerated to create aspen-birch habitat. Outside MAs 2.1 and 3.1, thousands of acres of aspen-birch forest will convert to softwood forest, much of it in the next 20 years. Overall, both the number of softwood trees and acres of softwood forest would increase across the Forest.

Most aspen-birch forest habitat occurs outside MAs 2.1 and 3.1. Without management or large-scale natural disturbance, it will move toward other forest types, determined by the ELT, as the aspen and birch trees die. Given its current age, most of the existing aspen-birch forest will convert to other habitat types in the next few decades. Land capability indicates that most existing aspen-birch outside MAs 2.1 and 3.1 will convert to softwood forest, though some would become hardwood or mixedwood forest. This would restrict aspen-birch to MAs 2.1 and 3.1 and larger areas of natural disturbance in other MAs.

Within MAs 2.1 and 3.1, managing for the aspen-birch composition objective in this alternative would result in an increase in this habitat. Existing aspen-birch habitat in MAs 2.1 and 3.1 would be regenerated to maintain it as aspen-birch forest. Even-aged regeneration of some softwood habitat would occur to create aspen-birch habitat. However, only a small amount of softwood habitat should be converted to aspen-birch or it could prevent attainment of the long-term softwood objective. Therefore, most of the increase in aspen-birch habitat would come from gradual conversion of hardwood and mixedwood habitat on hardwood ELTs through shorter-rotation even-aged regeneration harvests. In the first two decades, even-aged regeneration of hardwood and mixedwood forest with a moderate aspen or birch component would occur, but only a few hundred to about two thousand acres would convert as a result of the first harvest. In other stands, the amount of aspen and birch will increase, setting the stage for future conversion. This slight increase in aspen-birch forest in MAs 2.1 and 3.1 would be small compared to the decline in other MAs, so aspen-birch habitat forest-wide would decline substantially in the next 20 years.

As discussed earlier, softwood trees will become more prevalent in hardwood and mixedwood stands on softwood ELTs in all MAs. In some mixedwood stands, that gradual conversion would be enhanced through management in MAs 2.1 and 3.1, but stands would be unlikely to convert in

the next 20 years. As hardwood and mixedwood stands on hardwood ELTs across the Forest age, they will remain hardwood or mixedwood forest. In MAs 2.1 and 3.1, most hardwood and mixedwood forest habitat would be managed through a variety of even-aged and uneven-aged methods. Some would be managed more intensively to increase the aspen and birch components. In the next 20 years, more softwood, aspen, and birch trees would occur in some hardwood and mixedwood stands. In addition, a few thousand acres of existing old aspen-birch forest outside MAs 2.1 and 3.1 are likely to convert to hardwoods or mixedwoods in the next 20 years. Overall, the conversion of old aspen-birch to hardwoods and mixedwoods would exceed the managed conversion of these habitats to aspen-birch, so hardwood and mixedwood habitats on the Forest would increase slightly in the next 20 years.

Roughly half the wildlife opening habitat on the Forest is alpine habitat, which would remain at current levels for the foreseeable future. Almost all the remaining openings outside of MAs 2.1 and 3.1 are rock, gravel pits, debris slides, or wet meadows. In all MAs, these types of openings also would remain open naturally. Existing wildlife openings in MAs 2.1 and 3.1 that would not remain open naturally would be maintained through management, such as prescribed fire or mowing. In addition, a few thousand acres of forest in these MAs would be cleared in small patches to create new wildlife openings, and would then be maintained. As a result, wildlife opening habitat would increase on MAs 2.1 and 3.1, which would increase the amount available Forest-wide.

The primary change to forest composition expected in the next 20 years on the White Mountain National Forest is the natural conversion of thousands of acres of old aspen-birch habitat to softwoods and a small amount of hardwoods or mixedwoods. Habitat for all wildlife species should remain present on the Forest and all except aspen-birch forest should be well distributed.

Cumulative Effects

If the habitat composition objectives in MAs 2.1 and 3.1 (Table 3-13) were used to guide management for 150 or more years, softwood habitat would increase by almost 50 percent in these MAs as the softwood component in some mixedwood habitats increased enough to convert the stands to softwood habitat. Softwood habitat also would increase in hardwood and mixedwood habitat outside MAs 2.1 and 3.1, but this conversion would be slow. More existing high elevation aspen-birch habitat would convert to softwoods. The Forest-wide increase in softwood habitat would eventually bring the Forest closer to the potential natural vegetation (see Affected Environment).

Regular regeneration of existing aspen-birch habitat in MAs 2.1 and 3.1 would prevent it from becoming hardwood or softwood habitat, which would happen without harvest. Even-aged regeneration methods would be used to increase the aspen and birch component of some hardwood habitat, resulting in conversion of these stands to aspen-birch habitat in the long-term.

Meanwhile, the old aspen-birch and oak-pine forest on MA 2.1 and 3.1 lands identified as unsuitable or inaccessible for timber harvest, and that outside these MAs, would continue aging and would convert to northern hardwood, mixedwood, or spruce-fir habitat, depending on ELT. This conversion likely would occur in the next few decades for aspen-birch habitat and over the next 150 years or more in oak-pine. As a result, both habitats would decline on the Forest in the long-term.

The slow conversion to softwoods across the Forest, and to aspen-birch habitat in MAs 2.1 and 3.1, would result in a decrease in hardwood and mixedwood forest habitat levels over time, despite conversion of several hundred acres of oak-pine and aspen-birch to hardwood forest. This decline would bring them more in line with the potential natural vegetation of the land.

Development and timber harvest activities that resulted in the shifts in forest composition in the analysis area (see Affected Environment) are likely to continue in the future. The apparent continuing conversion of softwood forest to hardwood and mixedwood forest habitat off-Forest makes the White Mountain National Forest objective of increasing softwood forest habitat abundance more important to maintaining the diversity of habitats across the northern New England landscape. The Forest would provide an ever-increasing proportion of the softwood forest habitat in the region.

The expected decline in aspen-birch habitat on the Forest over the next few decades would enhance the decline in surrounding areas. Populations of species associated with aspen-birch habitat would decline throughout the area, bringing them closer to historic levels.

Overall, land allocation and long-term management to meet composition objectives could result in population changes for many species that currently use the Forest, but should not cause viability concerns or result in extirpation of any species. The Forest would continue to provide a diversity of habitats across the landscape to support the same wide array of wildlife and plant species.

Alternative 2

Direct and Indirect Effects

The distribution of all habitats among MAs allowing vegetation management and MAs that change primarily through natural processes would change by less than three percent compared to the current condition (Table 3-16). Changes of one to three percent are so small, when considered at the landscape scale, that they should not alter the ability of the Forest Service to manage or protect any habitat type.

As with Alternative 1, management in MA 2.1 would move the Forest toward habitat composition objectives (Table 3-13). In this alternative, the objectives would move the MA closer to potential natural vegetation on these lands while maintaining important wildlife habitats, such as aspen-birch forest and openings.

In MAs other than MA 2.1, changes in composition of all habitat types would be the same as those described for Alternative 1. Within MAs 2.1, all

mixedwood stands, and most hardwood stands, on softwood ELTs would be managed through uneven-aged treatments to encourage the softwood component. As a result, the number of spruce, fir, and hemlock trees in these stands will increase. Almost all existing softwood habitat in MA 2.1 would be managed through uneven-aged treatments or left to age, both of which would maintain it as softwood forest. Little, if any, would be converted to aspen-birch forest. The amount of softwood habitat will increase across the Forest in the next 20 years due to conversion of old aspen-birch forest to softwoods (Table 3-14a).

Existing aspen-birch habitat in MA 2.1 would be regenerated to maintain it as aspen-birch habitat. A few hundred acres of hardwood or softwood habitat could be managed to convert it to aspen-birch habitat where conversion would result in strong aspen-birch habitat and would benefit wildlife species. Because the objective would be to maintain the current amount of aspen-birch habitat in the MA, not to increase it, less conversion of softwood and hardwood habitats would occur than under Alternative 1. Forest-wide, aspen-birch habitat would decline substantially as land outside MA 2.1 converts to other habitats.

In MA 2.1, most hardwood forest habitat and mixedwood habitat on non-softwood ELTs would be managed through both even-aged and uneven-aged methods. Hardwood and mixedwood forest on softwood ELTs would be managed through uneven-aged methods, or not managed, to encourage conversion to softwood forest. In the next 20 years, hardwood and mixedwood habitats would remain at existing levels in MA 2.1, though more softwood trees would occur in some stands. Forest-wide, these habitats will increase as old aspen-birch dies and converts to other habitats.

Many existing permanent openings in MA 2.1 would be maintained. The only new wildlife opening habitat that would be created would be to replace existing openings that do not provide high quality habitat. Overall, the amount of wildlife opening habitat should not change from current levels in MA 2.1 or across the Forest.

As with Alternative 1, the primary change to forest composition expected in the next 20 years on the White Mountain National Forest is the natural conversion of thousands of acres of old aspen-birch habitat to softwoods and a small amount of hardwoods or mixedwoods. Habitat for all wildlife species should remain present on the Forest, and all except aspen-birch forest should be well distributed.

Cumulative Effects

Long-term changes to habitat composition in MAs other than 2.1 would be the same as described for Alternative 1. Meeting the composition objectives in MA 2.1 for this alternative would result in a doubling of spruce-fir forest in this MA, a small decrease in hardwood forest, and a substantial decrease in mixedwood forest as it converted toward softwood habitat over the next two centuries. This alternative results in a greater shift toward softwoods over time than Alternative 1. As with Alternative 1, regular regeneration of aspen-birch forest and management of oak-pine habitat in MA 2.1 would prevent these habitats from converting to softwood or hardwood forest.

Forest-wide, northern hardwood and mixedwood forests will reach their peak abundance on the Forest in the next two or so decades as a few thousand acres of old aspen-birch outside MA 2.1 convert to hardwoods or mixedwood. From that point, these habitats will gradually decline over the next two centuries as some of them convert to softwood forest, which would see a corresponding increase in abundance. Oak-pine habitats also would decrease in the long-term, while hemlock and opening habitats would remain stable across the Forest (Table 3-14b).

Effects to forest habitat composition outside the National Forest would be similar to those described for Alternative 1. The cumulative effects for this alternative would differ slightly because the increase in softwood habitat and decrease in aspen-birch habitat on the Forest in the long-term would be even greater. The proposed doubling of softwood forest habitat would further counteract the continuing conversion of softwoods to hardwood and mixedwood forest off-Forest, providing a better diversity of habitats at the regional scale than under Alternative 1. The larger decrease in aspen-birch habitat would intensify the apparent loss of this habitat in parts of New Hampshire surrounding the Forest. Populations of species associated with aspen-birch habitat would decline throughout the area, bringing them closer to historic levels.

Across the Forest, land allocation and long-term management to meet composition objectives would bring habitat composition more in line with potential natural vegetation (see Affected Environment). Composition changes could result in population changes for many species that currently use the Forest, but should not cause viability concerns or result in extirpation of any species from the Forest. Changes would be gradual, allowing species time to adjust to the degree possible. The White Mountain National Forest would continue to provide a diversity of habitats across the landscape to support the same wide array of wildlife and plant species.

Alternative 3

Direct and Indirect Effects

The proportion of all habitats except openings that would be in MAs allowing vegetation management would decrease by five to nine percent compared to the current condition (Table 3-16). Wildlife openings in these MAs would increase slightly. The habitat decreases are largely because seven percent less of the Forest as a whole is in these MAs. Loss of land from these MAs could alter the ability of the Forest Service to manage these habitat types, especially aspen-birch and oak-pine habitats, which require management or natural disturbance to persist in the long-term.

As with the other alternatives, management in MA 2.1 would move the Forest toward habitat composition objectives (Table 3-13). In other MAs, changes in habitat type composition would be the same as those described for Alternative 1. See Table 3-14a for expected habitat trends in MA 2.1 and across the Forest.

The habitat composition objectives for MA 2.1 in this alternative are the same as proposed in Alternative 2. However since fewer acres of aspen-

birch habitat are in MA 2.1 in this alternative, a few hundred acres of hardwood and softwood habitat in MA 2.1 would need to be converted to aspen-birch to meet the objective. This increase in management for aspen-birch habitat, and resulting declines in softwood and hardwood habitat, would be so small that they would not alter expected habitat trends from those for Alternative 2. Given the slowness with which hardwood and mixedwood stands will evolve toward spruce-fir forest with or without management, the differences among alternatives in allocation of acres of these habitats also should not change habitat trends during the analysis timeframe.

As with the other alternatives, the primary change to forest composition expected in the next 20 years on the White Mountain National Forest is natural conversion of thousands of acres of old aspen-birch habitat to softwoods and a small amount of hardwoods or mixedwoods. Habitat for all wildlife species should remain present on the Forest, and all except aspen-birch forest should be well distributed.

Cumulative Effects

The reduction in acres of softwood, mixedwood, hardwood, and aspen-birch habitat in MAs that allow commercial timber harvest could affect the Forest Service's ability to speed the conversion of mixedwood and hardwood habitat on softwood ELTs and to maintain aspen-birch habitat on the Forest. The conversion toward softwood forest would still occur across the Forest, just a little more slowly than with management. The impact on species using these habitats would be minimal. The allocation of more land to MAs that do not allow commercial timber harvest would further reduce the amount of aspen-birch habitat on the Forest in the long-term because more would gradually revert to hardwood or softwood habitat. Even with the larger decrease in aspen-birch habitat, changes should not cause viability concerns or result in extirpation of any species from the Forest, because aspen-birch habitat and associated species would naturally occur at low levels on the Forest. Some species would drop below desired levels, reducing hunting and viewing opportunities.

Long-term expected trends in all habitats would be the same as for Alternative 2 (Table 3-14b) because most changes could result from natural processes or management. As just stated, the expected conversion to softwoods would simply take longer under this alternative.

Effects of off-Forest management on forest composition outside the National Forest would be similar to those described for Alternative 1. The cumulative effects for this alternative would be similar to those described for Alternative 2, but with a larger decrease in aspen-birch habitat and associated species, both on the Forest and on the landscape.

Alternative 4

Direct and Indirect Effects

The proportion of northern hardwood and hemlock stands in MAs allowing vegetation management would increase by four to five percent (Table 3-16), which would increase the Forest Service's ability to manage these habitats

slightly. The distribution of all other habitats between MAs allowing vegetation management and those that do not would remain the same as current (see Affected Environment) or would change by less than three percent and should not alter the ability of the Forest Service to manage these habitats.

As with all other alternatives, management in MA 2.1 would move the Forest toward habitat composition objectives (Table 3-13). In other MAs, changes in habitat type composition would be the same as those described for Alternative 1.

The habitat composition objectives and the initial relative abundance of each habitat in MA 2.1 would be the same as for Alternative 2; therefore, the expected changes in habitat abundance across the Forest from vegetation management and natural processes would be the same as described for Alternative 2 (Table 3-14a).

As with the other alternatives, the primary change to forest composition expected in the next 20 years on the White Mountain National Forest is natural conversion of thousands of acres of old aspen-birch habitat to softwoods and a small amount of hardwoods or mixedwoods. Habitat for all wildlife species should remain present on the Forest, and all except aspen-birch forest should be well distributed.

Cumulative Effects

Cumulative effects to forest composition would be the same as described for Alternative 2 because the current composition, habitat composition objectives, and direct and indirect effects in this alternative are essentially the same as those for Alternative 2.

Age Classes

As discussed in the Affected Environment, stand-replacing natural disturbance levels are low and current patterns are likely similar to historic. Therefore, the Forest is probably within the historic range of variability for forest age class. The narrow ranges and low levels of large-scale natural disturbance mean that even fairly minimal levels of stand-replacing management could place the Forest outside the historic range of variability for age classes. Past management of what is now the White Mountain National Forest caused it to be well outside the historic range of variability in the past, which resulted in a substantially modified landscape.

For some wildlife and plant species, the age of a forest is as important in determining whether it is suitable habitat as the forest type. Therefore, wildlife also changed as a result of past management, with populations of species that rely on regeneration-age forest increasing considerably. Age class objectives proposed in all alternatives would move the Forest closer to historic levels. However all but Alternative 3 would moderate the continuing decline of habitats and species whose populations were elevated by past management. As a result, regeneration age forest would be created at levels that would be above average pre-settlement levels.

Given the large, fairly contiguous landscape and stated goals of the WMNF, the ideal is to have old growth available as a forest system in blocks large

enough to withstand natural disturbance cycles typical of a given forest type over the long-term. However until a substantial portion of the Forest meets this definition, smaller areas that are greater than 10 acres in size and have the desired structure and age should be protected as important, though isolated, communities and refugia for associated species. As the Forest ages over time and large areas of old growth become available, the need to protect small patches will diminish.

Age class objectives in Management Area 2.1 (and 3.1 in Alternative 1) vary among the alternatives for several habitats (see Chapter 2). Objectives are expressed as ranges to account for expected variation in even-aged harvest across the decades. Changes among alternatives in regeneration age class objectives result in corresponding differences in young and mature Forest objectives. Therefore, effects relating to age class distribution in MA 2.1 stem primarily from changes in regeneration age class objectives (Table 3-17).

Table 3-17. Regeneration age class objectives for MA 2.1 (and 3.1) lands by alternative, percent of MA(s).

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Northern Hardwood	4-7	3-4	1	3-6
Mixedwood	4-7	1	1	1
Spruce-Fir	1-2	1-2	1-2	1-2
Aspen-birch	12-15	12-15	12-15	12-15

As a result of varying age class objectives, different amounts of each age class would be expected on the Forest 20 years from now and 150 years from now, depending on the alternative implemented. Table 3-18a displays the expected trends in age classes across the Forest in the short-term, and Table 3-18b displays likely trends if proposed management continues for 150 years. See the Environmental Effects for each alternative for more information on differences and expected changes.

Effects Common to All Alternatives

Direct and Indirect Effects

Age class of forest habitats would be altered by vegetation management in MAs 2.1, 3.1, 7.1, 9.2, and the experimental forests. In all other MAs, forest habitats would be allowed to mature, except where natural disturbance or development occurred. New development outside MAs 2.1, 3.1, and the ski areas would be limited to trails and backcountry facilities such as shelters and tent platforms. These types of facilities impact only small patches of ground, so they would not actually alter the age of whole forest stands. Therefore, across more than half the Forest, in all alternatives, forest habitats would continue to age, moving from the mature to old age class except where large-scale natural disturbance occurred. A number of areas on the Forest would provide habitat to those species that prefer large blocks of relatively undisturbed forest habitat.

MAs 7.1, 9.2, and the experimental forests would continue to provide a mix of habitats. In all alternatives, vegetation would be managed in large areas of MA 7.1 and the experimental forests, including creation of new openings for ski runs and regeneration forest habitat for research projects. It would be allowed to age naturally in other areas. Most of MA 9.2 would age naturally, but timber harvest could occur in small amounts.

As stands of all types across the Forest age from young to mature or mature to old, the trees increase in size, canopy closes in, and decay results in more snags, cavities, and down logs. All of these processes improve the quality of habitat for some wildlife species. Uneven-aged timber harvest in mature forest gives remaining trees more room to grow, allowing them to increase in size more quickly. This can improve habitat quality for some species. The effects of harvest on snags, cavities, and down logs are addressed in a separate part of this section.

In softwood habitat, the primary change Forest-wide would be evolution of existing young forest into mature habitat and mature forest into the old age class (Table 3-18a). Levels of regeneration forest would remain essentially the same as current in all alternatives, with even-aged regeneration harvest and natural disturbance expected to be stable. See the Wildlife section, MIS subsection for more discussion on the effects of meeting age class objectives on softwood forest species.

Alternative 1

Direct and Indirect Effects

In northern hardwood and mixedwood habitats, moving toward proposed age class objectives (Table 3-19) would more than quadruple the amount of regeneration forest, and increase the amount of young forest, in MAs 2.1 and 3.1. This level of even-aged regeneration harvest would benefit species that prefer or depend on regeneration and young deciduous forest habitat (see MIS in Wildlife section). Mature forest habitat would decline slightly as some is regenerated and more moves into the old age class (Table 3-18a). Forest-wide, a majority of hardwood and mixedwood habitats would remain in the mature or old age classes.

Meeting the aspen-birch objectives in MAs 2.1 and 3.1 would require regeneration harvest of a large amount of aspen-birch habitat in the first decade or two before it dies and is harder to perpetuate. Therefore, the amount of aspen-birch in the regeneration age class would increase substantially and exceed the proposed objective in the next 20 years, but would level out over time with management. The mature age class would remain stable over the next 20 years as existing young forest ages. Young forest also would remain stable due to high levels of regeneration harvest in the first decades (Table 3-18a). Given the current age distribution of aspen-birch, only the old age class objective would be met during the next 20 years; others would require more time for management to achieve the desired balance. Forest-wide, aspen-birch as a whole will be declining as old age habitat converts to other types (see Habitat Composition discussion). The result is that old aspen-birch will decline substantially and in 20 years or so,

*Table 3-18a. Current Age Distribution on the WMNF and Expected Trends for Next 20 years, by Alternative and Habitat Type.**

Age Class	Current Condition	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Regeneration	4,205	↑ / ↑ / ↔ / ↑	↑ / ↔ / ↔ / ↑	↔ / ↔ / ↔ / ↑	↑ / ↔ / ↔ / ↑
Young	80,325	↑ / ↑ / ↓ / ↔	↑ / ↓ / ↓ / ↔	↓ / ↓ / ↓ / ↔	↑ / ↓ / ↓ / ↔
Mature	392,500	↓ / ↓ / ↓ / ↔	↓ / ↓ / ↓ / ↔	↓ / ↓ / ↓ / ↔	↓ / ↓ / ↓ / ↔
Old	291,900	↑ / ↑ / ↑ / ↓	↑ / ↑ / ↑ / ↓	↑ / ↑ / ↑ / ↓	↑ / ↑ / ↑ / ↓

* Arrows show increasing, stable, or decreasing "hardwood / mixedwood / spruce-fir / aspen-birch" trends

*Table 3-18b. Expected Age Distribution Trends on the WMNF for 20-150 years from start of implementation, by Alternative and Habitat Type.**

Age Class	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Regeneration	↔ / ↓ / ↑ / ↑	↔ / ↓ / ↑ / ↔	↓ / ↓ / ↑ / ↔	↔ / ↓ / ↑ / ↔
Young	↔ / ↔ / ↑ / ↑	↔ / ↓ / ↑ / ↔	↓ / ↓ / ↑ / ↔	↔ / ↓ / ↑ / ↔
Mature	↓ / ↓ / ↓ / ↓	↓ / ↓ / ↓ / ↓	↔ / ↓ / ↓ / ↓	↓ / ↓ / ↓ / ↓
Old	↑ / ↑ / ↑ / ↔	↑ / ↑ / ↑ / ↔	↑ / ↑ / ↑ / ↔	↑ / ↑ / ↑ / ↔

* Arrows show increasing, stable, or decreasing "hardwood / mixedwood / spruce-fir / aspen-birch" trends

Table 3-19. MA 2.1 and 3.1 Age Class Objectives.

Habitat Types	Percent Regen		Percent Young		Percent Mature		Percent Old	
	2004[1]	Obj.[2]	2004[1]	Obj.[2]	2004[1]	Obj.[2]	2004[1]	Obj.[2]
Northern Hardwood	1	4-7	22	20-35	65	43-61	12	15
Mixedwood	1	4-7	11	20-35	73	37-55	15	21
Spruce-Fir	1	1-2	6	3-6	69	64-68	24	28
Aspen/Birch	3	12-15	27	36-45	19	13-25	51	27

[1] Current condition changes between alternatives because landbase allocated to MA 2.1 changes between alternatives.
[2] Obj. = Objective.

aspen-birch age classes across the Forest will be essentially the same as the MA 2.1 and 3.1 conditions.

Meeting the proposed age class objectives would substantially increase hardwood, mixedwood, and aspen-birch regeneration age habitats on the Forest, and could increase it slightly in softwood habitat. This alternative proposes the most regeneration-age forest habitat and moderates the decline of some wildlife species more than other alternatives (see MIS in Wildlife section). However, even-aged regeneration harvest would still occur on less

than 2 percent of the Forest in any given decade. Natural disturbance regimes indicate that an additional one to six percent of the Forest would be in regeneration age forest habitat from wind and other disturbances.

Mature forest would become less abundant in all habitats except aspen-birch. Some of it would be harvested to meet the regeneration age class objectives. Some would continue to age because it is on lands that are not available or are unsuitable for timber harvest. A majority of the Forest would become old forest habitat, which would gradually increase in all but the aspen-birch habitat.

Cumulative Effects

Because the regeneration age class objectives are a percentage of each habitat type, expected reductions in mixedwood forest as it gradually converts to softwood habitat would result in slightly less regeneration age habitat in the long-term. Hardwood habitat declines are expected to be small enough that regeneration habitat levels should not change over the long term. As softwood habitat increases in MAs 2.1 and 3.1, regeneration and young softwood habitat also would increase, resulting in increases in these habitats across the Forest. As aspen-birch habitat in MAs 2.1 and 3.1 increases (see Habitat Composition discussion), acres of regeneration and young habitat also would increase. Effects of these changes on wildlife are discussed in the Wildlife section.

As previously stated, meeting the age class objectives for aspen-birch habitat would require more than two decades. Subsequent decades would see a leveling-out of regeneration harvest as efforts to regenerate a large amount of old and mature forest before it is lost give way to maintenance of the regeneration and young age classes. Future decades also would see the mature age class settling within the objective range. This would benefit species that select regeneration and young forest, and all species that use aspen-birch habitat (see MIS in Wildlife section).

A majority of the Forest would continue aging for the next 150 years, placing all Forest land that is not affected by timber harvest in the old age class. Those species that need structural diversity in a stand would benefit from natural aging of a forest, and would gradually find more suitable habitat over the next 150 years (Table 3-18b).

Land managed through uneven-aged methods would, ecologically, remain in the mature age class over the next 150 years. While some trees in these stands would be old, the structure and function of the habitat would probably more closely match mature forest, even with reserve tree standards and guidelines. Mature forest also would occur on some of the land managed through even-aged methods. However, given the aging of the majority of the Forest, mature forest habitat of all types would continue to decline over the next 150 years.

In the New Hampshire portion of the analysis area, nearly 60 percent of harvests are individual tree selection cuts. Almost 10 percent are even-aged regeneration harvests for timber, and another 10 percent are land clearing for development (Thorne and Sundquist, 2001). FIA (Northeastern Forest Research Station, 1995; 1997) and Thorne and Sundquist (2001) data indicate

that there was substantially more regeneration forest habitat off-Forest in the mid 1990s than on the National Forest (see Affected Environment). Many biologists agree that clearcutting, and, therefore, regeneration forest habitat of all types, is decreasing and will continue to decline in the analysis area. Total timber harvest is likely to decline in the future (see Affected Environment), but data was not found to address current trends for specific harvest methods. Recent Forest Practices legislation in Maine reduced the maximum allowable size for clearcuts, which is likely to reduce total acres of clearcut harvest, both because each unit is smaller and because some managers are using other harvest techniques instead of dealing with the new rules for clearcutting.

Declines in regeneration forest habitat off-Forest and increases in the same habitat on-Forest over the next few decades will likely result in a slight shift in species populations, balancing their distribution on the landscape.

The expected reduction in even-aged regeneration harvests off-Forest does not necessarily mean more high quality mature and old forest habitat. Forestland overall is expected to continue declining in the future as development pressures increase (Sundquist and Stevens, 2001). Many of the lands that remain forested would likely still be intensively managed. As parcel size decreases and ownership turnover increases, there is greater potential for poor management of mature forest habitats. However as information on how to manage forests to retain late-successional forest components becomes more readily available, there is potential for improvement. Which changes will happen more rapidly or on more acres is unknown, making the retention of much of the WMNF in mature and old forest conditions critical to ensuring local biodiversity in the long-term.

Alternative 2

Direct and Indirect Effects

Moving toward proposed age class objectives (Table 3-20) for hardwood habitat would at least triple the amount of regeneration forest, and increase the amount of young forest, in MA 2.1. This level of even-aged regeneration harvest would benefit species that prefer or depend on regeneration and young deciduous forest habitat (see MIS in Wildlife section). The increase

Table 3-20. MA 2.1 Age Class Objectives

Habitat Types	Percent Regen		Percent Young		Percent Mature		Percent Old	
	2004[1]	Obj.[2]	2004[1]	Obj.[2]	2004[1]	Obj.[2]	2004[1]	Obj.[2]
Northern Hardwood	1	3-4	22	15-20	65	61-67	12	15
Mixedwood	1	1	11	5	74	73	14	21
Spruce-Fir	1	1-2	6	3-6	69	66-70	24	26
Aspen-Birch	3	12-15	25	36-45	18	18-30	54	22

[1] Current condition changes between alternatives because landbase allocated to MA 2.1 changes between alternatives.

[2] Obj. = Objective

in regeneration-age hardwood habitat on the Forest would not be as large as in Alternatives 1 and 4. Despite the smaller increase in regeneration and young hardwood habitats, mature forest habitat would decline slightly on the Forest, as some is regenerated and much of it moves into the old age class (Table 3-18a). Forest-wide, even more hardwood habitats would be in the mature or old age classes than under Alternative 1.

Mixedwood forest in MA 2.1 would be managed differently than in Alternative 1. Most would be treated through uneven-aged methods to move them toward softwood forest habitat (see Habitat Composition discussion). Therefore, the regeneration age class objective is equivalent to current conditions, which is less than Alternative 1. Since mixedwood habitat levels in MA 2.1 would not change in the next 20 years, regeneration-age habitat would remain stable. Young mixedwood forest is currently abundant, but would decline in the next 20 years as it moves into the mature age class. Much of the mature mixedwood habitat across the Forest would move into the old age class, resulting in a slight decline in mature forest and an increase in old mixedwood habitat.

The proposed age class objectives for aspen-birch habitat are very similar to those for Alternative 1. Therefore, the management and time necessary to achieve these objectives, and age class trends, would be the same as for Alternative 1 (Table 3-18a). Forest-wide, old aspen-birch will decline substantially and in 20 years or so, aspen-birch of all ages across the Forest will be limited to what is in MA 2.1.

Meeting age class objectives in MA 2.1 would result in an increase in the amount of regeneration-age hardwood and aspen-birch habitat on the Forest, and a possible increase in softwood regeneration forest. Overall, this alternative would provide less regeneration forest habitat than Alternatives 1 and 4, but more than Alternative 3. To meet these habitat objectives, even-aged regeneration harvest would occur on just over one percent of the Forest. Natural disturbance regimes indicate that an additional one to six percent of the Forest would be in regeneration age forest habitat.

As would be true with all other alternatives, mature forest would decline in all habitats, except aspen-birch, due to even-aged regeneration harvest and advancement into the old age class. For all habitats except aspen-birch, natural aging of the Forest would mean an increase in the amount of old forest.

Cumulative Effects

The expected differences in hardwood and spruce-fir habitat abundance from Alternative 1 would not be great enough in the next 150 years to cause substantial differences in age class abundance. Mixedwood age class abundance will be different from Alternative 1 due to different objectives, as described for direct and indirect effects, but conversion to spruce-fir habitat should not add to those differences during the planning time period.

As with Alternative 1, meeting the age class objectives for aspen-birch habitat would require more than two decades. Subsequent decades would see a leveling-out of regeneration harvest as efforts to regenerate a large amount

of old and mature forest before it is lost give way to maintenance of the regeneration and young age classes. Future decades also would see the mature age class settling within the objective range. This would benefit species that select regeneration and young forest and all species that use aspen-birch habitat (see MIS in Wildlife section). Since aspen-birch habitat in MA 2.1 is expected to be stable, there would be no increase in regeneration and young forest habitats over time.

Mature forest habitat of all types would continue to decline as more of the Forest advanced to the old age class. This decline would be slightly less than for Alternative 1 because more mixedwood forest likely would be managed through uneven-aged methods, keeping it in the mature age class. However the majority of the Forest would eventually be in the old age class.

Effects to forest age outside the WMNF would be similar to those described for Alternative 1. The cumulative effects for this alternative would differ slightly because northern hardwood and mixedwood forest regeneration age class objectives on the Forest are slightly lower than under Alternative 1. Implementation of this alternative would almost triple the amount of regeneration forest habitat in MA 2.1. Despite this increase, the Forest would likely remain at levels below the adjacent lands, even if clearcutting on surrounding lands decreases somewhat. This would allow for a more even distribution of species that prefer or depend on regeneration and young forest habitats across the landscape in the analysis area compared to the current condition, but a slightly less-even distribution than under Alternative 1. As with Alternative 1, mature and old forest conditions would continue to dominate the Forest landscape, providing a core area of habitat for species dependent on these conditions.

Alternative 3

Direct and Indirect Effects

This alternative proposes the smallest amount of even-aged regeneration harvest (Table 3-17). As a result, regeneration-age hardwood habitat would remain stable at current levels, and young habitat would decline, as current young forest advances to the mature age class. Therefore, this alternative would provide the least habitat for species that use or depend on regeneration and young deciduous forest (see MIS in Wildlife section). Despite high levels of uneven-aged management, compared to the other alternatives, mature hardwood habitat across the Forest would probably still decline in this alternative (Table 3-18a), because so much mature habitat would not be managed and would move into the old age class. This decline would be smaller than in all other alternatives, and this alternative would result in even more of the Forest's hardwood habitat being in mature and old age classes (Table 3-21).

Management of mixedwood forest, and therefore expected trends in age class abundance, would be the same as in Alternative 2 (Table 3-18a).

The proposed age class objectives for aspen-birch habitat are very similar to those for Alternative 1. Therefore, the management and time necessary to achieve these objectives, and age class trends, would be the same as for

Table 3-21. MA 2.1 Age Class Objectives.

Habitat Types	Percent Regen		Percent Young		Percent Mature		Percent Old	
	2004[1]	Obj.[2]	2004[1]	Obj.[2]	2004[1]	Obj.[2]	2004[1]	Obj.[2]
Northern Hardwood	1	1	24	5-6	64	80-81	11	13
Mixedwood	1	1	12	3	73	77	14	19
Spruce-Fir	1	1-2	8	3-6	69	68-72	22	24
Aspen-Birch	3	12-15	31	36-45	20	17-29	46	23

[1] Current condition changes between alternatives because landbase allocated to MA 2.1 changes between alternatives.
[2] Obj. = Objective

Alternative 1 (Table 3-18a). Because less aspen-birch habitat is in MA 2.1 in this alternative, there would be fewer acres of regeneration and young aspen-birch habitat on the forest. Once the old aspen-birch declines substantially in 20 years or so, aspen-birch of all ages across the Forest will be limited to what is in MA 2.1.

Meeting age class objectives in MA 2.1 would result in an increase in the amount of regeneration-age aspen-birch habitat on the Forest, and a possible increase in softwood regeneration forest. Overall, this alternative would provide the smallest amount of regeneration forest habitat. Even-aged regeneration harvest would occur on less than one percent of the Forest. Natural disturbance regimes indicate that an additional one to six percent of the Forest would be in regeneration age forest habitat.

As would be true with all other alternatives, mature forest would decline in all habitats, except aspen-birch, due to even-aged regeneration harvest and advancement into the old age class. For all habitats except aspen-birch, natural aging of the Forest would mean an increase in the amount of old forest.

Cumulative Effects

The potential for changes in hardwood, mixedwood, and spruce-fir forest abundance to alter age class trends would be the same as for Alternative 2.

Long-term trends in age class abundance for aspen-birch would be the same as for Alternative 2 (Table 3-18b), because habitat composition and age class objectives would be essentially the same. Given the reduced land allocation to MA 2.1, there would be fewer acres of all aspen-birch age classes, but the age class distribution would be the same.

Mature mixedwood, softwood, and aspen-birch habitat would continue to decline as more of the Forest advanced to the old age class. These declines would be similar to those for Alternative 2. Mature hardwood forest would be stable (Table 3-18b), because more of this habitat would be managed through uneven-aged methods over the next 150 years, keeping it in the mature age class.

Effects to forest age outside the National Forest would be similar to those described for Alternative 1. The cumulative effects for this alternative would

differ slightly, because regeneration age class objectives in northern hardwood habitat are lower than under all other alternatives. Implementation of this alternative would increase the amount of regeneration forest habitat in MA 2.1 compared to current levels by about 40 percent, which would likely keep the Forest at levels within the natural disturbance regime and below the adjacent lands, even if clearcutting on surrounding lands decreases somewhat. As a result, the current relative distribution of habitats and species on the landscape would remain, with the Forest likely supporting only minimal populations of species that prefer or depend on regeneration and young forests. The Forest would provide a slightly larger concentration of habitat for species dependent on mature and old forest conditions, to balance potential changes off-Forest.

Alternative 4

Direct and Indirect Effects

Moving toward proposed age class objectives (Table 3-22) for hardwood habitat would quadruple the amount of regeneration forest, and increase the amount of young forest, in MA 2.1. This even-aged regeneration harvest benefits species that prefer or depend on regeneration and young deciduous forest habitat (see MIS in Wildlife section). The increase in regeneration-age hardwood habitat on the Forest would be similar to that in Alternative 1. Mature hardwood forest habitat would decline slightly on the Forest as some is regenerated and much of it moves into the old age class (Table 3-18a). Forest-wide, a majority of hardwood habitats would remain in the mature or old age classes.

Table 3-22. MA 2.1 Age Class Objectives.

Habitat Types	Percent Regen		Percent Young		Percent Mature		Percent Old	
	2004[1]	Obj.[2]	2004[1]	Obj.[2]	2004[1]	Obj.[2]	2004[1]	Obj.[2]
Northern Hardwood	1	3-6	22	15-30	65	45-63	12	19
Mixedwood	1	1	12	5	73	72	14	22
Spruce-Fir	1	1-2	6	3-6	69	64-68	24	28
Aspen-Birch	3	12-15	25	36-45	18	8-20	54	32

[1] Current condition changes between alternatives because landbase allocated to MA 2.1 changes between alternatives.
[2] Obj. = Objective

Management of mixedwood forest, and, therefore, expected trends in age class abundance, would be the same as in Alternative 2 (Table 3-18a).

The proposed age class objectives for aspen-birch habitat are very similar to those for Alternative 1. Therefore, the management and time necessary to achieve these objectives, and age class trends, would be the same as for Alternative 1 (Table 3-18a). Forest-wide, old aspen-birch will decline substantially and in 20 years or so, aspen-birch of all ages will be limited to what is in MA 2.1.

Meeting age class objectives in MA 2.1 would result in an increase in the amount of regeneration-age hardwood and aspen-birch habitat on the Forest, and a possible increase in softwood regeneration forest. Overall, this alternative would provide less regeneration forest habitat than Alternative 1, slightly more than Alternative 2, and substantially more than Alternative 3. To meet the proposed habitat objectives, even-aged regeneration harvest would occur on just over one percent of the Forest. Natural disturbance regimes indicate that an additional 1 to 6 percent of the Forest would be in regeneration age forest habitat.

As would be true with all other alternatives, mature forest would decline in all habitats, except aspen-birch, due to even-aged regeneration harvest and advancement into the old age class. For all habitats except aspen-birch, natural aging of the Forest would mean an increase in the amount of old forest.

Cumulative Effects

The potential for changes in hardwood, mixedwood, and spruce-fir forest abundance to alter age class trends would be the same as for Alternative 2.

Long-term trends in age class abundance for aspen-birch would be the same as for Alternative 2, because habitat composition and age class objectives would be essentially the same.

Mature forest habitat of all types would continue to decline as more of the Forest advanced to the old age class. This decline would be slightly less than for Alternative 1, because more mixedwood forest likely would be managed through uneven-aged methods, keeping it in the mature age class. However, the majority of the Forest would eventually be in the old age class.

Effects to forest age outside the White Mountain National Forest would be similar to that described for Alternative 1. The cumulative effects for this alternative would differ slightly, because the mixedwood habitat regeneration age class objective is lower than for Alternative 1. Implementation of this alternative would more than triple the amount of regeneration forest habitat in MA 2.1 throughout the next 50 years. Despite this increase, the Forest likely would remain at levels below the adjacent lands, even if clearcutting on surrounding lands decreases somewhat. This would allow for a more even distribution of species that prefer or depend on regeneration and young forest habitats across the landscape in the analysis area compared to the current condition, but slightly less of an even distribution than under Alternative 1. As with Alternative 1, mature and old forest conditions would continue to dominate the Forest landscape, providing a core area of habitat for species dependent on these conditions to balance potential reductions off-Forest.

Snags, Cavities, and Coarse Woody Debris

Effects Common to All Alternatives

Gore and Patterson (1986) and Fay et al. (1994) indicate that regeneration forest habitat has the highest levels of dead wood, with old uncut forest not

much lower, and young, pole-sized, and uneven-aged managed forests having the lowest levels. More of the available dead wood is small diameter material in regenerating forest than in uncut forest (Gore and Patterson, 1986). Uneven-aged, managed forest is estimated to have 15-20 percent of the dead wood found in old, uncut forest of similar types (Fay, 2000). In forest managed through even-aged methods, increased rotation length, increased basal area retention, and fewer intermediate entries can increase the potential for large diameter dead wood to develop (Tubbs et al., 1987). Requiring retention of snags, cavity trees, and down logs can increase the amount of dead wood available after any type of harvest and minimize the differences between treatment types.

Based on this information, landscapes comprised primarily of old, uncut forest or stands managed through even-aged, long-rotation methods are likely to have more and larger diameter dead wood available than those managed primarily with short rotation or uneven-aged methods, unless standards and guidelines to protect dead material are in place. The Timber Resources Affected Environment describes how much of various types of harvest have been implemented in recent years on the Forest. Currently, there are standards and guidelines requiring retention of snags and cavity trees; these standards and guidelines apply to even- and uneven-aged management.

All four alternatives propose even-aged and uneven-aged timber harvest, though how many acres would be impacted in the next 20 years varies. Standards and guidelines require that certain levels of snags, cavity trees, and down logs be retained through both even- and uneven-aged management in all alternatives. As a result, moderate levels of dead material would remain in all managed stands, regardless of harvest method.

All types of harvest would likely result in some loss of this habitat due to safety concerns and the logistics of implementing a sale (i.e., clearing for skid trails). This could affect individual animals using these habitat structures, and would reduce habitat availability slightly. However, the standards and guidelines should ensure that enough snags, cavity trees, and down logs are retained to provide the habitat necessary to maintain populations of all dependent species. Since the standards and guidelines to protect dead wood habitats apply to all alternatives, the difference in acres of harvest among alternatives should not result in noticeably different effects on these habitats or associated species at a landscape scale.

Permanent conversion of forest habitat to non-forest conditions, such as parking lots, often results in loss of snags, cavity trees, and down logs. Trails, campgrounds, and other recreational facilities often require removal of snags for safety reasons. In addition, campers collect dead and down material near backcountry campsites and campgrounds for firewood. All alternatives include additional campsites, parking areas, trails, and other recreational facilities across the Forest, though the amount of development varies among alternatives. Each of these facilities would impact a small amount of ground. Even under Alternative 4, which proposes the most recreational development, the loss of dead wood from recreational uses across the Forest would be minimal compared to the amount available. Some mortality of

individuals could occur and habitat would be reduced slightly, but overall wildlife populations should not be affected under any alternative.

On all the lands outside MA 2.1 and away from concentrated recreational use, forest habitats would continue to age, allowing snag, cavity tree, and down log habitats to increase over time. This increase would balance the small losses of habitat expected from harvest and recreation-related activities. With standards and guidelines to maintain habitat in harvest areas, and large areas of the Forest unaffected by harvest or concentrated recreation, none of the alternatives should alter populations of species dependent on snags, cavities, and down logs at a landscape scale.

Cumulative Effects

More than 80 percent of the analysis area in New Hampshire is in forestland (Sundquist and Stevens, 1999). Surveys have indicated that the majority of private landowners expect to harvest their land in the next two or so decades (Thorne and Sundquist, 2001). Most other landowners do not have strict requirements for snag, cavity tree, and down log retention. The northern New England states all have recommendations for retaining this habitat, but they are not legal requirements and may not be implemented by many landowners and managers. State riparian requirements would result in retention of some habitat features where they occur in designated no-harvest buffers, but these buffers are small relative to the size of most harvest areas. Therefore, it is likely that snag, cavity tree, and down log habitat will be reduced by timber harvest off-Forest.

Development of all types results in the permanent removal of snag, cavity tree, and down log habitat. In northern New England, about 10 percent of the land is in non-forest, including farmland, development, and swamps (Northeastern Forest Research Station, 1995; 1997). Much of the development is likely near the coast in Maine and New Hampshire, placing it outside the analysis area. Even within the analysis area, however, low levels of conversion of forestland for development are expected to continue in the next two or so decades (Sundquist and Stevens, 1999). Therefore, dead wood habitats are likely to decline due to development in the foreseeable future.

Individual animals, as well as the population levels of some species, could be affected in developed areas or where harvest is intense and State management recommendations are not applied. Standards and guidelines on the National Forest would help maintain populations of these species on the landscape and help minimize the impacts of off-Forest management. Protection of these habitats on the Forest is important to maintaining healthy populations of the species that are dependent on snags, cavities, and down logs.

Effects on Non-priced Benefits

See page 3-70.

Timber Resources

Affected Environment

Timber harvesting is one of the primary means utilized to manage vegetation on the White Mountain National Forest. While the production of forest products is important, the harvest program is focused on implementing integrated resource management objectives on those management areas where harvesting is planned. Harvesting is an important tool, used to regenerate mature stands to early successional vegetation thus providing an important wildlife habitat component. Harvesting is also used to influence the species composition of forest stands to improve diversity and enhance the quality of the timber products being grown. Scenery management, particularly, the creation of vistas, is another important objective incorporated into harvest prescriptions on the Forest.

Timber harvesting is only planned in Management Area 2.1 or 3.1, and it is also allowed for salvage purposes in Management Area 6.1. Since the acreage allocated to these MAs varies by alternative, the entire National Forest will be used as the analysis area for the effects analysis.

Timber Stand Conditions

The age class composition of the White Mountain National Forest has been affected by numerous natural factors over the years, including insect and disease infestations, windthrow, ice damage, and fire. By far the greatest impact was the heavy harvesting which took place across the White Mountains late in the 19th century and in the early decades of the 20th century. There have also been impacts to the age class diversity resulting from harvesting that has taken place since the Forest's establishment in 1913. The impacts are readily apparent in Table 3-23, which displays the distribution of age classes for each of the primary forest types in Management Areas 2.1 and 3.1, the Forest lands on which active harvesting is planned.

Table 3-23. Summary of Age Class (acres/% of habitat) by Forest Habitat Type in MAs 2.1 and 3.1.

Habitat Type	Regenerating	Young	Mature	Old	Habitat total/ % of MAs
Northern Hardwood	2,600 / 1	42,200 / 22	120,600 / 64	21,700 / 12	187,100 / 53
Mixedwood	550 / 1	8,700 / 12	54,900 / 73	10,900 / 14	75,050 / 21
Softwood	325 / 1	2,600 / 6	30,200 / 69	10,800 / 25	43,925 / 12
Aspen-birch	450 / 3	4,500 / 26	3,300 / 20	8,600 / 51	16,850 / 5
Oak-pine	30 / <1	800 / 13	4,600 / 77	550 / 9	5,980 / 2
Hemlock	25 / <1	450 / 5	7,600 / 82	1,200 / 13	9,275 / 3
Total Acres	3980 / 1	59,250 / 17	221,200 / 65	53,750 / 16	338,180 / 95*

* These habitat communities do not include most wetlands, water bodies, or recently acquired lands. Therefore, the totals in this table do not match those in other tables.

In each of the community types, the overwhelming majority of the acreage, is in mature and overmature age classes. Overall, 24 percent of the MA 2.1 and 3.1 lands are in an old (overmature) age class and 58 percent are in mature age class. Conversely, only about 17 percent are in the young age class and 1 percent is in a regeneration age class. This distribution of age classes plays an important role in determining how, when, where and why timber harvesting will take place on the Forest.

Having a forest with such a large component of mature and overmature timber stands presents distinct management challenges. Short-lived species such as aspen, paper birch and balsam fir are not only going beyond financial maturity but are rapidly approaching, or beyond, physiological maturity. In the case of aspen and paper birch, these types will often be replaced by other more shade tolerant species if they continue to grow old without some sort of site disturbance being introduced. This disturbance could result from natural events such as windstorms or wildfires or it could be brought about through harvesting. However, without it, these types will be declining on the Forest.

For other forest habitat types, such as northern hardwood, the situation is very different. Because this type often contains species with long physiological life spans such as sugar maple, imminent mortality is not so likely. Nevertheless even in these types, as the stands progress further into an overmature condition, a point is reached where growth slows down and timber productivity is diminished.

Forest Health

Major insect and disease outbreaks have not occurred on the White Mountain National Forest for many years. During the early to mid eighties, the southern portion of the Forest was impacted by an outbreak of gypsy moth, which also occurred across much of the northeastern United States. On the Forest, the large outbreaks of gypsy moth tracked very closely with the presence of red oak. Even though some heavy defoliation took place, most trees recovered and salvage operations were not needed.

A large windstorm occurred across the easternmost part of the WMNF in December of 1980. As a result, more than 60 MMBF of timber were salvaged shortly thereafter. The majority of the windthrow took place in softwood or mixedwood stands.

Around the same time, heavy outbreaks of spruce budworm impacted the spruce-fir type immediately north of the Forest. However, defoliation on the Forest was limited and salvage harvests were not needed.

Presently, there are no major insect and disease issues on the WMNF. In the general area there are non-native pests that could become a problem if they reach the Forest. Most notable among them is the hemlock wooly adelgid. It has caused considerable defoliation of hemlocks in the eastern US and has been detected along the coast of Maine and south of the National Forest in New Hampshire in both Hillsborough and Merrimack counties.

Two other insect pests, the Asian long-horn beetle and the emerald ash borer have been found in the eastern United States but not in northern New

England. Additionally, there is concern that sudden oak death, an introduced disease previously confined to California, may spread to the eastern US None of these poses an imminent threat to the forests of the White Mountains but, they could if they spread into this area.

Beech bark disease (beech scale-nectria complex) is present throughout the Forest, and has been for several decades. However, American beech continues to remain a sizeable component of many northern hardwood stands.

Low levels of native insects and diseases, such as spruce budworm, are always present and do not present a threat to forest health.

Droughty conditions in the northeastern US during 2001 and 2002 have lead to drought stress being exhibited by a number of tree species on the Forest. This has resulted in scattered mortality in species such as balsam fir particularly when drought works in concert with existing pathogens such as armillaria root disease and balsam wooly adelgid.

The most notable , recent, impact to forest health occurred as a result of a region-wide ice storm that struck the area in January of 1998. A total of approximately 251,000 acres were impacted across the Forest. Some species such as sugar maple, white ash and red oak have demonstrated a strong ability to regenerate live crowns and are recovering quite well. Other species including paper birch, American beech and aspen have not responded so well and have shown greater mortality. Although a large-scale salvage effort was not undertaken on the Forest, salvage treatments were incorporated into several existing timber sales shortly after the storm and salvage operations have been a component of several sales offered since the storm. Salvage operations were focused on harvesting the most severely damaged trees before they died or seriously lost quality.

Recent Trends in Even-aged and Uneven-aged Management

The 1986 Forest Plan emphasized even-aged management as the primary silvicultural method to be employed on the Forest. This was particularly true on MA 3.1 lands where even-aged treatments were expected to account for approximately 80 percent of the acres harvested. Treatments within MA 2.1, which had strong emphasis on visual quality, were projected to be a 50-50 mix of even-aged and uneven-aged silviculture.

Implementation at these levels was expected to result in an overall program with 70 percent of the acreage receiving even-aged treatments and 30 percent receiving uneven-aged treatments. While the production of forest products, particularly high quality sawlogs, is an important objective under the current Forest Plan, harvesting is also used as a primary tool in attaining habitat composition objectives critical to numerous wildlife species. Providing regeneration age class habitat is an important objective in habitat management and even-aged regeneration harvests are the primary means through which it is accomplished.

Table 3-24. Acres Harvested by Treatment Method 1987-2003.

Harvest Method	Actual Acres Treated	Acres Planned in 1986 Forest Plan*	Percentage of Planned Acres Treated
Even-age Regeneration (clearcuts,shelt seed cuts &strip cuts)	11,960	24,640	48.5
Even-age Intermediate (thinnings, shelt prep cuts, & improvement cuts)	16,300	23,460	69.5
Uneven-age	17,626**	15,080	116.9
Total/Average	**35,765**	**63,180**	**56.6**

* Projected Forest Plan acres are based on the estimates for the first decade plus 70% of the estimate for the second decade. This accounts for 17 years of the 2-decade period.

** Uneven-age acres include both single-tree and group selection treatments. Group selection figures are adjusted to account for the fact that treatment within group selection stands is usually applied on approximately 20% of the actual stand acreage.

Table 3-24 displays the actual results of harvest accomplished under the 1986 plan from 1987 through 2003.

As the table indicates, even-aged treatments in general, and regeneration harvests in particular, have not been implemented at anywhere near the rate the plan projected. Uneven-aged treatments, on the other hand, have occurred at a rate slightly greater than the intensity envisioned in the current Forest Plan.

The emphasis on even-aged management contained in the current Plan came from a combination of factors, the primary ones being 1) it results in a mix of age classes, which is highly desirable in providing age class diversity for wildlife; 2) it promotes the regeneration of valuable timber species such as paper birch and red oak; 3) it is the most suitable method for regenerating or converting sites to an aspen-paper birch type, which is considered an important wildlife habitat component; and 4) it is an efficient system to implement.

There have been several reasons why the amount of even-aged management has been implemented at a rate below expectations and the amount of uneven-aged management has been implemented at a slightly faster pace than projected.

The use of group selection harvesting has been emphasized in silvicultural guides developed since the 1986 Forest Plan was written. Incorporating groups into uneven-aged prescriptions allows for greater diversity in the regeneration resulting from harvest. Consequently, some resource objectives that could not be met with single tree selection are being met with group selections, thus leading to increased use of uneven-aged management.

The increased amount of residential development on private lands within the Forest proclamation boundary and adjacent to the Forest has resulted in increased public concern about impacts to scenic integrity. Often, uneven-aged treatments have a less noticeable visual impact. In order to make harvest prescriptions more compatible with the changes occurring on private lands,

uneven-aged management has been used to deal with unforeseen visual issues resulting from development in the proximity of the Forest.

Even-aged Management

Even-aged treatments consist of both intermediate harvests, such as thinnings, and regeneration harvests, such as clearcuts, shelterwood cuts, or seed tree cuts.

Thinnings are generally applied to stands that are not yet old enough to regenerate. They are used to remove poor quality material, densely stocked trees, or individual trees within a stand that may be mature. The trees remaining after thinning are then free to grow more vigorously.

By far, the principal form of even-aged regeneration harvest conducted on the Forest has been clearcutting. It is a form of silviculture that is well suited to many forest types, such as northern hardwood, paper birch and aspen. When clearcuts are implemented, reserve groups of older trees are retained to improve habitat diversity. Also, snags, den trees, and other trees important to wildlife are left standing to enhance wildlife habitat. Natural regeneration begins shortly after harvest. Most sites develop an initial flush of raspberry, blackberry, or pin cherry prior to becoming fully stocked with commercial tree species. Although these species have no timber value, they are an important food source for numerous wildlife species.

A summary of the methods of even-aged regeneration harvesting recently accomplished on the Forest are displayed in Table 3-25.

The net result is that approximately 3.5 percent of the 345,000 acres contained within MA 2.1 and 3.1 lands has been regenerated with even-aged methods since 1987.

Table 3-25. Acres of Even-aged Regeneration Harvest by Treatment Method from 1987 to 2003.

Treatment Method	Acres Treated
Clearcut	9,208
Seed Tree	164
Shelterwood	2,306
Stripcut	264
Total	**11,942**

As previously discussed, natural regeneration is generally abundant in harvested stands. However, in some locations on the Forest moose populations are heavy enough that browsing of regenerating saplings causes the saplings to remain stunted. After several years of browsing, the regeneration gets to a height where it is no longer browsed and top growth resumes at a normal rate. In some circumstances, moose browsing may alter the species composition that develops on a given site, as moose show preferences for some species over others.

Uneven-aged Management

At the time the 1986 Plan was developed, uneven-aged management was viewed primarily as single-tree selection. The primary silvicultural guide being utilized at that time was issued in 1969 (Leak et al., 1969) and described uneven-aged management as the practice of "cutting of individual trees or the harvesting of trees in small groups (two or three trees)." The revised guide (Leak et al., 1987), issued after the 1986 Forest Plan, provided a very different definition of uneven-aged management, with greater emphasis on group selection treatments. In this version of the guide, group selection is defined as "… the removal of trees in groups roughly 1/20 to 2 acres in size." The change from groups of 2 to 3 trees to groups up to 2 acres (several hundred trees) permitted much more versatility in the use of group selection as a management tool.

While there have been comparatively few uneven-aged treatments implemented with groups as large as 2 acres, numerous treatments have been applied with openings ranging up to 1.5 acres in size. Small group treatments with openings 0.2 acres or smaller have been implemented in softwood and mixedwood stands for the purpose of enhancing softwood regeneration. Small openings of this nature keep the site at least partially shaded, thus favoring softwood regeneration on many ecological land types. At the same time, keeping the openings small limits the potential for wind throw immediately after harvest. Figure 3-04 shows a typical group selection opening recently created in a spruce-fir stand.

Larger groups, usually a quarter acre or larger, have been used to regenerate a mix of tree species that do not regenerate well in shade on sites where

Figure 3-04. Group Selection Harvest in the Spruce-Fir Type.

even-aged management is not appropriate. This approach readily permits the establishment of species that are intermediate in shade tolerance, such as yellow birch. Groups in excess of 0.5 acres create conditions suitable for maintaining a component of even very intolerant species, such as aspen and paper birch (Leak et al., 1987).

The vast majority of harvesting in softwood stands is accomplished using uneven-aged management. This permits regeneration to become established on a site while most of the overstory remains intact, providing winter cover for deer and other wildlife species.

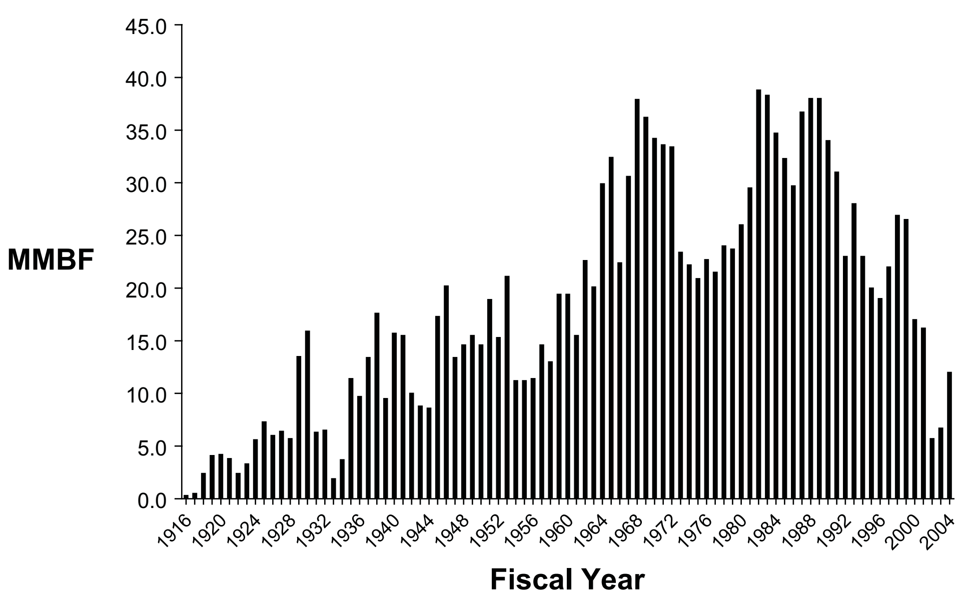
Uneven-aged management is also frequently applied in high quality northern hardwood stands where shade-tolerant sugar maple is a major component of the desired regeneration. It has been used increasingly in other hardwood types and even, to some extent, in aspen and paper birch when reasonably large groups are incorporated into prescriptions.

Timber Supply

The White Mountain National Forest has served as a source of timber products for the regional economy almost since its inception in 1913. Figure 3-05 is a summary of the volumes of timber harvested from the Forest from 1916 through 2003.

The harvest levels in Figure 3-05 depict a pattern of light harvesting in the early years, with harvest volumes peaking around 38 MMBF in the 1980s and then dropping back to around 25 MMBF through the 1990s. There was a noticeable drop in harvest levels between 1973 and 1980, due, at least in part, to the recession that occurred during the early stages of that period. At times, there were sales put up for bid that did not sell, and of those that

Figure 3-05. Timber Volumes Harvested on WMNF (1916-2003). The figures for FY 2004 are projected based on harvest levels through April of 2004.



sold, some were harvested slowly as market conditions limited harvest opportunities.

The dramatic drop from 26.5 MMBF in 1999 to 5.7 MMBF in 2002 is the result of sales not being offered on the Forest from mid-1999 through 2001. During this time, a biological evaluation and subsequent Forest Plan amendment dealing with threatened species were underway. Some volume remaining under contract continued to be harvested, but new sales were not being put under contract during these years. The year 2003 shows a rise in harvest, and that upward trend continued in 2004 . This increase is due to the fact that approximately 12 MMBF of timber was sold in FY 2002, and more than 18 MMBF in FY 2003. Harvest of these sales will be spread over a period of three years or more, so the upward trend in harvest levels is expected to continue.

The projected long-term sustained yield (LTSY) from the 345,000 acres of land allocated to Management Areas 2.1 and 3.1 in the 1986 Forest Plan is 69 MMBF per year. The allowable sale quantity established in the Plan is 35 MMBF per year or approximately 50 percent of the LTSY. Actual harvest levels through this period have averaged approximately 24 MMBF, or nearly 36 percent of the long-term sustained yield. As a result of the limited amount of harvesting that has been completed, the average age of stands on the Forest is increasing more rapidly than was projected in the 1986 Plan.

One of the results of having stands increase in age has been to see an increase in average stand diameter and subsequent increase in the sawlog component across the Forest. While this currently appears to be a positive factor, the long term implications of harvesting below the allowable sale quantity (ASQ), and thereby increasing average stand age, could cause long term sustained yield to diminish. As stands increase in age, they reach a point where incremental growth drops off. Eventually, mortality and growth nearly balance and net growth is negligible. This situation has been analyzed using the FIBER Growth Model (Solomon et al., 1995) as part of the Forest Plan revision process.

Market Conditions

The demand for forest products from the White Mountain National Forest continues to be strong. During 2002 and 2003, the Forest Service received an average of four bids per sale. Bids are typically received from loggers and mill owners residing in an area encompassing northeastern Vermont, central and northern New Hampshire, and western Maine. There is strong interest in sales containing significant quantities of sawlogs, especially sugar maple. Historically, National Forest timber sales have averaged around 30 percent sawtimber, and recent sales have been running 40 percent or higher. This increase is due in part to the increasing age of timber stands and partly to the fact that stands that were previously thinned or selectively harvested to remove low quality material are now being harvested again, and the average quality is significantly higher — thus increasing the sawlog yield.

There has been a marked difference between demand for high quality vs. low quality material marketed on the Forest. Table 3-26 displays the trend

Table 3-26. Value of Forest Products Sold on WMNF 1987-2003.

Fiscal Year	Sawtimber $ per MBF	Pulpwood $ per MBF
1987	76.57	13.24
1988	94.11	8.97
1989	96.21	19.99
1990	98.25	19.76
1991	94.96	20.62
1992	88.73	18.76
1993	121.25	19.59
1994	144.13	22.34
1995	135.54	21.09
1996	157.52	21.58
1997	192.68	22.08
1998	180.80	18.61
1999	137.56	22.26
2000	N/A	N/A
2001	N/A	N/A
2002	264.80	18.74
2003	322.25	31.70
Average	147.02	20.62

in price changes for forest products, on National Forest timber sales, from 1987 through 2003. Because sales were not sold from mid-1999 through 2001, there is no price data available for those years. These are only trends that have occurred through the last 16 years, and may or may not continue.

Although pulpwood is not traditionally sold in MBF, it is included in this table in MBF so that a relative comparison to sawlog values can be readily seen. Throughout the period, the prices paid for pulpwood remained almost constant, with the exception of a quick rise in 2003. Sawlogs, on the other hand, showed a steady increase in value, with values in 2003 more than four times higher than in 1987.

Historically, low-grade material on the Forest, while not in strong demand, has consistently been marketable. Within the past few years, marketing of pulpwood material went through a period of serious difficulty, as the major pulpwood mill in the area closed down. However, in 2003 that mill came back on line under new ownership, and the market for pulpwood products has significantly improved. Pulpwood from the National Forest is also processed at pulpwood mills at several locations in western Maine.

While there are pressures from foreign timber sources impacting some sectors of the sawlog market, sawlogs remain readily marketable.

The niche market in northern New England for paper birch millwood has historically been quite strong. Within the past two years, however, this market has diminished drastically. Numerous mills involved in the paper birch turning industry have closed or greatly reduced their procurement of millwood. As a result, the Forest Service is no longer marketing paper birch as millwood; it is now being sold as either pulpwood or sawlogs, depending upon its size and quality.

At one time, there was a good market for wood chips to power wood-fired electrical power plants . Several of these plants have been closed or are now in the process of being closed down. While there is still a demand for fuelwood chips, the future of the market is uncertain. Efforts to take advantage of fuelwood for generating power are continuing, as evidenced by the recent conversion of the Schiller Station plant in Newington, New Hampshire, from a coal fired boiler to a wood burning facility.

In a study of timber supply and demand in the White Mountain National Forest market area, it was determined that the Forest contains approximately 15 percent of the total economically-available sawtimber inventory in a market area consisting of Coos, Grafton, and Carroll counties in New Hampshire, and Oxford county in Maine (LeDoux et al., 2001). The National Forest also has approximately 13.5 percent of the available pulpwood inventory in the area.

Although National Forest sawlog stumpage is not specifically marketed by log grade, the quality of sawlogs, especially high value species such as sugar maple, red oak, and yellow birch, greatly impacts the stumpage prices. The most recent Forest Inventory and Analysis conducted in New Hampshire (Northeastern Forest Research Station, 1997) indicates that the sawlog quality on the National Forest is unusually high. Nearly 70 percent of the sawtimber volume on the Forest is projected to be in tree grades 1 or 2. This is a significantly larger high quality sawtimber percentage than is typically found on forestlands in northern New England.

Two of the primary reasons why the quality of timber on the Forest is better than on many of the surrounding lands relate to the age of the trees on the Forest and the management that has been applied. Generally, the trees on the National Forest are older and larger than on adjacent lands, and produce larger quantities of high quality sawtimber than do smaller trees. Also, over the course of several decades, silvicultural treatments have been applied to thousands of acres on the Forest. One of the primary purposes of these treatments has been to remove poor quality timber to create better growing conditions for the better quality trees that remain after thinning. Consequently, as harvests take place in previously treated stands, the average quality of trees available for harvest is better, and the value of the harvest is correspondingly increased.

Harvest Methods

An increasing amount of harvesting on the Forest is being done with mechanical harvesters instead of chainsaws, as had been the case until quite recently. It is anticipated that the trend toward mechanization will continue. One of the driving reasons for the shift is the safer working conditions

associated with mechanical harvesting. Equipment operators are generally working in an enclosed cab, and therefore not subject to many of the hazards faced by an individual running a chain saw. As mechanized equipment has evolved, it has become much better adapted to working on the mountainsides frequently encountered on the White Mountain National Forest. Also, with modern, boom-mounted cutting heads, it is possible to harvest an area while doing very little damage to residual trees or regeneration.

Rubber tired skidders, fitted with either a winch and cable or a grapple, remain the primary tool for moving products from the stump to the landing. On occasion, cut-to-length systems, which involve moving wood to the landing with a forwarder rather than a skidder, are used. Given the slopes that are frequently encountered on the Forest, however, forwarders will probably play only a limited role in harvest operations.

Products are trucked primarily with tractor trailers, but at times with tri-axles, to mills or concentration yards throughout northern New England and southern Quebec. Trucking is done on roads ranging from low standard winter roads to Interstate Highways.

WMNF Forester John Williams checks a timber sale (WMNF photo by Forrest Seavey)

Environmental Effects

Acres of Land Suited for Timber Production

Suitable forestlands are lands managed for timber production on a sustained yield basis. The process used to determine suitable forestland is described in 36 CFR 219.3 and 219.14 (1982 regulations). Initially, non-forested acreage, such as rock outcrops, wildlife openings, and waterbodies are broken out from forested acreage. The forestland component is then reduced by the acreage of lands withdrawn by an act of Congress, the Secretary of Agriculture, or the Chief of the Forest Service. These include allocations such as Wilderness, Research Natural Areas, or experimental forests. Subsequently, lands on which restocking cannot be assured within five years, or on which irreversible damage to soil and water resources would occur, are removed from the suitable base. Once these adjustments are made, the remaining lands are referred to as “lands tentatively suited for timber management.”

The “tentatively suited” lands are then further reduced by land allocation decisions made during the planning process to identify “suited lands.” The reasons for these reductions include management area designations, inaccessibility, and others.

The breakdown of acreage included in each management area under the respective alternatives is displayed in Table 3-27. More detailed information regarding land classification is included in Appendices B and E. The amount and type of land allocated to the General Forest Management area, particularly, the amount of land suited for timber harvesting, will be important factors in determining the level of harvest which is planned.

Under each alternative, the relative amount of land within MA 2.1 (and 3.1 in Alternative 1) classified as suitable for timber harvesting remains fairly constant. Alternatives 2 and 4 include the lowest percentage (at 78 and 79 percent respectively), while Alternative 3 has the greatest percentage (but only slightly higher at 83 percent). The major impact to timber availability lies not in the mix of lands allocated but in the total acreage classified as suitable for timber harvesting under the respective alternatives. These impacts will be discussed further in subsequent sections of this document.

Table 3-27. Acres of MA 2.1 Lands and Lands Suitable for Timber Management.

Alternative	MA 2.1 Land (Acres)	Lands Suitable For Timber Mgt. (Acres)	% of MA 2.1 Suitable for Timber Mgt.
1	357,000*	287,200	81%
2	358,000	281,300	79%
3	296,000	243,800	83%
4	366,000	284,300	78%

* *Includes both 2.1 and 3.1 lands.*

Distribution of Suitable Lands by Ecological Land Component

In order to make growth projections that link to specific site characteristics, the FIBER Growth Model was used. It was selected because it is ecologically-based, and was developed from data taken across the northern New England area. In order to load data into the model, information about forest types and Ecological Land Types (ELTs) was assimilated and categorized into three basic Ecological Land Components (ELCs) corresponding to the three habitats described in the FIBER model: sugar maple-ash, beech-red maple, and spruce-fir. Because of the importance of the aspen-paper birch component to wildlife species, a refinement was made to the ELCs to break out aspen-paper birch types that are present within each of the ELCs.

The types of lands that are included in the landbase deemed suitable for timber management play an important role, not only in the types of habitat that can be provided, but also in the kinds of forest products that can be produced. A breakdown of the relative distribution of lands across the major ELCs and the aspen-paper birch sub-groupings is displayed in Table 3-28.

It is readily evident from Table 3-28 that each of the alternatives contains almost the same relative mix of ELCs. Therefore, differences in the types of habitat provided or the mix of forest products produced are more likely to be a function of the silvicultural treatments applied under a specific alternative rather than being tied to any inherent differences in the specific sites being allocated to timber management under a given alternative.

It is important to remember that, although the relative mix of ELCs remains quite constant, the actual acreage considered suitable for harvesting reaches a maximum under Alternative 1 and is far lower under Alternative 3. Alternatives 4 and 2 have slightly less land allocated as suitable for timber harvesting than does Alternative 1.

Table3-28. Percentage of Ecological Land Components Contained within Suitable Landbase under Each Alternative.

Ecological Land Component	Alt 1	Alt 2	Alt 3	Alt 4
Beech-Red Maple	24	23	24	23
Sugar Maple -White Ash	39	40	40	40
Spruce-Balsam Fir	32	32	32	32
Aspen-Paper Birch on Beech-Red Maple ELC	1	1	1	1
Aspen-Paper Birch on Sugar Maple-White Ash ELC	2	2	2	2
Aspen-Paper Birch on Spruce-Balsam Fir ELC	2	2	1	2
Total	**100**	**100**	**100**	**100**

Effects of Management Area Assignments on Harvest Expectations

Effects Common to Alternatives 2, 3, and 4

Direct and Indirect Effects

Alternatives 2, 3, and 4 take a different approach to allocating lands managed for timber production from Alternative 1. These alternatives eliminate Management Area 3.1 and place all lands with planned timber harvest in MA 2.1, now called the General Forest Management area.

The goals for MA 2.1 have been modified to include a mix of the goals that were previously established for Management Areas 2.1 and 3.1. The production of high quality sawtimber, the need to provide habitat diversity, and the need to protect visual resources are all included as goals for MA 2.1. The goal of managing stands of small diameter trees for fiber production is not included under any of these alternatives.

These changes grew from a realization that, in actual practice, MAs 2.1 and 3.1 had a great deal in common and at times seemed almost indistinguishable. Protecting and enhancing visual quality is an important consideration for our publics regardless of the management area assignment.

Growing small diameter stands of trees specifically for fiber production has not been done under the 1986 Plan, despite its presence as a goal. Copious quantities of small diameter, low value fiber products are produced as a by-product of culturing stands to produce high quality sawtimber. Therefore, the concept of setting a goal specifically to manage for small diameter stands to produce fiber does not mesh well with the overall goal of managing the Forest for high quality sawtimber. Managing stands specifically to produce fiber would mean that short rotation lengths would be necessary. Short rotation lengths could lead to concerns with both visual quality and nutrient cycling. It might also mean the harvesting of forest products just prior to the point where they begin to increase greatly in value as they age from pole sized trees to sawlog sized trees. With an abundant supply of fiber already available in northern New England, there is little reason to manage stands on the Forest specifically for fiber production.

Consequently, Alternatives 2, 3, and 4 combine the most pertinent goals of MAs 2.1 and 3.1 into a redefined MA 2.1, and eliminate MA 3.1.

Alternative 1

Direct and Indirect Effects

Management Areas 2.1 and 3.1 constitute the land base available for sustainable timber management under this alternative. Under the current plan, both MA 2.1 and MA 3.1 emphasize production of high quality forest products and active management of habitat for wildlife species. MA 2.1 places special emphasis on protecting and enhancing visual quality, while MA 3.1 also includes a goal of growing small diameter trees for fiber production.

MA 2.1 includes 119,000 acres, or 15 percent of the total National Forest acreage, while MA 3.1 includes 238,000 acres, or 30 percent of the total. Combined, they account for 357,000 acres, or 45 percent of the total White Mountain National Forest land base. These numbers differ slightly from acreage shown in the 1986 Forest Plan, which depicts 118,000 acres in MA 2.1 and 227,000 in MA 3.1, yielding a total land base available for timber management of 345,000 acres. The primary reason for the approximately 0.3 percent overall discrepancy relates to land acquisitions that have taken place through the current planning period.

Alternative 2

Direct and Indirect Effects

As described above, all of the lands with planned harvest activities are included in Management Area 2.1. Several changes in MA boundaries also take place between this alternative and Alternative 1, resulting in an allocation of approximately 358,200 acres of land to MA 2.1. This is only a slight increase (1,200 acres) from Alternative 1, amounting to a difference of less than 1 percent.

Although the total acres of MA 2.1 land in this alternative are very similar to the total MA 2.1 and 3.1 land allocation in Alternative 1, there are adjustments made to the landbase in numerous locations. These can be seen by comparing the management area maps in Chapter 2. Some of the changes are due to land acquisition, others relate to lands being assigned to Recommended Wilderness, while still others resulted from refining the boundaries of the MA 2.1 landbase to better reflect actual on the ground conditions. Updated information regarding steepness, rockiness, drainage, and other factors resulted in minor changes being made to numerous small pieces of the MA 2.1 landbase across the Forest.

Alternative 3

Direct and Indirect Effects

This alternative includes the smallest allocation of lands on which harvest activities may be planned. As with Alternative 2, harvest activities are planned in MA 2.1, and no lands are assigned to MA 3.1. The total amount of land assigned to MA 2.1 is 296,000 acres, or 37 percent of the Forest's acreage.

The decrease in lands assigned to the General Forest Management area results primarily from the expansion of MA 9.1, Recommended Wilderness. Approximately 98,000 acres of land is included in MA 9.1, representing the largest such allocation in any alternative. As a result, the amount of land in MA 2.1 is 15 to 20 percent less in this alternative than in any of the others.

Alternative 4

Direct and Indirect Effects

This alternative allocates the greatest amount of land to MA 2.1, with 366,000 acres. It is similar to Alternatives 2 and 3 in that no land is allocated to MA 3.1 Although it has slightly more land allocated to MA 2.1 than Alternatives 1 and 2, it still encompasses only 45 percent of the total Forest land base.

This alternative includes many of the same adjustments to MA 2.1 lands that were described under Alternative 2. The increase of approximately 9,000 acres from Alternative 1 results largely from reclassifying a portion of the 16,100 acres of land formerly in MA 2.1A and 9.4 into MA 2.1. Both MA 2.1A and 9.4 are lands identified as "holding areas" under the current plan.

All Alternatives

Cumulative Effects

From a programmatic standpoint, the amount of land allocated to MA 2.1, the General Forest Management area in which harvest activities are planned, varies little among alternatives 1,2, and 4. The range of this allocation is from 357,000 acres in Alternative 1 to 366,000 in Alternative 4, a span of only 9,000 acres — less than a 2.5 percent variation from the current allocation. Alternative 3 makes a notable departure from this range, with an allocation of only 296,000 acres — roughly 20 percent less than is included in Alternatives 1,2, and 4. The lands within MA 2.1 that are suitable for harvesting vary in much the same manner as the gross MA 2.1 allocations. As Table 3-27 indicates, Alternative 3 has the least suitable land: 243,800 acres. Alternatives 1, 2, and 4 have similar suitable land bases, with 287,200; 281,300; and 284,300 acres respectively.

As previously described, Alternatives 2, 3, and 4 allocate lands that were previously in Management Areas 2.1 and 3.1 into Recommended Wilderness. In each case, these lands include stands where silvicultural treatments have been applied to improve the quality of those stands for future harvest. The change in management area allocation will mean that those previously planned harvests will not take place and the financial return on those stand improvement treatments will not be realized.

The limited amount of suitable land included in Alternative 3 means that it has the most limited potential to provide timber products. Alternatives 1, 2, and 4 all have similar land bases, but differ in the intensity of treatment and the amount of timber they are anticipated to produce. Harvest intensity and product yield would be greatest under Alternative 1, and reduced in Alternatives 2 and 4.

The Effects of Even-aged versus Uneven-aged Management Prescriptions

The two basic silvicultural systems used to manage forest stands are even-aged or uneven-aged, defined by the method each employs to regenerate trees on a site. The even-aged system involves managing stands of trees that are essentially all of one age class, while the uneven-aged system promotes a range of age classes throughout any given stand. In general, the uneven-aged system tends to favor species that are tolerant of shade, such as American beech, sugar maple or red spruce. The even-aged approach favors species that are intolerant of shade, including aspen and paper birch.

Uneven-aged management frequently involves the use of single tree selection prescriptions, but may be modified to include harvesting trees in groups ranging in size from a small fraction of an acre up to 2 acres (USDA Forest Service, 1986a). Regeneration is usually occurring on a continuum over time

and not tied to a single regeneration harvest, as is the case with even-aged management.

The even-aged system, on the other hand, includes a harvest that is intended to remove a mature crop of trees, thereby creating conditions favorable for the establishment of regeneration that will provide the stocking for a new crop of trees.

There are wide variations in techniques used to implement each of these systems. Even-aged harvesting on the White Mountain National Forest is most frequently accomplished using clearcuts ranging in size from 10 to 30 acres. It may also use patch clearcuts ranging from 2 to 9 acres in size. Another approach is the use of seed tree cutting, which retains either individual trees or small groups of trees scattered across the harvest area to provide a source of seed to stock the regenerating stand. Additionally, a variety of shelterwood harvests may be used. Typically, this involves leaving sufficient overstory in place to provide a partially-shaded environment within which the regeneration can develop. The trees that are retained may either be harvested once the regeneration is established or left to be managed with the regenerating stand.

In actual on-the-ground practice, there is considerable latitude in the manner in which either even-aged or uneven-aged prescriptions may be applied.

The composition of regenerating stands can be substantially impacted by the method chosen to manage a particular site. Appendix G of the Forest Plan shows the responses that can be expected from implementing various even-aged or uneven-aged treatments on specific habitat types. In general, harvests that remove or substantially open the overstory, such as clearcuts or shelterwood cuts, promote shade-intolerant species, while lighter harvests, such as single tree selections, foster shade-tolerant species. The specific species that will regenerate following a harvest is also strongly influenced by the ecological land type (ELT) where the harvesting is being implemented.

When even-aged management first came into use on the White Mountain National Forest in the early 1970s, and for many years after that, silvicultural clearcutting was the primary type of harvest employed to regenerate even-aged stands. However, standards and guidelines call for retaining wildlife reserve groups in clearcut units at the rate of one-quarter acre per ten acres of treatment. Additionally, snags, den trees, and other trees important to wildlife are retained, and individual trees or groups of trees also may be retained for their value in enhancing visual quality.

These modifications may result in units that resemble a form of group seed tree cutting rather than a silvicultural clearcut, and as new information comes to light and future resource needs have to be accommodated, more silvicultural adaptations may be implemented.

For the purpose of comparing alternatives, discussion will focus on the first two decades of the planning period, with some additional review through five decades, and minimal discussion of very long-range effects.

Effects on Acres Treated per Decade

Table 3-29 displays the acres projected for treatment per decade, with various silvicultural treatments under each of the alternatives for the 1st, 2nd, 5th, and 15th decades. While the 1st and 2nd decades are shown separately in the tables, in order to simplify discussion they will be combined and discussed as a 20 year period in the text.

Alternative 1

Direct and Indirect Effects

This alternative includes a mix of treatments based on the direction established in the 1986 Forest Plan. It calls for implementing approximately 3,800 acres of harvesting per year during the first two decades. Even-aged regeneration harvests would amount to a little over 1,700 acres per year, while even-aged intermediate harvests (primarily thinnings) would be approximately 1,100 acres annually during this time period. Approximately 1,000 acres per year of uneven-aged harvests would also take place. This would result in approximately 74 percent of the acres being treated with even-aged prescriptions and 26 percent with uneven-aged. By the 5th decade, the configuration of the harvest would change slightly with a little less even-aged regeneration harvesting taking place and a greater amount of thinning. The overall split between even-aged and uneven-aged treatments would shift to nearly 80 percent even-aged and 20 percent uneven-aged.

In the first two decades, even-aged regeneration harvests would be applied to approximately 0.5 percent of the Management Area 2.1 lands in an average year. Harvesting of any type would be applied to approximately 1.0 percent of these lands per year. On the whole, that means that harvest activity of any kind would occur on approximately 0.5 percent of the total WMNF land area during a typical year.

Because this alternative includes the greatest amount of even-aged regeneration harvesting, it would strongly favor the regeneration of shade intolerant species such as paper birch, yellow birch, aspen and red oak. Shade tolerant species such as beech and sugar maple would continue to be present in the regenerating stands, but at lesser amounts than if uneven-aged management were to be used to a greater extent.

Uneven-aged management would be the preferred management system for managing softwood stands or sites with a strong softwood tendency. This will most frequently be done with group selection treatments using very small openings (typically less than a quarter acre). Uneven-aged management, in the form of single tree selection, will be applied in high quality northern hardwood where it is desirable to regenerate shade tolerant species like sugar maple. Group selection harvesting, using groups ranging in size from a few trees up to two acres, will be done in a variety of hardwood or mixedwood stands to promote a mix of regeneration including species that are relatively intolerant of shade.

Table 3-29. Projected Timber Harvest Activities in the 1st,2nd 5th and 15th Decades.

1st Decade	**Projected Annual Acreage by Treatment for Each Alternative**			
Treatment Type	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Intermediate cuts*	1,050	560	710	1,220
Selection cuts**	1,100	1,930	2,160	2,130
Even-aged regeneration cuts***	1,700	940	480	1,120
Total	**3,850**	**3,430**	**3,350**	**4,470**

2nd Decade	**Projected Annual Acreage by Treatment for Each Alternative**			
Treatment Type	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Intermediate cuts*	1,170	970	770	1,830
Selection cuts**	900	400	2,020	1,540
Even-aged regeneration cuts***	1,760	1,200	480	1,150
Total	**3,830**	**2,570**	**3,270**	**4,520**

5th Decade	**Projected Annual Acreage by Treatment for Each Alternative**			
Treatment Type	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Intermediate cuts*	1,990	500	560	2,450
Selection cuts**	900	1,110	2,380	2,380
Even-aged regeneration cuts***	1,480	1,180	480	1,120
Total	**4,370**	**2,790**	**3,420**	**5,950**

15th Decade	**Projected Annual Acreage by Treatment for Each Alternative**			
Treatment Type	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Intermediate cuts*	2,850	2,810	1,370	2,210
Selection cuts**	900	1,170	2,380	2,350
Even-aged regeneration cuts***	2,160	1,200	480	1,320
Total	**5,910**	**5,180**	**4,230**	**5,880**

* Intermediate cuts include: thinnings, shelterwood preparation cuts, shelterwood removal cuts and improvement cuts.

** Selection cuts include:single tree and group selection cuts.

*** Even-aged regeneration cuts include: clearcuts, patch clearcuts, stripcuts, seed tree cuts and shelterwood seed cuts.

Alternative 2

Direct and Indirect Effects

Under this alternative, the total harvest is reduced to an average of approximately 3,000 acres per year in the first two decades. The most notable change from Alternative 1 is a reduction of even-aged regeneration harvesting by nearly 40 percent, down to about 1,100 acres per year in the first twenty years. Intermediate harvests are reduced from 1,100 acres per year to approximately 800 acres, while uneven-aged harvests rise slightly under this alternative to approximately 1,200 acres per year.

By the 5th decade, the total harvest acreage would increase slightly. The relative mix of harvest treatments would remain quite similar to the early decades. The very long term projection shows the total acres of harvesting increasing substantially. The amount of even-aged regeneration harvesting would remain fairly constant, but both even-aged intermediate and uneven-aged harvests would increase.

In the first two decades, the net result is a treatment mix that is 64 percent even-aged harvests and 36 percent uneven-aged. In the 5th decade, the breakdown of acres treated remains very similar. By the 15th decade, the total number of acres treated rises by more than 80 percent, due largely to an increase in the amount of intermediate harvests in even-aged stands.

Even-aged regeneration harvests would be applied to approximately 0.3 percent of MA 2.1 lands per year. Harvesting of all types combined would be applied to approximately 0.8 percent of the MA 2.1 landbase, or slightly over 0.4 percent of the Forest.

This represents an intensity of harvesting similar to that which actually took place under the 1986 Forest Plan, from its inception through 1998, the point at which timber sales ceased to be offered due to a threatened and endangered species analysis that was underway.

The decreased emphasis on even-aged regeneration harvesting will result in some reduction in the amount of shade intolerant species being regenerated, compared to Alternative 1.

Alternative 3

Direct and Indirect Effects

This alternative provides the least intense use of even-aged management of any of the alternatives. In the initial decades, even-aged regeneration harvesting is reduced to 480 acres per year, while intermediate cutting is applied on only about 710 acres per year. Uneven-aged harvesting is projected to occur on more than 2,100 acres per year. This results in an overall program that includes 36 percent even-aged treatments and 64 percent uneven-aged treatments.

Even-aged regeneration harvests would take place on a little less than 0.2 percent of MA 2.1 lands. Harvesting of all types combined would occur on approximately 1.1 percent of the MA 2.1 landbase, or slightly over 0.4 percent of the Forest in an average year.

This alternative provides the least emphasis on regenerating shade intolerant tree species. Consequently, the amount of aspen, paper birch, or similar species to be regenerated is expected to be the least of any of the alternatives. Given the small amount of even-aged regeneration planned under this alternative, and the importance of maintaining the aspen-paper birch type, regeneration harvests will focus almost exclusively on regenerating the aspen-birch. There will be some even-aged regeneration harvesting on Beech-Red Maple ELC's, but probably very little in Sugar Maple Ash or Softwood ELC's, other than for the purpose of maintaining an aspen-paper birch component that might be growing there.

While this alternative provides for the lowest annual harvest of any of the alternatives, it involves treating a higher percentage of the MA 2.1 lands per year than either Alternative 2 or 4. This is due to the fact that it includes a small suitable acreage base and uses uneven-aged management to a much greater extent. The comparatively light yield per acre resulting from uneven-aged treatments means that more acres would be treated in a given year to obtain even the small yield of forest products associated with this alternative.

Alternative 4

Direct and Indirect Effects

In the initial decades, this alternative provides the second greatest amount of even-aged regeneration harvest, at approximately 1,120 acres per year. It calls for moderate amounts of intermediate and uneven-aged harvests, with 1,220 and 2,130 acres respectively. Even-aged regeneration harvesting would take place on 0.3 percent of the MA 2.1 lands annually. Harvesting of any kind would be seen on 1.2 percent of the MA 2.1 land, or 0.6 percent of the Forest in an average year.

The total acres treated rises by the 5th decade, but the proportional allocation of treatments remains similar.

The aspen, paper birch, and other shade intolerant species will be regenerated in substantial proportions, given the fairly high level of even-aged regeneration harvesting that is implemented under this Alternative. This results in an overall program that includes 52 percent even-aged treatments and 48 percent uneven-aged treatments.

All Alternatives

Cumulative Effects

The number of acres treated ranges from a low of about 3,000 acres per year under Alternative 2 to a high of almost 4,500 acres per year under Alternative 4. The amount of even-aged regeneration harvesting ranges from 480 under Alternative 3 to around 1,700 in Alternative 1. Alternatives 2 and 4 fall near the middle of this range, with about 1,100 acres of even-aged regeneration harvesting in each.

Each of the alternatives treats between 0.8 and 1.2 percent of its respective MA 2.1 land base (MAs 2.1 and 3.1 in Alternative 1). Consequently, after two decades of operations it is anticipated that harvesting would have taken place on 20 percent of the General Forest Management area under Alternative 1, 16 percent

under Alternative 2, 22 percent under Alternative 3, and 24 percent under Alternative 4. When looking at the entire White Mountain National Forest, the percentage of the total land base that would experience any type of harvest activity in the initial two decades amounts to:

- Alternative 1 — 10 percent.
- Alternative 2 — 8 percent.
- Alternative 3 — 8 percent.
- Alternative 4 — 12 percent.

As a general rule, when more acres are harvested in a given year or decade, the potential for impacts to other Forest users increases. Because each of the alternatives harvests such a small percentage of the overall National Forest acreage annually, harvest activity will be at a small enough scale that it can be kept reasonably compatible with most other uses. This will be most easily achieved with Alternatives 2 and 3, and will require more coordination with the increased activity levels under Alternatives 1 and 4. More detailed information on the effects to recreation are included in the Recreation section of this document.

Effects on the Volume of Timber Sold and the Intensity of Harvest

Table 3-30 displays the projected volume for each alternative during the 1st, 2nd, 5th and 15th decades. The volume projections are based on growth and yield estimates derived from the FIBER growth model (Solomon et al., 1995) applied to representative stands developed from the data in the Forest's stand database. Yield tables developed through FIBER were then run through the SPECTRUM program to arrive at allowable harvest levels under each alternative.

FIBER 3.0 is an ecological growth model developed by the USDA Forest Service Northeast Forest Experiment Station for projecting growth in northeastern forest types. It predicts growth based not only on the present composition of the Forest, but also on site characteristics inherent to the lands being analyzed.

SPECTRUM is a linear program forest planning model used across the country to optimize land allocation, activity, and output scheduling for National Forests over a specified planning horizon.

The yields resulting from SPECTRUM projections were modified using historical data from harvesting done on the White Mountain National Forest, along with professional judgment to account for some overestimation of "per acre" yield projections. The primary adjustments were attributable to two phenomena.

First, because SPECTRUM is a non-spatial model, there is a tendency for it to overestimate yields that will actually be achieved through management. It does this by selecting the best stands to treat at any given moment from across the entire General Forest Management area. In reality, when timber sales are designed, they are limited to a discrete piece of land that is being analyzed for possible treatments. In any given year, only a small portion of the General Forest Management area undergoes analysis leading to a subsequent timber sales. The stands that will be treated in that year's sale

Table 3-30. Annual Projections of Species/ Product Outputs for Decades 1,2,5 and 15.

Decade 1 Unit of Measure Projected Annual Output

Species Product	Alt 1	Alt 2	Alt 3	Alt 4
Hardwood Sawtimber MCF	2,200	1,400	800	1,800
Softwood Sawtimber MCF	800	800	200	600
Hardwood Pulpwood MCF	2,600	1,500	1,700	2,300
Softwood Pulpwood MCF	300	300	200	300
Total MCF	**5,900**	**4,000**	**2,900**	**5,000**
Hardwood Sawtimber MMBF	13.1	8.5	4.9	10.9
Softwood Sawtimber MMBF	4.6	5.0	1.2	3.9
Hardwood Pulpwood MMBF	15.4	8.9	10.5	13.5
Softwood Pulpwood MMBF	2.0	1.7	1.5	1.7
Total MMBF	**35.1**	**24.1**	**18.1**	**30.0**

Decade 2 Unit of Measure Projected Annual Output

Species Product	Alt 1	Alt 2	Alt 3	Alt 4
Hardwood Sawtimber MCF	2,100	1,500	1,100	1,600
Softwood Sawtimber MCF	900	500	600	800
Hardwood Pulpwood MCF	2,500	1,700	1,100	2,300
Softwood Pulpwood MCF	300	200	200	300
Total MCF	**5,800**	**3,900**	**3,000**	**5,000**
Hardwood Sawtimber MMBF	12.5	9.3	6.8	9.4
Softwood Sawtimber MMBF	5.6	3.3	3.4	4.8
Hardwood Pulpwood MMBF	15.0	10.3	6.5	13.9
Softwood Pulpwood MMBF	1.8	1.1	1.3	1.9
Total MMBF	**34.9**	**24.0**	**18.0**	**30.0**

Decade 5 Unit of Measure Projected Annual Output

Species Product	Alt 1	Alt 2	Alt 3	Alt 4
Hardwood Sawtimber MCF	1,900	1,600	900	1,700
Softwood Sawtimber MCF	600	800	300	800
Hardwood Pulpwood MCF	3,000	1,700	1,700	2,900
Softwood Pulpwood MCF	300	200	600	400
Total MCF	**5,800**	**4,300**	**3,500**	**5,800**
Hardwood Sawtimber MMBF	11.5	9.5	5.1	9.9
Softwood Sawtimber MMBF	3.7	4.9	1.7	4.6
Hardwood Pulpwood MMBF	17.8	10.3	10.3	17.5
Softwood Pulpwood MMBF	2.0	1.3	3.8	2.6
Total MMBF	**35.0**	**26.0**	**21.0**	**34.6**

Table 3-30. Annual Projections of Species/ Product Outputs for Decades 1,2,5 and 15 (continued).

Decade 15 Unit of Measure Projected Annual Output

Species Product	Alt 1	Alt 2	Alt 3	Alt 4
Hardwood Sawtimber MCF	2,300	1,800	900	1,700
Softwood Sawtimber MCF	700	900	500	1,000
Hardwood Pulpwood MCF	3,100	2,200	1,700	2,500
Softwood Pulpwood MCF	500	400	1,300	700
Total MCF	**6,600**	**5,300**	**4,400**	**5,900**
Hardwood Sawtimber MMBF	13.5	10.6	5.5	10.0
Softwood Sawtimber MMBF	4.4	5.7	3.0	6.1
Hardwood Pulpwood MMBF	18.8	13.5	9.9	15.2
Softwood Pulpwood MMBF	3.2	2.2	7.6	3.9
Total MMBF	**39.9**	**32.0**	**26.0**	**35.2**

program are confined to those included in the limited areas being analyzed. As a result, it is highly unlikely that the highest yielding sites from across the entire Forest will be the ones included in the areas under analysis in any given time. Also, stands are selected for treatment based on integrated resource objectives, not simply for the purpose of harvesting wood products.

A second reason for the overestimation of volumes in the projections is the way that uneven-aged management is modeled by FIBER, versus the way it might be implemented in actual practice. In the model, uneven-aged treatments are calculated as though they are all single tree selection prescriptions, with individual trees being selected from across the entire treated stand. In actual practice, this may be done at times, but there are also many circumstances where group selection treatments are applied to only a very limited amount of the acreage within a stand. In order to achieve desired wildlife habitat conditions, this is frequently limited to as little as 15 to 20 percent of the total stand area. The result of this is that the volume per acre harvested from the overall stand is much less than the FIBER model would predict from typical single tree selection treatments.

Without these adjustments, it is very likely that the volume expectations resulting from the acres planned for treatment under each alternative would be unrealistically high. This is particularly true in the case of uneven-aged management. The adjustments have been made, therefore to ensure that the estimate of volume projections is as realistic as possible in relation to the acres planned for treatment.

Alternative 1

Direct and Indirect Effects

This alternative provides the greatest harvest volumes, with an allowable harvest of 35 MMBF per year in the first decade, and with decades 2 through 5 yielding approximately the same level. Over the long term, the allowable harvest increases to approximately 40 MMBF per year by the 15th decade.

The yields from the various treatment methods are projected to be approximately 15 MBF/acre for even-aged regeneration harvests, 4 MBF/acre for intermediate harvests and 3.1 MBF/acre for uneven-aged harvests. The weighted average volume per acre for all methods of treatment combined is around 9.0 MBF/acre.

Harvesting at these levels (35 MMBF/year) uses approximately 75 percent of the long term sustained yield (LTSY) that is projected for the suitable land base. The harvest levels rise to 40 MMBF, or approximately 86 percent of the long term sustained yield, in the late decades of the planning period. As a result, losses to mortality will occur during the decades as species age beyond physiological maturity. Because this alternative represents the highest level of harvesting being considered, mortality is expected to be at the lowest level of any of the proposed alternatives.

Alternative 2

Direct and Indirect Effects

The allowable harvest level is approximately 24 MMBF per year in the first decade, and rises to 26 MMBF per year in 5 decades, and eventually to 32 MMBF in 15 decades. This level of harvesting most closely resembles the actual outputs that were attained under the current Forest Plan prior to the cessation of timber sales in 1999 due to the endangered species issues. The yields per acre for various treatment methods are expected to be very similar to Alternative 1. The weighted average yield per acre is the second highest in the initial two decades, at approximately 8 MBF per acre.

In the first two decades, the yield under this alternative, 24 MMBF per year, represents 52 percent of the LTSY, which is 46.3 MMBF per year. Mortality will occur at a lower rate than under Alternative 3, but more than under Alternatives 1 and 4.

Alternative 3

Direct and Indirect Effects

This alternative provides the lowest yield of timber products, with an annual allowable harvest level of approximately 18 MMBF per year in the first decade, rising to 21 MMBF per year within the first 5 decades. Ultimately, the allowable harvest rises to 26 MMBF per year through the course of 15 decades. Yields per acre for the various treatments are similar to the other alternatives, but the aggregate yield per treated acre is the lowest of any alternative due to the high percentage of uneven-aged management. SPECTRUM projections indicate an overall yield of only 5.5 MBF/acre under this alternative.

This alternative harvests the smallest percentage of LTSY in the next two decades. The projected yield of 18 MMBF per year amounts to only 44 percent of the LTSY. The amount of mortality within the suited lands can, therefore, be expected to be greater than under any of the other alternatives. Over the long term, this alternative promotes stand conditions across the Forest that result in the lowest timber productivity of any of the alternatives.

Alternative 4

Direct and Indirect Effects

This alternative provides a level of harvest that is lower than what was called for under the 1986 Forest Plan (Alternative 1), but greater than what has actually been accomplished under that Plan (Alternative 2). The allowable harvest is 30 MMBF per year in the early decades, and moves to 35 MMBF per year by the 5th decade. It changes little between then and the 15th decade, when it is slightly over 35 MMBF per year. The yields per acre associated with each of the treatment types are similar to each of the other alternatives, while the average harvest per acre for all harvests methods ranks third, behind Alternatives 1 and 2, yielding 6.6 MBF per acre.

This alternative provides the second highest annual harvest, 30 MMBF per year, and implements harvest activities on the greatest number of acres per year. In the first two decades, the harvest of 30 MMBF per year amounts to 61 percent of the LTSY of 49.0 MMBF per year. Mortality will take place a lower rate than under alternative 1, but more than Alternatives 2 and 3. This alternative will create forest conditions that provide the second highest long term timber productivity, behind Alternative 1 but greater than Alternatives 2 and 3.

All Alternatives

Cumulative Effects

In general, the alternatives that incorporate the most intensive harvesting also generate the greatest amount of growth through the next 150 years. While this at first seems paradoxical, the reason, as previously explained, lies in the current maturing condition of the forest stands now comprising the suitable land base.

The harvest levels under each of the alternatives should result in a program that is economically viable . Volume yields per acre can be an important factor influencing the marketability of the timber sale program. While implementing integrated resource objectives is the primary purpose of the program, they cannot be accomplished if sales are not bid on and harvested. Those alternatives with higher volume per acre outputs are likely to be more efficient to operate, and therefore would result in greater interest and more competitive bidding from the forest industry. From this perspective, Alternative 1 results in the greatest yields per acre, followed closely by Alternative 2. Alternative 4 ranks third, and Alternative 3 provides the lowest yields per acre.

One phenomenon not well described by the SPECTRUM model is that, as program size increases, there is a greater tendency to treat marginally operable stands in order to achieve harvest expectations. As previously explained, SPECTRUM is a non-spatial model; in day-to-day practice, harvests result from analysis conducted on only a limited amount of the General Forest Management area in any given year.

This means that if an alternative calls for attaining high levels of harvest, there will be a strong tendency to treat every acre possible within the areas

being analyzed. This will produce a maximum amount of harvest volume, but could also mean that commercially marginal stands are included in the sales. The result could be limited marketability of some timber sales or sales that do not sell at all — and resource management objectives that do not get met. Conversely, if harvest expectations are lower, more selectivity can be incorporated into sale design, and marketing the overall program can be improved.

While there is considerable judgment needed to assess this situation, the alternatives can be evaluated from the following perspective. Alternatives 1, 2, and 4 can be readily compared because they have very similar land bases. Alternative 3, with a much smaller suitable land base, requires a somewhat different assessment.

Of the first three, Alternatives 1 and 4 could prove difficult to implement, but for slightly differing reasons. Alternative 1 has the highest harvest levels but achieves these by relying very heavily on even-aged regeneration harvesting. Given the effects associated with this type of harvesting, it is uncertain how much could be accomplished. The impact to Forest scenery is greatest under this alternative.

Visual analysis indicates that it will be extremely difficult to implement Alternative 1 and still meet scenery management objectives. From the onset, there is a real risk that the acres of even-aged regeneration harvesting will not be accomplished. A detailed assessment of the effects on scenery is included in the Scenic Resources section of this document.

Alternative 4, on the other hand, includes lower even-aged regeneration harvest levels (approximately 1,100 acres per year versus 1,700 acres per year for Alternative 1). It sustains a fairly high volume output by incorporating a large number of acres of thinning.

Incorporating large amounts of thinning in projects could easily lead to numerous marginal stands marked for treatment, and the resulting sales being unmarketable. A typical case might be a stand 50 to 60 years old with barely enough stocking to make a thinning feasible. The stand might be left to grow another 10 to 15 years to increase stocking levels and make harvesting more marketable, however, under Alternative 4, with its high thinning expectations, stands of this nature would likely be marketed as early as possible. This could result in treatments that have limited benefits silviculturally or from a wildlife habitat perspective, and only serve to generate greater harvest volume. From the timber industry perspective, the high volume output may seem attractive, but historically, sales with a sizeable component of marginal treatments as described above have proven difficult to sell. The Affected Environment portion of the timber resources section of this document discusses some of the historic trends related to marketability of forest products on the Forest.

Alternative 2 involves a similar land base to Alternatives 1 and 4, but the harvest intensity is considerably lower. It entails far less even-aged regeneration harvesting than Alternative 1 and slightly less than Alternative 4. From that perspective, it is readily compatible with scenery management objectives. It differs from Alternative 4 in that it includes only about half as

much thinning acreage. Consequently, it will often not be necessary to harvest in every stand that might possibly support a thinning treatment. More discretion can be used in sale design, and the result could be a sale program that is much more appealing to potential bidders than would be the case under Alternative 4. It provides the opportunity to accomplish a well-integrated resource management program and still provide a reliable source of marketable forest products.

Alternative 3 has the lowest output expectation, but it also has, by far, the smallest land base being managed to attain that volume. Even with the small land base, because of the small output expectation, there should be sufficient discretion in the development of timber sales to insure that the program remains marketable.

Effects on the Mix of Forest Products

The mix of forest products is an important factor in assessing the overall timber sale program. Recent history has shown that the demand for high quality products, such as veneer and high-grade sawtimber, continues to increase. Lower value products, such as pulpwood, are generally marketable, but the demand fluctuates. The primary timber products that the Forest Service strives to produce are high quality sawlogs and veneer, an objective that is readily compatible with the broad range of resources for which the Forest is managed. These products can be provided as part of an integrated management strategy aimed at improving habitat diversity, protecting or enhancing scenic quality, and protecting soil, water, and other resources.

One noticeable change from the situation described in the 1986 Forest Plan has occurred in the paper birch millwood industry. For many decades, a steady market for paper birch millwood existed in northern New Hampshire and western Maine. During the past several years, that market has all but disappeared. Consequently, much of the small diameter paper birch (8 to 9 inches in diameter) that was sold at a premium price as millwood, now must be marketed as lower value pulpwood. Larger, good quality paper birch remains readily marketable as sawtimber or veneer.

The market for fuel chips remains uncertain. Several wood-fired generating plants continue to provide a market for chips harvested from National Forest timber sales. Some of these mills have been bought out and could be closed down. Currently, some chips are being processed from low quality material included in sales on the Forest and sold to the chip burning plants that continue to operate. Recent increases in gasoline prices may lead to greater demand for wood-fired generating plants.

High quality sawtimber can be produced using a variety of even-aged and uneven-aged harvest treatments. The mix of sawtimber projected to be produced by each alternative is displayed in Table 3-31. The information in this table will be reviewed later in the text.

Table 3-31. Breakdown of Sawtimber Outputs Projected to be Harvested Annually under Each Alternative for the 1st,2nd, 5th and 15th decades.

Decade 1 Unit of Measure Projected Annual Output

Species Product	Alt 1	Alt 2	Alt 3	Alt 4
Paper Birch Sawtimber MCF	340	200	140	320
Red maple & Other Sawtimber MCF	920	600	360	860
Sugar Maple & Oak Sawtimber MCF	590	380	200	380
Yellow Birch & Ash Sawtimber MCF	330	240	110	260
Spruce, Fir & Pine Sawtimber MCF	770	830	200	650
Total MCF	**2,950**	**2,250**	**1,010**	**2,470**
Paper Birch Sawtimber MMBF	2.0	1.2	0.8	1.9
Red maple & Other Sawtimber MMBF	5.5	3.6	2.2	5.2
Sugar Maple & Oak Sawtimber MMBF	3.5	2.3	1.2	2.3
Yellow Birch & Ash Sawtimber MMBF	2.0	1.4	0.7	1.6
Spruce, Fir & Pine Sawtimber MMBF	4.6	5.0	1.2	3.9
Total MMBF	**17.6**	**13.5**	**6.1**	**14.9**

Decade 2 Unit of Measure Projected Annual Output

Species Product	Alt 1	Alt 2	Alt 3	Alt 4
Paper Birch Sawtimber MCF	240	200	160	220
Red maple & Other Sawtimber MCF	910	660	530	790
Sugar Maple & Oak Sawtimber MCF	630	460	280	360
Yellow Birch & Ash Sawtimber MCF	320	230	170	210
Spruce, Fir & Pine Sawtimber MCF	930	540	570	790
Total MCF	**3,030**	**2,090**	**1,710**	**2,370**
Paper Birch Sawtimber MMBF	1.4	1.2	1.0	1.3
Red maple & Other Sawtimber MMBF	5.5	4.0	3.2	4.7
Sugar Maple & Oak Sawtimber MMBF	3.8	2.8	1.7	2.2
Yellow Birch & Ash Sawtimber MMBF	1.9	1.4	1.0	1.3
Spruce, Fir & Pine Sawtimber MMBF	8.1	3.2	3.4	4.8
Total MMBF	**18.2**	**12.6**	**10.3**	**14.3**

Table 3-31. Breakdown of Sawtimber Outputs Projected to be Harvested Annually under Each Alternative for the 1st,2nd, 5th and 15th decades (continued).

Decade 5 Unit of Measure Projected Annual Output

Species Product	Alt 1	Alt 2	Alt 3	Alt 4
Paper Birch Sawtimber MCF	200	140	80	160
Red maple & Other Sawtimber MCF	910	640	330	860
Sugar Maple & Oak Sawtimber MCF	560	560	310	440
Yellow Birch & Ash Sawtimber MCF	260	240	140	200
Spruce, Fir & Pine Sawtimber MCF	620	820	280	760
Total MCF	**2,550**	**2,400**	**1,140**	**2,420**
Paper Birch Sawtimber MMBF	1.2	0.8	0.5	1.0
Red maple & Other Sawtimber MMBF	5.5	3.8	2.0	5.2
Sugar Maple & Oak Sawtimber MMBF	3.4	3.4	1.9	2.6
Yellow Birch & Ash Sawtimber MMBF	1.6	1.4	0.8	1.2
Spruce, Fir & Pine Sawtimber MMBF	3.7	5.0	1.7	4.6
Total MMBF	**15.4**	**14.4**	**6.9**	**14.6**

Decade 15 Unit of Measure Projected Annual Output

Species Product	Alt 1	Alt 2	Alt 3	Alt 4
Paper Birch Sawtimber MCF	250	210	140	230
Red maple & Other Sawtimber MCF	700	610	530	830
Sugar Maple & Oak Sawtimber MCF	920	640	170	420
Yellow Birch & Ash Sawtimber MCF	390	320	70	200
Spruce, Fir & Pine Sawtimber MCF	730	950	500	1020
Total MCF	**2,980**	**2,730**	**1,400**	**2,700**
Paper Birch Sawtimber MMBF	1.5	1.2	0.8	1.4
Red maple & Other Sawtimber MMBF	4.2	3.7	3.2	5.0
Sugar Maple & Oak Sawtimber MMBF	5.6	3.8	1.0	2.5
Yellow Birch & Ash Sawtimber MMBF	2.3	1.9	0.4	1.2
Spruce, Fir & Pine Sawtimber MMBF	4.4	5.7	3.0	6.1
Total MMBF	**18.0**	**16.3**	**8.4**	**16.2**

The percentage distribution of products organized by High Value Hardwood Sawlogs, Low Value Sawlogs, Spruce Fir and Pine Sawlogs, as well as Puplwood, is summarized in Table 3-32, and will be discussed under each alternative and in cumulative effects.

The mix of forest products is very important to purchasers of timber from the Forest, and a discussion of product yields by alternative is provided below. It is particularly important to track how each alternative contributes to the Forest's niche of producing high quality sawlogs.

Table 3-32.Species-Product Mix Expressed as a Percentage of Total Harvest for the First Two Decades.

Species Product	Percentage of Harvest by Alternative			
	Alt 1	Alt 2	Alt 3	Alt 4
High Value Hardwood Sawlogs*	20.8	21.3	17.8	17.4
Low Value Sawlogs **	15.6	15.6	14.8	16.5
Spruce, Fir & Pine Sawlogs	14.5	17.1	12.8	14.4
Hardwood Pulpwood	43.6	40.0	47.1	45.7
Softwood Pulpwood	5.5	6.0	7.5	6.0
Total	100.0	100.0	100.0	100,0

* Includes Paper Birch, Yellow Birch, Sugar Maple, White Ash and Red Oak.
** Includes Red Maple, Aspen, Beech, Other Hardwoods and Hemlock

The White Mountain National Forest has an inventory of standing sawtimber that amounts to approximately 15 percent of the available sawtimber size material in the immediate northern New Hampshire/western Maine market area. This includes Coos, Grafton, and Carroll counties in New Hampshire, and Oxford county in Maine. Consequently, while the National Forest produces a limited amount of the total timber harvested, it is a very important source of sawtimber to the numerous mills throughout the region. Analysis of FIA Plat data indicates that 70 percent of the sawtimber on the Forest is in tree grades 1 and 2, a good indicator that the quality of the timber to be harvested is considerably better than that found elsewhere in northern New England.

Tree grade relates to the quality of products that can be produced from the bole of a given tree. Grade 1 trees are usually fairly large, have very little rot and few if any branches on the lower portion of the bole. The wood from such trees is typically free from defects and, depending upon species may be very valuable. Grade 3 or 4 trees are often smaller and/or more defective. The forest products produced from these low grade are commonly have defect or knots and the trees are far less valuable.

In recent years, the demand for this high value sawtimber has been well established in the bidding patterns for Forest Service timber sales, and that demand is expected to remain high, even with competition from some foreign markets causing some New England wood products industries to downsize or close.

Alternative 1

Direct and Indirect Effects

This alternative provides the greatest quantity of products overall, and also the greatest quantity of sawlogs. It results in the highest yield of pulpwood products. While pulpwood is not as valuable as sawtimber, it is an important an important resource for mills in both Maine and New Hampshire.

In the first decade, the allowable harvest is 35 MMBF, with a projected split of 50 percent sawtimber and 50 percent pulpwood. The yield of products

remains quite stable over time, with both sawtimber and pulpwood volumes staying fairly near 50 percent.

The mix of species products harvested remains diverse throughout the first two decades. The split between hardwoods and softwoods is projected to be approximately 80 percent hardwood and 20 percent softwood in that time period. High value hardwoods (sugar maple, oak, yellow birch, paper birch, and white ash) comprise 21 percent of the harvest. Other hardwood sawlogs and hemlock account for 16 percent, and softwood (spruce, fir, and pine) sawlogs comprise 14 percent. Pulpwood yields run heavy to hardwoods, with 44 percent of the total harvest hardwood pulpwood and only 5 percent softwood pulpwood.

Looking ahead 5 decades, the overall split between sawlogs and pulpwood remains reasonably constant. The output of high value hardwoods remains steady, with the exception of paper birch, which decreases. Other hardwoods and hemlock remain stable during this period, and the spruce, fir, and pine yields drop off.

In the late decades, approaching 150 years from now, the amount of high value hardwood rises, other hardwoods and hemlock drop off, and the spruce, fir, and pine yields return to levels similar to those of today.

Alternative 2

Direct and Indirect Effects

This alternative has an allowable harvest of 24 MMBF of forest products in the first decade, and increases slightly to 26 MMBF through the next four decades. Over the next two decades, outputs are expected to be approximately 45 percent pulpwood and 55 percent sawtimber, with the breakdown between hardwoods and softwoods anticipated at roughly 75 percent hardwood and 25 percent softwood. The relative amounts of high value hardwoods, as well as low value hardwood and hemlock, will be similar to Alternative 1. Sawlogs comprise a slightly larger percentage of the harvest than under Alternative 1. The breakdown between hardwood and softwood pulpwood will be very similar to Alternative 1, with a slightly lower percentage of pulpwood in this alternative.

In 50 years, the product mix follows a very similar trend to that shown for Alternative 1, and over the very long run, the mix of products remains fairly constant, with moderate increases in high value hardwoods as well as spruce, fir, and pine.

Alternative 3

Direct and Indirect Effects

The output of forest products drops to 18 MMBF in the first decade under this alternative, and rises to 21 MMBF by the fifth decade. This alternative is projected to yield approximately 55 percent pulpwood and 45 percent sawtimber in the first two decades, representing the lowest percentage of sawlogs of any of the alternatives. The overall ratio of hardwoods to

softwoods is 80 percent hardwood and 20 percent softwood. The mix of products includes the second lowest percentage of high quality sawlogs, 18 percent, and the lowest percentage of softwood sawlogs, 13 percent. The yield of other hardwoods and hemlock is about the same as Alternatives 1 and 2, nearly 15 percent. At 47 percent, the percentage of hardwood pulpwood is the greatest of any of the alternatives. The softwood pulpwood yield of 7 percent is similar to each of the other alternatives.

Over the first five decades, the amount of pulpwood in the outputs rises slightly and the percentage of all categories of sawtimber diminishes accordingly. Through the course of 150 years, a similar pattern in the outputs is predicted.

Alternative 4

Direct and Indirect Effects

This alternative has the second highest percentage of pulpwood predicted in the outputs, 51 percent. Only Alternative 3 has a greater percentage of pulpwood. It yields a little smaller percentage of high quality sawlogs than Alternatives 1 and 2, along with slightly more low value hardwood and hemlock.

During the fifth decade, the pulpwood component rises to nearly 60 percent. The relative mix of sawlog species stays similar, but the overall percentage of sawlogs drops consistent with the increase in the pulpwood yields. The most notable patterns projected over the 150 year period are a continuation of the relatively high pulpwood yields and a distinct increase in the amount of softwood in the harvest.

All Alternatives

Cumulative Effects

It is anticipated that demand will continue to exist for the mix of products, both pulpwood and sawtimber, to be produced under each of the alternatives. Alternatives 1 and 2, producing the greater proportion of high quality sawlogs, are likely to be more readily marketable than alternatives yielding higher percentages of pulpwood, as is the case with Alternative 3.

Each of the alternatives provides for additional timber to be harvested in some management areas outside of MA 2.1. Generally, these will be incidental amounts resulting from such activities as hazard tree removal, construction clearings, or similar activities. The volumes resulting from these activities are expected to be extremely minor, and are not included in the output projections.

Salvage harvests are permitted not only in MA 2.1, but in several other management areas as well. The degree to which these activities may need to be undertaken is obviously unknown at this point.

Effects of the Intensity of Harvest Activities

All Alternatives

Direct and Indirect Affects

It is anticipated that each of the four alternatives will use similar approaches to harvesting. However, the degree to which logging machinery will be active on the Forest varies.

During the next twenty years, the most activity would occur with Alternative 4, as it provides the second highest volume yields and treats the greatest number of acres. Alternative 1 provides the greatest volume, but because of the heavy reliance on even-aged regeneration harvesting, it would spread harvest activities across fewer acres. Alternative 3 provides the least volume, but ranks third in terms of the amount of activity that would be spread across the landscape because of the high percentage of uneven-aged management incorporated in this alternative. Alternative 2 is third in terms of outputs produced, but it produces these outputs by implementing harvest activities on the least acreage. It does this by having a fairly even balance between even-aged and uneven-aged management.

A detailed analysis of the impacts that harvest activities will have upon the landscape is included in the Scenic Resources section of this document.

Effects on Culmination of Mean Annual Increment

All Alternatives

In the first 20 years, the culmination of mean annual increment (CMAI) measured in total cubic feet per acre is expected to occur well before planned rotation ages under all the alternatives. The FIBER growth model was used to predict when mean annual increment would culminate for representative stands on each of the ELCs being managed. The results are shown in Table 3-33. Thinning treatments could serve to move the culmination of mean annual increment to an older age, but it remains well short of rotation age for all forest types with planned thinnings.

Table 3-33. Projected Culmination of Mean Annual Increment by Ecological Land Component (ELC).

ELC	Age (nearest 10 years)
Sugar Maple-White Ash	50
Beech-Red Maple	60
Spruce-Balsam Fir	60
Aspen.-PBirch on S.Maple-W.Ash	50
Aspen-P.Birch on Beech-R.Maple	50
Aspen-P.Birch on Spruce-B.Fir	60

Under each of the four alternatives, rotation ages are well beyond the CMAI due largely to the fact that management is focused on producing high quality sawtimber and not maximizing fiber production. If fiber production were the primary objective, then rotation ages might very well be established much closer to the culmination of mean annual increment. However, managing stands primarily for fiber production is not an objective included in any of the alternatives.

Effects on the Long Term Sustained Yield

All Alternatives

The Long Term Sustained Yield (LTSY), the greatest uniform timber yield from suited forestlands that can be sustained under a specific management scenario, is shown for each of the alternatives in Table 3-34.

Table 3-34. Long-Term Sustained Yield by Alternative.

Unit of Measure	Long-Term Sustained Yield by Alternative			
	Alt. 1	Alt. 2	Alt. 3	Alt. 4
MCF/yr	77.7	77.1	67.8	81.6
MMBF/yr	46.6	46.3	40.7	49.0

The LTSY ranges from a low of 40.7 MMBF per year under Alternative 3 to a high of 49 MMBF per year under Alternative 4. Most of the variation can be explained by the acreage of suitable land assigned to the respective alternatives, rather than any inherent differences in the productivity of land classified as suitable under the respective alternative.

Effects on Projected Harvest Compared to Projected Growth

All Alternatives

The rate of growth projected to occur under each of the alternatives varies substantially. Table 3-35 depicts the changes in growth rate that can be expected over time.

Table 3-35. Average Rate of Growth per Acre per Year Projected for Decades 1, 2, 5 and 15 by Alternative.

Alternative	Unit of Measure	Growth per Acre per Year			
		Decade 1	Decade 2	Decade 5	Decade 15
1	Cu. Ft	16.4	17.9	19.2	24.8
	Bd. Ft.	100	107	115	150
2	Cu.Ft.	14.4	17.7	17.1	20.4
	Bd. Ft.	90	106	103	122
3	Cu. Ft.	18.5	16.9	19.4	19.9
	Bd. Ft	111	101	116	119
4	Cu. Ft.	14.7	17.3	20.2	24.0
	Bd. Ft.	88	104	121	143

The suitable lands included under each of the alternative vary from 243,800 acres in Alternative 3 to 284,300 acres in Alternative 4. Because different lands are involved in each alternative, the per acre rates of growth in the initial decade have a spread from 14.4 cubic feet per acre to 18.5 cubic feet per acre. However, the most important information contained in Table 3-36 is the trend in growth that occurs across the decades under each alternative. In general, the greater the amount of harvesting proposed in a given alternative, the greater the increase in growth rate over time. The lowest harvest levels take place under Alternatives 2 and 3, and they are projected to have the lowest per acre growth rate at the end of the 150 year period. Conversely, Alternative 1, which incorporates the greatest amount of harvesting, results in the highest per acre growth rate and the second highest percentage increase over the 150 year period. This trend can be readily seen by looking at Table 3-36.

Table 3-36. Percentage Increase in Per Acre Growth Rate Over 150 Year Period.

Alternative	% Increase in Growth
1	50%
2	36%
3	7%
4	62%

The reason for greater growth resulting from increased harvesting lies in the current age class mix of forest stands on the Forest. At the present time, the average stand is 80 to 90 years old. Rates of growth certainly vary based on factors such as site quality and species composition, however, there is a common trend in the development of forests from the seedling stage through to an overmature condition. Growth begins slowly, accelerates for a period of time, and then begins to slow down or even become negative as the Forest ages. The high average age of stands on the White Mountain National Forest means that many of those stands are reaching the point where growth is slowing. Through harvesting and subsequent regeneration, the sites supporting these slow growing trees are restocked with younger, more rapidly growing trees, and therefore the average growth per acre on the Forest increases.

The total growth projected to occur on suited lands varies greatly among the alternatives. This is due not only to the intensity of silvicultural treatments, but also to the relative amount of suited lands included with each alternative. Table 3-37 displays the total growth anticipated on suited lands under each alternative.

Table 3-37. Total Growth in MCF and MMBF Projected to Accrue during the 15 decade Period by Alternative.

Unit of Measure	Total Growth			
	Alt 1	Alt 2	Alt 3	Alt 4
MCF	818,000	667,300	584,100	795,800
MMBF	4,900	4,000	3,500	4,800

Effects on Forest Health

All Alternatives

Prescriptions developed to implement any of the alternatives would be focused on maintaining forest health in the General Forest Management area. However, the long term health of the Forest is dependent upon a variety of highly uncertain factors, such as drought, windstorms, and fire, as well as insect and disease infestations and others.

Each of the alternatives provides for implementation of the Healthy Forests Restoration Act. However, on the White Mountain National Forest projects developed under the Act will be limited in scope. Much of HFRA deals with the protection of old growth ecosystems and fuels reduction.

The Forest has a very limited amount of old growth, and most stands that currently exist are in management areas that do not have planned timber harvest activities. Additionally, the Forest has a very low fire occurrence (see the Wildland Fire section). While there will be some opportunity to use harvesting to reduce fuel hazards, this will be limited in scale.

At present, one of the most important factors relating to forest health is the mature condition of many of the stands. Older, less vigorous trees often tend to be more susceptible to pathogens and therefore have increased potential for mortality. This will likely be most notable in the aspen-paper birch component on the Forest. Because of these species' relatively short life span, and the fact that both need open light conditions to regenerate, larger amounts of even-aged regeneration harvesting favor their perpetuation.

Under each of the alternatives, regeneration of aspen-paper birch is considered a priority. Given the limited amount of even-aged regeneration harvesting permitted under Alternative 3, almost all of it will need to be focused on the regeneration of these species. The other three alternatives permit larger amounts of even-aged regeneration harvesting, and would very likely be more successful at regenerating a greater amount of the aspen-birch type.

Overall forest health relates not only to the General Forest Management area but also to the other lands across the Forest. Several other management areas permit harvest treatments, including harvest to control undesirable insect and disease infestations. Each of the alternatives allows salvage operations in some management areas outside the General Forest Management area.

There are differences among the alternatives in the degree to which they permit active response to insect or disease infestations. In general, the alternatives with large amounts of land allocated to Wilderness (MA 5.1) or Recommended Wilderness (MA 9.1) permit a less vigorous response to insect and disease outbreaks. Each of the alternatives has the same amount of existing Wilderness acreage, approximately 114,000 acres, but they differ considerably in the amount of land allocated to Recommended Wilderness.

Alternative 3 allocates the most to Recommended Wilderness (nearly 98,000 acres) and would therefore be the most limiting in response to insect or disease outbreaks. Alternative 2, with a Recommended Wilderness allocation

of approximately 34,000 acres, would be the next most restrictive. Alternative 4, with approximately 18,000 acres allocated to Recommended Wilderness would be less restrictive, while Alternative 1, with no recommendation, would be the least restrictive.

Effects on Specialty Forest Products

All Alternatives

Direct and Indirect effects

The overall approach to managing Specialty Forest Products is similar through each of the alternatives. The changes in management area assignments across the four alternatives do, however, have an impact. Alternatives 1, 2, and 4 have similar acreages assigned to MA 2.1 (MA 2.1 and 3.1 combined, in the case of Alternative 1). Consequently, the lands on which most of the firewood gathering, maple tapping, bough gathering, and Christmas tree harvesting take place remain fairly constant. Alternative 3, on the other hand, reduces the MA 2.1 land base and substantially increases lands assigned as Recommended Wilderness (MA 9.1), thereby reducing the opportunity to engage in such activities on the Forest.

Native Americans are interested in the availability of black ash for use in basket making. The number of permits issued has been, and is expected to be, very small. There are only minor differences among the alternatives in terms of providing incidental quantities of black ash.

Over the past fifteen years, none of these programs has been major in scale. The total income to the Forest from all of these products combined averages less than $5,000 per year, and the financial impacts resulting from differences among any of the alternatives are subtle and difficult to detect. Alternative 3 removes sufficient land from MA 2.1 so that a few individuals who have historically used those lands for special forest products may notice the impact.

Cumulative Effects

Cumulatively, the resource impacts resulting from the harvest of specialty forest products are small. The tapping of sugar maple trees for sap can reduce the quality of logs that may be harvested from tapped trees. Poorly formed trees, such as those growing along roadsides or that have developed in old pasture settings, are ideal for tapping. These trees are often large crowned and produce sap well, but because of their excessive branching they produce low grade logs, and very little log value is lost as a result of the wounding that takes place from tapping. Conversely, high quality trees with clean boles can have their value greatly reduced by tapping. It is anticipated that demand for tapping permits will probably stay constant and the cumulative impacts on timber value, wildlife habitat, recreational values, and other resources will be extremely minor.

Black ash does not tend to occur in pure stands. When it is found, it is present as a minor inclusion in other forest types. It will, therefore, need to be managed at a very small scale — ranging from a fraction of an acre to a few acres. Because of the poorly drained sites on which it grows, it is usually

harvested by hand and the bolts of ash hand-carried to a roadside location. Due to the limited number of permits issued, and the low impact harvest methods employed, the cumulative impact to Forest resources is expected to be minimal.

The cumulative impacts to Forest resources from both Christmas tree harvesting and balsam bough gathering are projected to be minor. Both programs are small scale, and it is not anticipated that there will be increased demand.

Effects on Firewood Gathering

All Alternatives

The situation with personal use firewood is similar to specialty forest products. The number of firewood permits issued will depend upon demand, which at present, and probably for the near future numbers about 150 permits per year. The value of these permits is not expected to be great, perhaps $3,000 annually.

Firewood harvesting under Alternatives 1, 2, and 4 is expected to remain fairly constant, because the acres available for this activity do not vary greatly from what is currently condition. Alternative 3, with significantly less land available for firewood gathering, will reduce the opportunities for the public to engage in this activity.

Effects on Timber Stand Improvement

All Alternatives

In recent years, timber stand improvement (TSI) projects have been very limited in magnitude, with less than 150 acres typically completed per year. They have focused on keeping a component of species which are important parts of the ecosystem but which occur in limited amounts on the Forest. Activities such as release of oak and white pine have accounted for the majority of TSI projects. It is not anticipated that TSI activities will expand greatly, although they may increase moderately.

Generally, the alternatives that involve the greatest amount of harvesting would result in a greater amount of TSI being completed. For that reason, Alternative 1 would be expected to result in the greatest amount of treatment, followed by Alternatives 4, 2, and 3, in that order.

Effects on Non-Price Benefits

All Alternatives

Opportunities to provide areas that demonstrate the application of sound silvicultural treatments.

Each of the alternatives will afford an opportunity to conduct on-the- ground conservation education. Alternatives 1, 2, and 4 will each provide a good mix of even- and uneven-aged treatments. Alternative 3 will have only a very limited amount of even-aged treatments to use for demonstration purposes. Overall, Alternatives 2 and 4 would provide a better balanced mix, with the alternatives ranked 2, 4, 1, and 3 in this regard.

Habitat improvement for species using regeneration age class forest.

The most diverse habitat would be provided by Alternative 1, due to the large amount of even-aged regeneration harvesting it calls for. Alternatives 2 and 4 would provide moderate benefits, and Alternative 3 would be minimal.

New roads available for recreational use.

Each of the alternatives would be similar in this regard, because about 1 mile per year of new road construction is projected per year under each of them.

Skid trails available for hunter access or other recreational use.

The amount of skid trail to be used varies slightly among alternatives, with Alternative 1 being the greatest, followed by 4, 3, and 2, in that order.

Number of vistas created.

On the assumption that a larger amount of even-aged regeneration harvesting would lead to more vistas being created, it would appear that the alternatives would rank 1, 4, 2, and 3. However, if the Forest harvests as heavily as Alternative 1 calls for, a very "busy" landscape would result. For that reason, if the focus was on the number of vistas providing a "pleasing view," the alternatives would rank 4, 2, 1, and 3.

Acres of fuel reduction accomplished

This relates most closely to the total number of acres proposed for treatment under each alternative; thus their ranking would be 4, 1, 3, and 2.

Non-Native Invasive Species

Affected Environment

Non-native invasive species are plants or animals whose origin is generally somewhere other than North America. They may be completely harmless or even beneficial in their native environments, but when introduced elsewhere, they can disrupt the established order and function of the ecosystem and become especially aggressive or difficult to manage. In the United States, non-native invasive species are a primary cause for almost half of the species being listed under the Endangered Species Act (The Nature Conservancy, 1996) and are estimated to cost $138 billion per year in major environmental damages and losses nationwide (Pimentel et al., 1999).

Direction for managing non-native invasive species comes from a variety of sources. The Federal Noxious Weed Act of 1974, as amended (7 U.S. C. 2801 et seq.) requires cooperation with State, local, and other federal agencies in the management and control of non-native invasive species. Executive Order 13112 requires all pertinent federal agencies (subject to budgetary appropriations) to 1) prevent the introduction of invasive species; 2) detect and rapidly respond to and control populations of such species in a cost-effective and environmentally sound manner; 3) monitor invasive species populations; 4) restore native species and habitat conditions in ecosystems

Conservation educator Clare Long and biological technician Kori Marchowsky demonstrate the use of loosestrife beetles for purple loosestrife control (WMNF photo by Margo Roberts)

that have been invaded; 5) conduct research and develop technologies to prevent introduction and provide for environmentally sound control measures; and 6) promote public education on invasive species.

USDA Departmental Regulation 9500-10 promotes integrated management approaches to research and control within the Department of Agriculture. Forest Service Manual 2080 provides policy on noxious weed management. The Eastern Region (Region 9) of the Forest Service, which includes the White Mountain National Forest, has developed a strategy for addressing invasive plants (US Forest Service, 2003). The White Mountain National Forest is a designated Weed Management Area.

This section focuses on invasive plants, which is the biggest concern on the Forest. The Timber Resources section addresses insects and disease, including non-native species. No invasive vertebrate species are known to exist on the Forest.

The analysis area for non-native invasive species includes the towns encompassing the White Mountain National Forest. This represents potential source populations both on and off the Forest. Town boundaries are used because inventory data is often summarized by administrative lines such as towns or counties. Effects discussions include both the Forest Service's contribution to prevention and control, as well as the effects of activities both on and off the Forest that may increase the potential for further spread.

During 2001 and 2002, an invasive plant inventory was conducted by the New England Wild Flower Society. It covered approximately 220,000 acres across the Forest and adjacent lands, and focused on highly disturbed areas (e.g., roads, timber sale areas), but also included trails, Wilderness, and other sites with lower probability for occurrence. Almost 40 species were found occurring on or adjacent to the Forest (Map 3-03). Table 3-38 shows the breakdown by species.

Two-thirds of the invasive plant occurrences were found outside the Forest on private land. Almost half (47 percent) of all occurrences are individuals that were intentionally planted (e.g., in a garden). Thirty percent of the occurrences are found along roads. All three ranger districts contain infestations, with the majority found on the west side of the Forest, along the I-93 corridor. As yet, most of the occurrences are not extensive. Approximately 10 percent of occurrences include more than 100 individual plants and only 3 percent include more than 1,000 plants.

The areas of greatest ecological concern on the Forest are Research Natural Areas and open wetlands (because they are so limited on the Forest and because aquatic invasive species are especially prolific and difficult to eradicate). Eurasian water milfoil (*Myriophyllum spicatum*) is not yet known on the Forest, although it occurs in lakes and rivers to the south.

Other significant ecological areas (e.g., alpine and cliffs) are of less concern because their harsh environmental conditions make establishment of non-native invasive species less likely.

Non-native invasive species may spread through a variety of processes, including wind or water dispersal, in forage for wildlife such as birds, or by

Map 3-03. Locations of Non-Native Invasive Plants on the White Mountain National Forest.

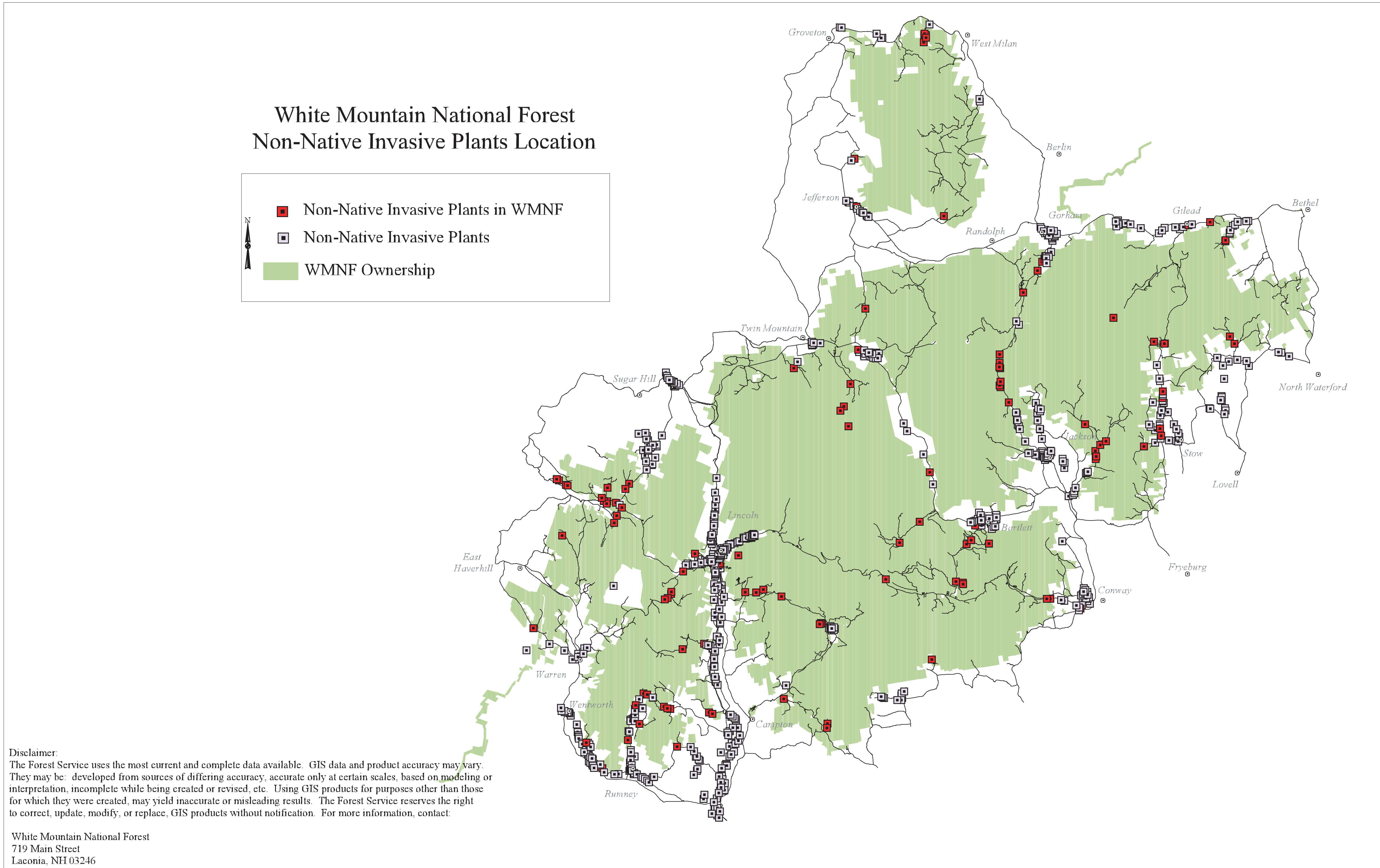


Table 3-38 Known Invasive Plants Occurring on or Near the White Mountain National Forest.

Common Name	Scientific Name	# of occurrences
Barberry, European	*Berberis vulgaris*	4
Barberry, Japanese	*Berberis thunbergii*	220
Bittersweet Nightshade	*Solanum dulcamara*	2
Bittersweet, Asiatic (Oriental)	*Celastrus orbiculata*	79
Buckthorn, Common	*Rhamnus cathartica*	1
Buckthorn, Glossy (Smooth)	*Rhamnus frangula*	40
Canada Thistle	*Cirsium arvense*	2
Celadine	*Chelidonium majus*	30
Coltsfoot	*Tussilago farfara*	80
Cypress Spurge	*Euphorbia cyparissias*	15
Dame's Rocket	*Hesperis matronalis*	2
Euonymus, Winged (Burning bush)	*Euonymus atropurpurea*	195
Goutweed	*Aegopodium podagraria*	49
Helleborine	*Epipactis helleborine*	5
Honeysuckle, Morrow	*Lonicera morrowii*	159
Honeysuckle, Tartarian	*Lonicera tartarica*	34
Honeysuckle, Other or Unknown	Other *Lonicera ssp.*	20
Iris, Yellow	*Iris pseudacorus*	7
Japanese Knotweed	*Polygonum cuspidatum*	282
Live-forever	*Sedum telephium*	1
Locust, Black	*Robinia pseudo-acacia*	187
Maple, Norway	*Acer platanoides*	157
Olive, Autumn	*Elaeagnus umbellata*	36
Olive, Russian	*Elaeagnus augustifolia*	1
Phragmites (Common Reed)	*Phragmites australis*	9
Privet (Blunt-leaved, California, Common, or Unknown)	*Ligustrum spp.*	36
Purple Loosestrife	*Lythrum salicaria*	30
Reed Canary Grass	*Phalaris arundinacea*	2
Rose, Multiflora	*Rosa multiflora*	50
Sorrell, Field (Sheep)	*Rumex acetosella*	7
Spotted Knapweed	*Centaurea spp.*	6
Swallowwort (Black, Pale, or Unknown)	*Cynanchum spp.*	5
Tree-of-Heaven	*Ailanthus altissima*	1
Total		**1,754**

using barbs that attach to fur or clothing. However, while seeds and plant material may be dispersed or carried to new sites, new occurrences generally do not establish and spread unless certain environmental conditions exist. Invasive plants tend to be most successful when soil has been disturbed and sunlight levels are high (i.e., open canopy). The majority of the invasive plant occurrences on or near the Forest are in open sunlight conditions along roads or in fields, yards, or gardens. Management activities that perpetuate these conditions (e.g., road/trail construction and maintenance, timber sale operations, wildlife opening maintenance, prescribed burning) may be more likely to result in population increases. Other activities, such as hiking, boating, using pack animals, or landscaping, can also spread invasive plants. At the same time, prevention, mitigation, and eradication efforts may help reduce or eliminate potential effects.

Analysis of effects will compare how the conditions described above differ between alternatives. Specifically, each alternative will be evaluated based on the following indicators:

- Acres in management areas that allow vegetation management or summer motorized trails.
- Acres of timber harvest, including the proportion of regeneration harvest, whose prescriptions are the most likely to result in open canopy conditions.
- Miles of road and/or summer motorized trail to be constructed and/or maintained.

Although there are additional activities that may contribute to the spread of invasive plants (e.g., utility rights-of-way maintenance, facility construction, boating), the three listed above encompass the most likely sources that may change across the proposed alternatives. Current condition of these indicators may be found in the Timber, Recreation, and Wildlife effects sections.

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

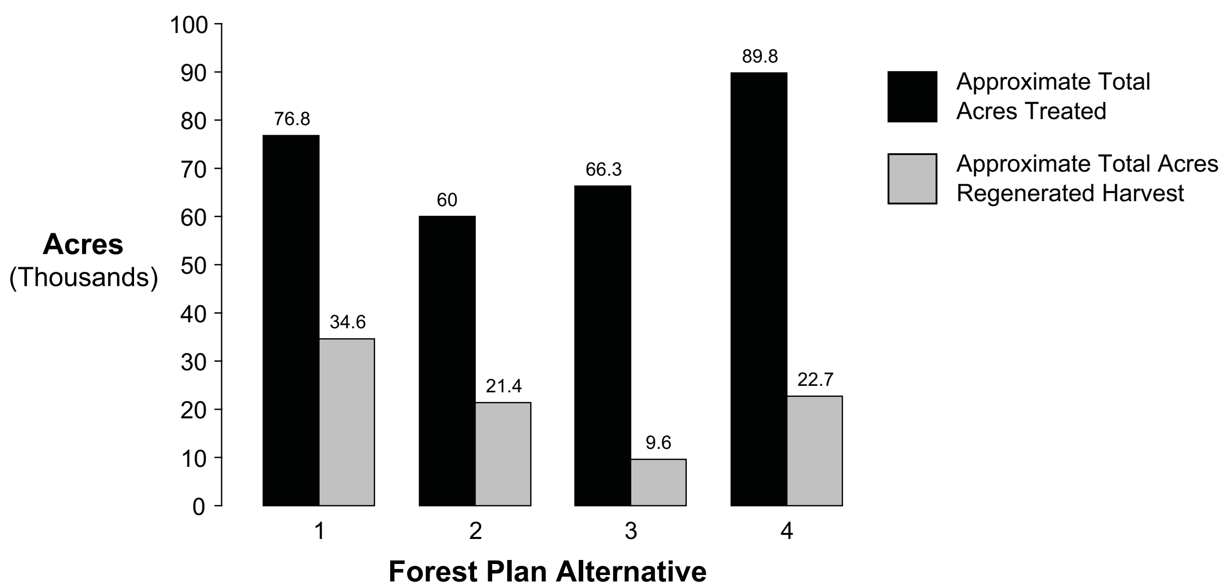
All alternatives would add a number of standards and guidelines designed to prevent establishment of non-native invasive species on the Forest, and to eradicate or control the spread of existing populations. Implementation of Forest-wide prevention measures would reduce the risk of invasive species being introduced, especially through machinery or equipment. Eradication efforts could employ mechanical, chemical, or biological control mechanisms. This would facilitate use of the most effective and cost-efficient eradication treatments available to prevent further infestation and spread. Given projected funding levels, it is unlikely that the spread of non-native invasive species could be completely prevented on the Forest, but new program direction would help mitigate the rate of spread and subsequent effects on native communities.

In evaluating the differences between the alternatives, non-native invasive species would be most influenced by:

1. The total amount of timber harvest (because this activity causes the most soil disturbance across the Forest and because large machinery is a known vector for transporting invasive plant material).
2. The proportion of regeneration timber harvest (which opens canopies and provides a more suitable colonization site).
3. The amount of road construction (which causes soil disturbance and generally opens canopies to create suitable colonization sites).
4. The amount of summer motorized trail construction (same rationale as roads).

Figure 3-06 shows the relative difference of timber harvest acres by alternative.

Figure 3-06. Total Projected Harvest Acres – First Two Decades of Forest Plan Implementation.



Alternative 1

Direct and Indirect Effects

The risk for spread of non-native invasive species is higher in Alternative 1 compared to the other alternatives. Non-native invasive species are most likely to occur in disturbed sites, such as recently harvested stands, along roads, and on landings, because these species tend to grow well in open sunlight conditions and can out-compete native plants in the same situation. The risk increases when motorized equipment is introduced, because such vectors readily transport seeds and other plant material from one infestation to a new site. The more regeneration harvests are implemented, the higher the probability that non-native invasive species will become established, because these treatments create larger sites that remain open for longer

periods of time compared to other harvests. Although the Forest's inventory showed minimal occurrence of non-native invasive species in recently logged stands, much of the harvesting equipment currently being operated on the Forest is coming from areas that are not yet heavily infested.

Alternative 1 would allow timber harvest within 357,000 acres in Management Areas 2.1 and 3.1. The amount of timber harvest activity (approximately 77,000 acres treated during the first two decades of Forest Plan implementation) is second only to Alternative 4 in terms of magnitude, and the amount of regeneration harvests proposed (almost 35,000 acres) is the highest of the alternatives. More ground disturbance would occur from timber operations and more open conditions would be provided than in the other alternatives. Therefore, the risk of non-native invasive species spread on the Forest is greatest in this alternative. Mandatory equipment cleaning clauses would be included in all timber sale contracts, which would help to reduce the chances of invasive plant materials being brought from another area by equipment. This would be the same in all alternatives.

Road construction for timber harvest purposes would be minimal, since the road system is well established, but some additional miles would be needed, especially for temporary roads. The biggest road activity is not new construction, but reopening of old roads that have not been recently used. These roads have typically become naturally revegetated, and would require brushing and replacement of culverts and ditches in order to be used. The vast majority of these roads would be closed after the timber sale was completed in the area, but may serve to support source populations of invasive plants that may have become established on the disturbed roadbed during road preparation activities.

Summer motorized trail construction would occur on a case-by-case basis, likely within these same management areas. While the magnitude of this activity cannot be precisely predicted, it is estimated for planning purposes that this could encompass two separate areas, totaling approximately 60 miles. This is the highest of any alternative. Depending on site conditions, it is likely that non-native invasive species could become established on the trails, especially on the edges. ATVs provide an efficient vector to transport seeds and plant materials to other locations, perpetuating the non-native invasive species spread to new areas and continuing region-wide effects to native plant communities. Also, unlike other equipment, there is no standard or guideline that requires inspection before entering the Forest. Assuming ATVs remain on the trail itself, it appears unlikely that many non-native invasive species would spread to the Forest interior, since, as yet, they seem relatively slow to colonize existing shaded forests. However, linear spread along trails would be likely, which could then serve as a source for future colonization.

Cumulative Effects

The majority of non-native invasive species occurs outside the Forest boundary. The towns of Bartlett and Jackson, and the I-93 highway corridor, are notable for numbers of non-native invasive species occurrences. Mapping also shows a spread of invasives along highways 112 (including the

Kancamagus Scenic Highway), 16, and 302 through the Forest. Many of these species are easily spread through birds, wind, or maintenance equipment. As infestations increase around the Forest, the risk of spread will also increase. Activities such as development (which may lead to increased road densities and more open ground) will likely increase and will further the opportunities for establishment of non-native invasive species. Prevention and eradication efforts on the Forest alone may reduce the spread, but may be a losing battle if no effort is made outside the Forest boundaries. Statewide and regional programs related to non-native invasive species have recently begun (e.g., the State of New Hampshire's release of purple loosestrife beetles in various locations, regional invasive plant survey efforts coordinated by the New England Wild Flower Society, legislation to ban selling of certain invasive plants). Any regional prevention and control strategy will require support from other agencies and private citizens on whose properties many non-native invasive species occurrences are and will be found. Assuming this support can be built, there is a chance of controlling invasive species spread on the Forest. Given the steady spread of invasive species across all parts of the United States, it is likely their populations will continue to expand around the Forest. However, implementation of local strategies would help maintain native plant communities and the species that depend upon them. Over the next 50 to 100 years, it is anticipated that the Forest could become more of a refugium where native species, especially those that are rare, would find greater protection from non-native invasive species threats that may be more prevalent elsewhere in the Northeast. However, Alternative 1 would have the greatest possibility of the Forest contributing to the spread of non-native invasive species both on and off-Forest. Because eradication efforts (i.e., funding levels) are presumed to be the same in all alternatives, implementing Alternative 1 would result in more occurrences requiring treatment per unit of eradication effort. This would increase the risk of non-native invasive species spreading from the Forest to surrounding areas and make it more difficult for the Forest Service to protect native communities compared to the other alternatives.

Alternative 2

Direct and Indirect Effects

Mitigation measures would be the same as in Alternative 1. Alternative 2 would allow vegetation management on 358,000 acres in Management Area 2.1. The amount of timber harvest activity is almost 22 percent less than in Alternative 1, while the amount of regeneration harvest is almost 40 percent less than in Alternative 1.

Risk of non-native invasive species establishment is less than in Alternatives 1 and 4 because fewer acres would be disturbed and left with open canopies, but there is still some risk that invasives could become established. Currently, most of the Forest's past clearcuts and other open canopy harvests are relatively free of invasives, presumably because regenerating stands grow so quickly that the invasives are not able to compete successfully. However, several sites exist where eradication efforts have been implemented to

remove invasives from stands that did not have completely open canopies.

Alternative 2 would require less road work than Alternatives 1 or 4, reducing the risk of non-native invasive species spread as a result.

Required equipment cleaning provisions would reduce the risk of infestations caused by equipment as in Alternative 1.

No summer motorized trail construction would be allowed in Alternative 2, therefore, the risk of non-native invasive species spread as a result of trail construction or use would be nonexistent.

Cumulative Effects

Activities and effects outside the Forest would be the same as described in Alternative 1, however, cumulative effects would be less. With fewer timber harvests and no summer motorized trail construction or use, the risk of contributing to regional non-native invasive species spread would be reduced.

Alternative 3

Direct and Indirect Effects

Mitigation measures would be the same as described in Alternative 1.

Alternative 3 would allow vegetation management on 296,000 acres in Management Area 2.1. The total acres of proposed timber harvest and the amount of regeneration harvest would be the lowest of any alternative. Road construction/reconstruction needs would be similar to Alternative 2. Risk of non-native invasive species spread would be slightly less than that described in Alternative 2.

No summer motorized trail construction would be allowed in Alternative 3, therefore, the risk of non-native invasive species spread as a result of trail construction or use would be nonexistent, as in Alternative 2.

Cumulative Effects

Cumulative effects would be similar to those described in Alternative 2.

Alternative 4

Direct and Indirect Effects

Mitigation measures would be the same as described in Alternative 1.

The risk for non-native invasive species spread and establishment would be higher in this alternative than in Alternatives 2 and 3, but probably somewhat less than Alternative 1. Alternative 4 would allow vegetation management on 366,000 acres in Management Area 2.1. The amount of timber harvest activity is the highest of any alternative, although the amount of regeneration harvest is less than Alternative 1. Therefore, the amount of open canopy is expected to be correspondingly less than Alternative 1.

Road construction and reconstruction are the highest of any alternative, although the resulting risk in terms of non-native invasive species spread is probably not measurably different from Alternative 1.

Alternative 4 allows for summer motorized use within a designated area. Without site-specific parameters, the effects of this activity cannot be quantified, but it is assumed that a proposed trail would be 20-30 miles in length. Effects would be the same as those described in Alternative 1, but would be of a lower magnitude since there would be fewer miles of trail designated.

Cumulative Effects

Effects of off-Forest activities contributing to non-native invasive species spread on the Forest would be the same as those described in Alternative 1. Compared to Alternatives 2 and 3, this alternative would have a greater possibility of the Forest contributing to the spread of non-native invasive species both on and off-Forest, but would probably contribute less than in Alternative 1.

Moose cow and calf (WMNF photo by Forrest Seavey)

Wildlife

The White Mountain National Forest is home to a wide variety of animals occupying a range of habitats, from low elevation wetlands to high alpine peaks. Over 200 vertebrates alone may be found on the Forest, along with countless invertebrates. People are interested in the Forest's wildlife for a number of reasons, including hunting and trapping opportunities, birdwatching or other forms of wildlife viewing, unique research opportunities, or simply for their intrinsic ecological value as a component of the Forest's biodiversity.

Wildlife are inextricably linked to their habitats. Habitat requirements may include broad (coarse filter) components (e.g., mature softwoods or regenerating hardwoods) and specific (fine filter) components (e.g., soil pH, nest tree size, presence of vernal pools), and may range from small components (e.g., individual snags) to large areas (e.g., spruce-fir landscapes), depending on the species. Some species are associated with very strict habitat requirements (habitat specialists), while others may occupy a wide range of conditions (habitat generalists).

This section takes a coarse filter approach and evaluates effects to common wildlife species occupying broad habitat types. Effects to broad terrestrial habitats are described primarily in the Vegetation section, while this section takes those effects one step further and displays the response of individual species or groups of species to changes in broad terrestrial habitats or increasing human use levels. Wetland and aquatic habitats are addressed in the Stream Habitats and Water Resources sections of this document. Information on endangered, threatened, and sensitive species, other species of potential viability concern, and the microhabitats on which they depend, can be found in the Rare and Unique Features section.

In order to effectively address the broad suite of common, terrestrial wildlife species, this section is divided into four focus areas:

- **Management Indicator Species**, a method that uses individual species to represent broad stand-level habitat types reflecting the timber management/wildlife habitat issue, and to some extent the land allocation issue. (See Chapter 1 for detailed descriptions of the issues.)
- **Ecological Indicators**, a method that uses groups of species or communities to evaluate effects on ecosystems in response to the recreation issue.
- **Forest Fragmentation**, which addresses species that need large blocks of habitat, as opposed to particular stand-level conditions.
- **Migratory Birds**, which addresses the WMNF role in maintaining bird populations to contribute to national Partners in Flight bird conservation efforts.

Management Indicator Species and Ecological Indicators

Management Indicator Species (MIS) and Ecological Indicators provide a mechanism to assess the effects of Forest Plan alternatives on plants, animals, and biological communities and provide the most direct tie to the Forest Plan revision issues. Individual MIS were selected because their population changes are believed to indicate the effects of management activities on selected biological communities (36 CFR 219.19). Language in Forest Service Manual 2621 (WO amendment 2600-91-5) expanded MIS to include other indicators (called Ecological Indicators in this document), which can include species, species groups, or habitats of high concern.

In this revision, MIS were used to evaluate the timber management/wildlife habitat issue and, to some extent, the land allocation issue because there is a direct cause and effect relationship between vegetation changes and levels of habitat that lead to population increases or decreases. In addition, individual species could be identified to represent other species using the same broad habitat types (the definition of MIS). For the recreation management issue, cause and effect relationships are more difficult to define. Also, a single species could not be found to effectively represent others with similar habitat requirements. Therefore, the Ecological Indicator (EI) approach was selected to address this issue, using communities or groups of species to evaluate effects of recreation use on ecosystems of concern. Since MIS and EI respond to different Forest Plan revision issues, they are presented separately below.

Management Indicator Species

The 1986 Forest Plan used 25 MIS to track a variety of habitat types and conditions. Appendix F displays how these species and their representative habitats are addressed in the revision process. Additional details can be found in the project file.

For this Forest Plan revision, MIS were selected to respond specifically to the timber harvest/wildlife habitat issue, i.e., timber harvest effects on wildlife and the amount of early successional (regeneration age class) habitat to be provided in each alternative. It was unnecessary to select a MIS for every broad habitat that may be found on the Forest, since most are not expected to differ by alternative or change substantially over time.

The land allocation issue also plays a role in MIS discussions in that, to some extent, habitat levels are dependent on how much land is available where timber harvest is allowed. It is also important to track management areas where timber harvest is not allowed, because these areas will contribute a large proportion of mature habitats, as well as some quantities of early successional habitats through natural disturbance.

To address these issues, the alternatives propose differing amounts of land where timber can be harvested, as well as a series of vegetative objectives based on major habitat community types. These habitat types include northern hardwood, mixed hardwood-softwood, spruce-fir, aspen-birch, wildlife opening, hemlock, oak-pine, wetlands, and non-vegetated habitats. Rather than identifying MIS for all nine of these habitats, selection of MIS

focused specifically on those habitats most likely to change as a result of timber management. In this way, differences between alternatives are more easily highlighted and future monitoring can focus on those habitats most likely to be altered by management. MIS selection also required that MIS only be designated if population changes were believed to indicate the effects of management activities on other species of the selected habitat type.

Selected MIS are shown in Table 3-39. In this case, all five MIS are birds. Eighty-five species were evaluated as possible MIS. The individual species that best represented the above conditions were chosen. Of all vertebrates, birds are the most specific in their habitat requirements. They are also easier to identify than many plants and invertebrates. Detailed information on the selection process for MIS is in the planning record.

Table 3-39. WMNF Management Indicator Species Selected for Forest Plan Revision

MIS	Habitat condition
Chestnut-sided warbler (*Dendroica pensylvanica*)	**Regeneration Hardwoods** (Predominantly seedling and sapling stages of northern hardwoods, but could also include some scattered softwoods; seedling and sapling stages.)*
Rationale for selection: • Strongly tied to shrubby hardwood conditions; • Partners in Flight High Priority species (see Migratory Bird subsection); • Population changes are believed to indicate effects of management activities on other species of selected major biological communities ... (36 CFR 219.19)**	
Other species that use this habitat: Moose, white-tailed deer, black bear, cedar waxwing, mourning warbler, common yellowthroat	

* Although habitat composition objectives for hardwood-softwood (mixed wood) were developed, there are no species that show a strong preference for mixed wood forests. Mixed wood stands may be predominantly hardwoods with scattered softwood trees or predominantly softwoods with scattered hardwood trees. In either case, they are important because they support a diverse assemblage of species. However, there do not appear to be any species that use mixed wood forests exclusively or prefer them more than the more homogeneous hardwood or softwood stands. Because of this, the vegetative habitat community types were left as predominantly hardwoods and predominantly softwoods. Mixed wood conditions will be monitored, but not through MIS.

** 36 CFR 219 is the regulation promulgated under the National Forest Management Act. These regulations direct the development and revision of Forest Plans. Section 219.19 identifies a series of categories from which MIS shall be chosen, where appropriate.

MIS	Habitat condition
Scarlet tanager (*Piranga olivacea*)	**Mature/Old Hardwoods** (Predominantly northern hardwoods, but could also include some scattered softwoods; at least poletimber stage, but also includes all-aged stands.)
Rationale for selection: • Prefers northern hardwoods, mixed woods, and oak-pine. Not as specific as some species preferring large trees, but will use both even- and uneven-aged mature stands. • Population changes are believed to indicate the effects of management activities on other species of selected major biological communities …(36 CFR 219.19)	
Other species that use this habitat: Fisher, northern goshawk, barred owl, pileated woodpecker, red-eyed vireo	

Table 3-39. WMNF Management Indicator Species Selected for Forest Plan Revision (continued).

MIS	Habitat condition
Magnolia warbler (*Dendroica magnolia*)	**Regeneration Softwoods** (Predominantly spruce-fir, but could also include some scattered hardwoods; seedling and sapling stages.)
Rationale for selection: • Prefers both seedling and sapling stages of softwood stands • Population changes are believed to indicate the effects of management activities on other species of selected major biological communities…(36 CFR 219.19)	
Other species that use this habitat: Moose, snowshoe hare, bobcat, yellow warbler, purple finch, dark-eyed junco	

MIS	Habitat condition
Blackburnian warbler (*Dendroica fusca*)	**Mature/Old Softwoods** (Predominantly spruce-fir, but could also include some scattered hardwoods; at least poletimber size.)
Rationale for selection: • Show a strong affinity for mature softwoods in NH and ME. • Population changes are believed to indicate the effects of management activities on other species of selected major biological communities…(36 CFR 219.19)	
Other species that use this habitat: Red-breasted nuthatch, ruby-crowned kinglet, red squirrel, American marten, white-tailed deer (winter)	

MIS	Habitat condition
Ruffed grouse (*Bonasa umbellus*)	**Aspen/Paper Birch** (Stands where the majority of the overstory is aspen and/or paper birch. This habitat community type is different from the hardwoods and softwoods above in that there is no distinction for age class)
Rationale for selection: • Although ruffed grouse will use other types, it prefers aspen/birch. • It is a species with special habitat needs that may be influenced significantly by planned management programs (36 CFR 219.19) • Population changes are believed to indicate the effects of management activities on other species of selected major biological communities…(36 CFR 219.19) • Species commonly hunted, fished, or trapped (36 CFR 219.19)	
Other species that use this habitat: Beaver, American woodcock, yellow-bellied sapsucker, Nashville warbler	

Affected Environment

For all MIS, the primary mechanism for habitat change to be evaluated will be timber harvest. Natural ecological processes also create suitable habitat conditions, both early-successional (through wind or ice storm events) and mature (through allowing stands to grow older). Natural disturbance processes will be allowed to continue in the same manner for all the alternatives, so differences in habitat outputs will be primarily a function of the amount and type of timber harvesting projected and the size of the land base on which timber harvesting activities may occur. (See the Vegetation section for additional details on frequency of natural disturbance processes and information on historical trends in habitat availability.)

All MIS are widespread in New England, but occupy small breeding territories. In order to evaluate habitat and population trends, it is necessary to focus effects analysis on the breeding population for each species. These five bird species are generally abundant in northern New England and no large barriers to movement exist, so the entire Northeast and beyond could be delineated as a single breeding population for each MIS. Such a large analysis area would make effects analysis moot, since habitat changes resulting from the different alternatives would be so small as to be immeasurable over such a large scale. Instead, cumulative effects analysis for all MIS will use the land base encompassing the five ecological subsections, described by McNab and Avers (1994) and mapped by Keys et al. (1995), that surround and include the White Mountain National Forest (Map 3-02, Vegetation section). All five subsections are a part of the Adirondack-New England Mixed Forest-Coniferous Forest-Alpine Meadow Province (M212), characterized by northern hardwoods, northern hardwood-spruce, and/or spruce-fir forests. The analysis area in total is approximately 5,700,000 acres, of which the White Mountain National Forest makes up approximately 14 percent. This analysis area will allow for a more meaningful evaluation of population and habitat changes caused by different Forest management direction in each alternative, as well as incorporate habitat changes off the Forest that contribute to the larger breeding population. The habitat levels on the Forest can thus be evaluated in a reasonable way within a regional landscape context.

It is also recognized that actions occurring a great distance away may influence the population trends of the breeding populations. For example, loss of winter habitat for many neotropical migratory birds affects numbers of returning individuals. Some of these influences can be avoided by selecting MIS that are resident species, but it then becomes difficult to select a species that shows a tight species-habitat relationship. The MIS (and Ecological Indicators) selected for this Forest Plan revision were chosen primarily for their relationship to a particular habitat or measure of ecosystem health. Other factors outside the analysis area that affect population trends will be considered in future monitoring and evaluation, but are not included in this analysis.

MIS 1. Chestnut-sided warbler (regenerating hardwoods)

Chestnut-sided warblers occupy shrubby, open, and dry areas of deciduous and mixed stands. They prefer regenerating growth typically provided by stand-replacing harvests such as clearcutting, but may be found in a variety of dense, brushy (3 to 10 feet tall) habitat conditions. In northern New England, the species is considered widespread and abundant (DeGraaf and Yamasaki, 2001).

Prior to widespread European settlement, relative abundance of chestnut-sided warblers (and most species) is unknown. It is likely that some early successional habitat has always been present in the Northeast, whether by ecological processes (e.g., beaver activity or windthrow) or anthropogenic influences (e.g., Native American burning). Chestnut-sided warbler habitats would probably have been small and patchy on the Forest, but larger and more extensive along the coast (Lorimer and White, 2003). Chestnut-sided warblers were likely present in small numbers on the Forest and would have had correspondingly higher populations in larger disturbed areas along the coast.

Around the turn of the century, though, that situation would have changed as timber harvest increased throughout the region. The Vegetation section presents information on habitat availability on the Forest during the early part of the 20th century. Although exact acres of suitable habitat are unknown, it is likely that substantially more habitat was available compared with either the present or earlier centuries. Large timber harvests and subsequent fires on and around what is now the White Mountain National Forest removed large areas of mature forest of all types, and as these stands regenerated, abundant early successional habitat became available. Off the Forest, land clearing for agriculture, and the subsequent abandonment of these lands, resulted in the creation of "thicket" habitats. It is presumed that populations of chestnut-sided warblers grew in response to this increase in available habitat, both on and off the Forest.

Today, hardwoods make up approximately 60 percent of the Forest (not including mixed woods). Based on the Forest's stand database, hardwood habitats are skewed to older age classes, with more than three-quarters of the Forest currently 60 years old or older. Less than one percent of the Forest is in a regenerating condition (0-9 years old). This is probably underestimated to some degree, since small patches of habitat in the form of brushy riparian areas or patches from uneven-aged harvest prescriptions may exist that have not been captured in the stand database. Additional habitat may also exist as a result of natural disturbance (e.g., small blowdowns), but this would not be expected to contribute substantial amounts of habitat for chestnut-sided warbler. The Vegetation section summarizes information on northern hardwoods, where disturbances tend to be very small in size (less than 0.2 acre), and even large disturbances such as hurricanes are usually not forceful enough to be stand-replacing events on the Forest.

Across the entire analysis area, northern hardwoods are the dominant forest type, making up approximately half of the total area. Data on age class is not available by forest type across the entire analysis area, but approximately

17 percent of all forested acres are in seedling or sapling size classes (Northeastern Forest Research Station, 1995; 1997) and may be assumed to offer suitable chestnut-sided warbler habitat.

Baseline population information for chestnut-sided warblers is available both on and off the Forest. The White Mountain National Forest has completed annual breeding bird surveys on permanent plots since 1992. A detailed analysis of these data was completed in 2000, and five species, including chestnut-sided warbler, showed a statistically significant declining trend (MacFaden and Capen, 2000). Unfortunately, it is unclear how much of this trend is related to survey protocol. Since points are permanently marked, those that were in open or regenerating stands in 1992 have revegetated to a stage where habitat is no longer suitable and may not have been replaced by similar habitat adjacent to the original point. The amount of even-aged regeneration harvests on the Forest has declined in recent decades, so a decline in species that rely on early successional habitats is not surprising. However, additional vegetation analysis is needed to determine the extent to which the bird data reflects the habitat decline.

In any case, the population decline on the Forest mirrors that seen in the five subsections surrounding the Forest. Data from national Breeding Bird Survey (BBS) routes administered by the U.S. Geological Survey (Sauer et al., 2003) were identified within the analysis area and population trends evaluated over this larger area. A total of seventeen permanent transects are located within the analysis area (ME=2, NH=6, VT=9). Between 1966 and 2002, the average number of chestnut-sided warblers observed per transect declined, although with fluctuations over the time period. This is consistent with the trend maps compiled by Sauer et al. (2003) for the same area over the period 1966-1996.

MIS 2. Scarlet tanager (mature hardwoods)

Scarlet tanagers are associated with mature deciduous and mixed forests. Although they inhabit a wide range of forest stages, they are most abundant in mature stands. The scarlet tanager is a common and widespread breeder in New England (DeGraaf and Yamasaki, 2001).

The Vegetation section discusses the Forest Service's use of Ecological Land Types (ELTs) to identify land capability (or climax forest conditions). In other words, ELTs help explain how the Forest would likely appear if no disturbance were to occur on a particular site. If we assume that, for the most part, land capability was achieved prior to European settlement, the Forest would have had approximately twice as much softwoods and 25 percent less hardwoods than currently exist. Since frequent, large natural disturbances would not be expected on the Forest (Lorimer and White, 2003), it is safe to assume that the vast majority of hardwoods in existence prior to European settlement would have been mature and offered suitable scarlet tanager habitat.

Using the same information presented for chestnut-sided warbler above, it is clear that in the past 100 years mature hardwoods became less prevalent, with correspondingly lower scarlet tanager populations. As regenerating stands on the Forest matured, scarlet tanager habitat became suitable again.

In addition, more hardwood stands currently exist on the Forest than what land capability would predict, so scarlet tanager populations over the last few decades may actually be higher than at any other time.

Currently, habitat for scarlet tanagers is abundant on the Forest, with more than three-quarters of hardwoods in a mature condition. This is similar to the entire analysis area, where the majority of all forest types are in sawtimber or poletimber size classes (Northeastern Forest Research Station, 1995; 1997).

Forest data from permanent bird monitoring points show scarlet tanagers declining since 1992, but the change is not statistically significant. When Breeding Bird Survey transects within the analysis area were analyzed, scarlet tanagers showed a stable trend over the last four decades. However, the overall stable trend results from a combination of individual increasing and decreasing transect trends. Transects in New Hampshire appear to show declining trends, while those in Vermont and Maine tend to have more increasing trends (Sauer et al., 2003).

MIS 3. Magnolia warbler (regenerating softwoods)

Magnolia warblers use habitats dominated by conifers, including mixed hardwood/softwood forests and conifer-forested wetland. They may be found in woodland clearings with small conifers, thickets along roadsides, successional forests, and forest edges. They prefer dense stands of young spruce and fir. Magnolia warblers are locally common in New England (DeGraaf and Yamasaki, 2001).

Prior to European settlement, softwoods would have been more than twice as abundant on the Forest (based on land capability) compared to today. Natural disturbance (primarily windthrow) would place an estimated three to six percent of this habitat in a regenerating condition, which would have provided habitat for magnolia warblers (see Vegetation section for details).

Large harvests and subsequent fires around the turn of the century would have created more regeneration habitats of all types. Magnolia warblers would have found additional habitat following harvests, especially on strong softwood ELT sites (see Vegetation section). Habitat created through natural disturbance would still have been present in high elevations that were inaccessible to logging operations.

As the Forest has matured over the last century, the amount of habitat for magnolia warblers in lower elevations has declined. Currently, softwoods (i.e., spruce and fir) make up approximately one-quarter of the Forest, but regenerating softwoods are relatively uncommon. Fewer than one percent (349 acres) of softwood stands are less than 10 years old. Many more stands contain a strong softwood understory, but are overtopped with paper birch or hardwoods. These stands are not counted as regenerating softwoods in the Forest's stand database, but in some cases may provide suitable habitat for magnolia warbler. Most softwood stands that have had small group cut prescriptions also would provide more regenerating softwood habitat than appears in the stand database, although this would not add more than one or two percent additional habitat.

Natural disturbance in high elevations ("fir waves") creates far more habitat for magnolia warblers than what exists from timber harvest in lower elevations. In addition, the krummholz zone below alpine is made up of mature trees in terms of age class, but these stands are so stunted and dense that they serve the same function as regenerating habitats. This alone offers several thousand additional acres of suitable habitat for magnolia warblers.

Across the analysis area, softwoods appear in the same proportion as on the Forest. Data on age class is unavailable by forest type, but approximately 17 percent of all forested acres in the analysis area are in seedling or sapling age classes (Northeastern Forest Research Station, 1995; 1997).

In recent years, population trends on the Forest were not statistically significant (MacFaden and Capen, 2000). Within the larger analysis area, data also reflect a stable trend overall, although like the scarlet tanager, this appears to result from a combination of increasing and decreasing trends on individual transects. Northern New Hampshire and Maine show declining trends, while southern New Hampshire and northern Vermont display increasing trends (Sauer et al., 2003).

MIS 4. Blackburnian warbler (mature softwoods)

Blackburnian warblers prefer mature coniferous and mixed hardwood/softwood forests. In New England, breeding is limited to Vermont, New Hampshire, Maine, western and central Massachusetts, and western Connecticut (DeGraaf and Yamasaki, 2001).

Prior to European settlement, land capability indicates softwoods on the Forest would have been more than twice as abundant as they are today. Natural disturbance is estimated to occur over some three to six percent of softwood habitats at any one time (Lorimer and White, 2003), so not all of this would have been mature habitat. However, it can be assumed that habitat for blackburnian warblers was abundant and populations would have been higher than those that currently exist.

Similar to scarlet tanager, habitat was less abundant 100 years ago following widespread harvests compared to current conditions. Although population data is unavailable, it is assumed that fewer blackburnian warblers would have been present on the Forest compared to current populations.

Currently, mature and old softwoods make up 98 percent of the softwood community on the Forest. This may be higher proportionally than the entire analysis area, where approximately 83 percent of all forest types are in sawtimber or poletimber size classes (Northeastern Forest Research Station, 1995; 1997).

Bird monitoring on the Forest shows no statistically significant trend for blackburnian warblers between 1992 and 1999 (MacFaden and Capen, 2000). Similarly, trends in the larger analysis area appear to be stable. Blackburnian warblers appear less frequently than some other species, so data may be less reliable. Sauer et al. (2003) show declining trends in the southern part of the analysis area and increasing trends in the north.

MIS 5. Ruffed grouse (aspen/ paper birch)

Ruffed grouse inhabit a range of habitat conditions, including hardwoods, mixed woods, and softwoods, often with aspen or birch trees present. Hens and their broods prefer dense understories and open herbaceous ground cover, e.g., regenerating clearcuts or old burns. Drumming logs near brushy escape cover are needed in the fall. In winter, ruffed grouse use more mature stands for cover and roosting. Catkin-bearing shrubs, and trees such as aspen and birch, are a characteristic component of suitable habitat. Ruffed grouse are resident throughout virtually all of New England (DeGraaf and Yamasaki, 2001).

Based on land capability, aspen/paper birch would not occur without disturbance on the Forest. It is likely that some natural disturbance (e.g., from beavers) would have maintained some trees on the Forest. However, they probably would not have supported a measurable grouse population. Much of the Forest's aspen-paper birch regenerated following the large timber harvests and subsequent fires at the turn of the century. Combined with the substantial increase in all regenerating habitats, it is assumed that grouse populations grew considerably at that time.

Although ruffed grouse will occupy a variety of habitat types, they are used in this Forest Plan revision specifically to represent aspen and paper birch. Aspen and paper birch combined make up approximately ten percent of the Forest, although the majority (95 percent) is paper birch. Mature and old age classes are most prevalent. This is comparable to the proportions in the entire analysis area (Northeastern Forest Research Station, 1995; 1997).

Unlike the other MIS, ruffed grouse are resident species, so their trends are more directly tied to local conditions. Ruffed grouse are not as common as the other MIS on the Forest, so there are less data to evaluate. Between 1992 and 1999, no statistically significant trends were observed on the Forest (MacFaden and Capen, 2000). Over the analysis area, Breeding Bird Survey data shows a gradual decline following a large peak in the mid-1970s. Trend maps display declining trends in the northern part of the analysis area, but increasing trends in the south (Sauer et al., 2003).

Environmental Effects

Effects information is presented first in a series of tables that summarize the alternatives and effects. Following these summarized tables is more detailed information on effects to each MIS.

Habitat Summary

Management Indicator Species (MIS) are used to evaluate changes in response to the timber harvest/wildlife habitat issue. Although natural succession and disturbance processes will affect habitat for all five MIS, this discussion centers on timber harvest actions that will result in potential differences by alternative. Relative to this analysis, there are four general factors that determine how much habitat will be provided for each MIS in the different alternatives:

1. Amount of land in management areas that allow timber harvest.
2. Percent composition objective (i.e., amount of the Forest that will be in hardwoods or softwoods or aspen-paper birch.
3. Amount of even-aged regeneration harvest proposed.
4. Amount of each vegetation type that will be in the appropriate age class for the representative MIS.

1. Amount of land in management areas that allow timber harvest

The amount of land available for harvest is important because it provides the base where early successional habitats may be created through management actions. Generally, areas with more land available for harvest allow a wider distribution of early successional habitats to occur. Table 3-40 shows that in Alternatives 1, 2, and 4, the amount of land available to create early successional habitats through timber harvest is about the same (almost half of the Forest). The land base is smaller in Alternative 3.

Table 3-40. Land Allocated to Management Areas 2.1 (and 3.1 in Alternative 1) by Alternative.

Alternative 1	Alternative 2	Alternative 3	Alternative 4
357,200 acres 45% of Forest	358,200 acres 45% of Forest	296,100 acres 37% of Forest	365,900 acres 46% of Forest

2. Amount of the Forest that will be in hardwoods or softwoods or aspen-paper birch

The percent objectives will provide the base amount of habitat from which different age classes can be provided (either naturally or through timber harvest). For example, alternatives that target a higher percentage of the land base in northern hardwoods would create more opportunities to provide habitat for chestnut-sided warblers and scarlet tanagers.

For species that utilize mature/old age classes, habitat may be found in any management area. However, for early successional species, the discussion is most relevant in MAs 2.1 and 3.1, because this is where timber harvest can create these habitats. Table 3-41 summarizes this information from Chapter 2.

Table 3-41. Long-Term Percent Habitat Objectives in MA 2.1 (and 3.1 in Alternative 1) by Alternative.

Habitat type	Current %*	Alternative 1	Alternatives 2-4
Northern hardwoods	53	51	51
Softwood	12	18	24
Aspen/birch	5	8	5

***Note current condition in terms of percent objectives would differ slightly in Alternatives 2-4 because the amount of land allocated to MA 2.1 changes between alternatives.

For MIS, the percent objective for northern hardwoods would be about the same in all alternatives (but recall that the difference in the amount of MA 2.1/3.1 land in each alternative will result in different total acres, even if the percent objective is the same). For softwoods and aspen-birch, Alternatives 2, 3, and 4 would have the same percent objective. Alternative 1 would have a higher amount of aspen-birch and a lower amount of softwoods than the other alternatives.

3. Amount of even-aged regeneration harvest proposed

This provides the estimate of the total acres of early successional habitat that will be created (across all vegetative types) in each alternative. Table 3-42a shows the range that could be created in each alternative; Table 3-42b estimates the amount of habitat to be created specifically in decades 1, 2, and 15 of Forest Plan implementation.

Table 3-42a. Range of even-aged regeneration harvests to be produced over 15 decades.

Alternative	Acres
1	14,800 – 21,600
2	9,300 – 12,000
3	4,800
4	11,200 – 16,200

Table 3-42b. Estimated acres of even-aged regeneration harvest in decades 1, 2, and 15 of Forest Plan implementation

Alternative	Decade 1	Decade 2	Decade 15
1	17,000	17,600	21,600
2	9,400	12,000	12,000
3	4,800	4,800	4,800
4	11,200	11,500	13,200

The numbers in Tables 3-42a and 3-42b are estimates based on model runs that may not hold true in actual implementation, but they are good approximations for comparison of alternatives. Table 3-42b indicates Alternative 1 would provide the most amount of regeneration habitat in decades 1, 2, and 15. Alternatives 4 and 2 would provide less than Alternative 1 and are close to each other in terms of relative amount. Alternative 3 would provide the least amount of early successional habitat.

4. Amount of each vegetation type that will be in the appropriate age class for the representative MIS

Chapter 2 identifies different age class objectives for each vegetative type by alternative. When combined with the three factors above, a total amount of habitat for each MIS can be estimated (Table 3-43).

Table 3-43. Estimated Short-Term (20 Years) Forest-Wide Total Acres of Habitat Available for Each MIS by Alternative (Based on Habitat Percent Objectives) and Percent Change from Current Conditions.[1]

MIS[2]	Current Acres	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
CSWA[2]	2,800	13,200	371%↑	7,800	179%↑	1,600	43%↓	11,900	325%↑
SCTA	275,300	287,400	4%↑	291,900	6%↑	303,500	10%↑	287,200	4%↑
MAWA	300	400	33%↑	400	33%↑	300	same	400	33%↑
BLBW	185,000	190,600	3%↑	190,700	3%↑	190,900	3%↑	190,600	3%↑
RUGR all ages	72,700	17,300	76%↓	17,700	76%↓	12,700	85%↓	17,700	76%↓
regen. habitat only	500	2,367	373%↑	2,655	431%↑	1,780	256%↑	2,655	431%↑

↑ Indicates increase in habitat from current conditions

↓ Indicates decrease in habitat from current conditions

CSWA = chestnut-sided warbler (regeneration hardwoods); SCTA = scarlet tanager (mature and old hardwoods); MAWA = magnolia warbler (regeneration softwoods); BLBW = blackburnian warbler (mature and old softwoods); RUGR = ruffed grouse (aspen and paper birch)

[1] Note: These tables only account for habitats created through timber harvest; natural disturbance processes are assumed to act equally across all alternatives to create additional habitat.

[2]Note acres given for regeneration habitats are average estimates of the amount of habitat available at any one time during a 10-year period. Since by definition, regeneration habitat is only 10 years old, only a portion of the total acres regenerated during the 20 years would be considered suitable habitat at any one time.

Note: Table 3-43 only depicts early successional habitats that would be created through timber harvest. Natural disturbance processes such as windthrow or fire can also create patches of suitable habitat, but these are assumed to have similar effects in all alternatives. In addition, these patches are generally not tracked in the Forest's stand database, so to include them in Table 3-43 would throw off the comparison with the current condition that was taken from the stand database. The Vegetation section discusses in detail how natural disturbance processes may affect habitat conditions on the Forest. In summary, disturbances in northern hardwoods are generally small (less than 0.2 acre), but frequent. Typical invading species such as aspen, paper birch, and yellow birch often colonize such gaps. Disturbances in softwoods are larger, with estimates of stand-replacing events occurring over approximately three to six percent in low elevation softwoods. Larger patches of regenerating softwoods are more common in high elevation softwoods, where "fir waves" and krummholtz provide the structure and density typical of regenerating softwood stands over several thousand acres. In all habitat types, habitat created through timber harvest would be additive to habitat created through natural disturbance. In other words, timber harvests would not generally be designed to "mimic" a natural disturbance event that has been suppressed, but rather would add habitat in addition to that created through natural factors.

Population Summary

The four factors above lead to different levels of early successional habitat being provided in each alternative that may result in different population levels of each MIS. In order to compare alternatives quickly, Table 3-44 summarizes expected changes to population trends for each MIS across the Forest.

Table 3-44. Summary of Expected Forest-Wide MIS Population Trends Compared to Current Conditions.

	Short-term[1]/Long- term[2]/Forest role[3]			
	Alt. 1	**Alt. 2**	**Alt. 3**	**Alt. 4**
Chestnut-sided warbler	↑ / ↑ / ↑	↑ / ↑ / ↑	↓ / ↓ / ↓	↑ / ↑ / ↑
Scarlet tanager	= / ↓ / =	= / ↓ / =	= / ↑ / ↑	= / ↓ / =
Magnolia warbler	= / ↑ / ↑	= / ↑ / ↑	= / ↑ / ↑	= / ↑ / ↑
Blackburnian warbler	= / ↑ / ↑	= / ↑ / ↑	= / ↑ / ↑	= / ↑ / ↑
Ruffed grouse	↑ / ↑ / ↑	↑ / ↑ / ↑	= / = / =	↑ / ↑ / ↑

↑ positive trend; ↓ negative trend; = stable trend
[1] Short-term = first 20 years on the WMNF
[2] Long-term = 150+ years on the WMNF
[3] Forest role = the proportion of analysis area population that would be held on the WMNF

The next section provides detailed effects to each MIS by alternative and further explains the information presented in the summary tables.

MIS 1. Chestnut-sided warbler

Alternative 1

Direct and Indirect Effects

Over the next 20 years, Alternative 1 would provide the most habitat for chestnut-sided warbler and other species that prefer early successional hardwoods. As acres of regeneration age class (0-9 years old) hardwoods increase, the population of chestnut-sided warblers on the Forest would similarly increase. Birds would be well-distributed in Management Areas 2.1 and 3.1.

Cumulative Effects

Over the long term (150 years and beyond) the amount of regeneration habitat produced is expected to be at the high end of the range modeled for this alternative. Therefore, chestnut-sided warbler numbers would continue to increase over time. Populations would not reach historic peaks that likely occurred when much of the Forest was in a regenerating condition, but Alternative 1 could slow or reverse the recent decline as additional early successional habitat is created.

Lorimer and White (2003) suggest early successional habitats are currently more prevalent in inland forests and less prevalent in coastal regions than

during pre-settlement times. This is presumably because increased development near the New England coast has converted the habitats that would have naturally been maintained in early successional conditions, and past timber harvesting in inland forests has increased the amount of suitable habitat.

See the Vegetation effects section for details on cumulative effects to even-aged regeneration habitats within the analysis area. Levels of clearcutting (to regenerate habitat as opposed to prepare for development) appear to be decreasing off-Forest. Consequently, numbers of chestnut-sided warblers and other species that require early successional habitats would continue declining, although these species were not identified by local experts to be included in the Species Viability Evaluation for this Forest Plan revision. Therefore, it does not appear that any anticipated reduction in the analysis area would be so great as to cause a viability problem during the next 20 years.

How birds are distributed across the analysis area may be altered in Alternative 1. With increased suitable habitat on the Forest, and subsequent increased populations over time, the Forest could support a larger proportion of the regional population than it currently does.

Alternative 2

Direct and Indirect Effects

Chestnut-sided warblers would have less habitat provided in Alternative 2 compared to Alternatives 1 and 4, but would have more habitat than in Alternative 3. In Management Area 2.1, even-aged regeneration habitat would more than double the current condition, so species that prefer regenerating hardwoods would have more available habitat in the short term (20 years). Chestnut-sided warbler numbers would be expected to increase and would be more widely distributed than currently, although the magnitude of both the population change and the distribution change would be less than in Alternative 1.

Cumulative Effects

Cumulative effects would be similar to those of Alternative 1, although less available habitat created on the Forest in Alternative 2 would mean correspondingly less suitable habitat in the analysis area. Forest populations in Alternative 2 would be more scattered and less likely to serve as a primary source for dispersing birds in the analysis area compared to Alternative 1, but could still offer a number of suitable breeding sites for the larger population.

Alternative 3

Direct and Indirect Effects

Alternative 3 would provide the least amount of habitat for chestnut-sided warblers on the Forest, almost 90 percent less than in Alternative 1 in the first two decades of Forest Plan implementation. Birds would be more scattered around the Forest and would further decline from current

conditions. It is likely that with natural disturbance, chestnut-sided warblers would still persist on the Forest, but population numbers would be greatly reduced from current levels.

Cumulative Effects

Cumulative effects from private development within the analysis area would be similar to Alternative 1, but with reduced even-aged regeneration habitat being created on the Forest, the WMNF would contribute very little to the overall population.

Alternative 4

Direct and Indirect Effects

Alternative 4 would produce levels of hardwood habitat slightly less than Alternative 1. Therefore, direct and indirect effects would be similar to those described in Alternative 1.

Cumulative Effects

Cumulative effects for chestnut-sided warbler would be similar to those described in Alternative 1.

MIS 2. Scarlet tanager

Alternative 1

Direct and Indirect Effects

Alternative 1 would harvest the most volume of timber, including the most acres treated with even-aged regeneration treatments. Mature and old forests combined would be maintained at levels comparable to current conditions over the next 20 years, although the proportions in each age class would shift as stands outside Management Areas 2.1 and 3.1 continue to age. Scarlet tanager populations would be expected to remain stable and well distributed throughout the Forest.

Cumulative Effects

Over the next 50 to 150 years, habitat quality may increase as stands grow older and factors such as average tree size, vegetative diversity, and more dead/down wood such as snags and logs provide additional habitat for invertebrates on which scarlet tanagers forage.

In the long term (more than 150 years), though, Alternative 1 would reduce the amount of hardwoods (of all age classes) on the Forest, as many stands outside MA 2.1 would continue along natural succession pathways and eventually convert to softwoods. (See the Vegetation section for details). Scarlet tanager populations may decline slightly, but abundant habitat should still remain available to support populations that are well distributed across the Forest.

As development outside the Forest reduces available habitat, the White Mountain National Forest could hold a greater proportion of the habitat. However, this may be negated somewhat by the eventual conversion of hardwoods to softwoods.

Alternative 2

Direct and Indirect Effects

Estimated habitat levels for scarlet tanager would be six percent higher than current conditions and only two percent higher than that proposed for Alternative 1. The difference between Alternatives 1 and 2 is probably small enough that a measurable difference in scarlet tanager populations could not be detected. Scarlet tanager population trends on the Forest would be expected to remain stable and well distributed.

Cumulative Effects

Over the long term (more than 150 years), habitat conditions would be similar to Alternative 1. Within the analysis area, habitat may be reduced by private development and stand conversion as described in Alternative 1. However, with the majority of forested lands in a mature condition, suitable habitat would still be available during the planning period. Although population numbers will likely decline on the Forest if habitat is converted, Forest harvest levels proposed in Alternative 2 would not change the overall mix of mature/old and regeneration/young stands in the analysis area to the point that a significant additional change would result to the analysis area population.

Alternative 3

Direct and Indirect Effects

Alternative 3 would result in the greatest amount of habitat being available for scarlet tanager, since even-aged regeneration harvests would be at the lowest levels. Although more acres are proposed for harvest in Alternative 3 compared to Alternative 2, the majority of these harvests would have uneven-aged prescriptions, which would keep the overall stand in a mature condition. Since uneven-aged stands are repeatedly entered over time, habitat quality (factors described in Alternative 1) would be less than in stands outside MA 2.1, although they would still be considered suitable habitat.

Populations would not likely show a noticeable change during the planning period, since it would take longer than 20 years for currently young stands to mature into suitable habitat. But as currently young hardwood stands mature and are not regenerated with even-aged harvest prescriptions, populations would increase and become the highest of any alternative.

Cumulative Effects

Within the analysis area, scarlet tanager populations would likely continue their fluctuations, since that appears unrelated to stand age. During the first few decades of Forest Plan implementation, populations would remain stable, as explained in alternatives 1 and 2. In the long term (more than 150 years), populations may increase, assuming private development within the rest of the analysis area doesn't significantly reduce habitat levels. The Forest would contribute the most amount of habitat to the regional population under this alternative.

Alternative 4

Direct and Indirect Effects

Alternative 4 would project habitat amounts comparable to Alternative 1. Therefore, effects are assumed to be the same as in Alternative 1.

Cumulative Effects

Cumulative effects would be the same as those described in Alternative 1.

MIS 3. Magnolia warbler

Alternative 1

Direct and Indirect Effects

In the first two decades of Forest Plan implementation, Alternative 1 would create approximately half the acres of habitat that are currently identified in the Forest's stand database. However, this difference is only 1,700 acres, not enough to make a difference to Forest-wide magnolia warbler populations. The high elevation krummholz habitat and "fir waves" in higher elevations effectively provide the same structural conditions as regenerating softwoods resulting from harvest, although not all wildlife species are found that high. These higher elevation habitats occupy far more acres than those created through harvest, and will moderate changes to lower elevation softwoods.

Magnolia warbler populations would be expected to maintain stable trends, although year to year numbers may fluctuate.

Cumulative Effects

Over the next 150 years of Forest Plan implementation, the number of softwood dominated stands will increase on the Forest as it gradually converts to climax conditions (meeting land capability). This would be especially prevalent outside of MAs 2.1 and 3.1. As softwoods become more dominant, additional regeneration harvests would create more habitat for magnolia warbler. This would be a long-term (more than 100 years) effect.

Over the analysis area, a reduction in forested lands is assumed to result in a proportional reduction in softwood habitats. (See the Vegetation section for details). A trade-off between lands outside the Forest being lost to private development, and an increase in softwood stands on the Forest as natural conversion continues, is assumed to somewhat balance each other out. Overall, the population of magnolia warblers over the entire analysis area would be expected to remain stable, but the Forest could hold a larger proportion of the population over time.

Alternative 2

Direct and Indirect Effects

Alternative 2 would provide almost the same amount of regenerating and young spruce-fir habitats as Alternative 1, therefore direct and indirect effects can be considered effectively the same.

Cumulative Effects

Cumulative effects would be similar to Alternative 1, except that in the long term the Forest would move more stands to softwoods than in Alternative 1. Although the habitat age class objectives for softwoods are the same in all alternatives, Alternative 2 would have more total acres of softwoods than Alternative 1. Therefore, Alternative 2 would produce slightly more acres of regeneration and young softwoods in the long term than Alternative 1. Whether or not this would correspond to a discernible difference in wildlife populations is unknown. Magnolia warbler populations would be at least as high as in Alternative 1.

Alternative 3

Direct and Indirect Effects

Alternative 3 would produce less habitat in Management Area 2.1 compared to Alternative 1. However, the amount of acres is so small that it may not result in a measurable difference in magnolia warbler populations. The bulk of the habitat would still be created through natural processes in higher elevations.

Cumulative Effects

Cumulative effects would be the same as Alternative 2. In the long term, more of the Forest would convert to softwoods. The Forest would continue to contribute the majority of the high elevation habitat in the analysis area, but because MA 2.1 is reduced, Alternative 3 would contribute very little in lower elevation softwoods. However, cumulative effects are likely similar to direct and indirect effects, in that the magnitude of the difference in terms of total acres is probably so small that changes in population numbers may not be readily discernible.

Alternative 4

Direct and Indirect Effects

Effects to magnolia warbler would be the same as described in Alternative 2, as there is effectively no difference in the amount of habitat being created in these two alternatives.

Cumulative Effects

Cumulative effects for magnolia warbler would be the same as described in Alternative 2.

MIS 4. Blackburnian warbler

Alternative 1

Direct and Indirect Effects

Based on habitat objectives, mature and old softwoods in Management Areas 2.1 and 3.1 would occur over slightly more acres than the current condition over time. This difference would be less pronounced in the first 20 years of Forest Plan implementation because stands cut in the last few years would take several decades before they reach mature status. Over the entire Forest,

habitat would remain the same as the current condition, and blackburnian warbler populations would be expected to remain stable.

Cumulative Effects

In the long term (more than 100 years), more habitat for blackburnian warblers should become available as stands convert to more softwoods. This would be more evident outside of MAs 2.1 and 3.1 as stands naturally progress towards land capability conditions. Blackburnian warbler populations would be expected to increase as more mature softwood stands are formed.

Similarly, the majority of softwoods in the analysis area would occur as mature stands. Proposed levels of timber harvest in softwoods on the Forest are not great enough to cause an impact to mature softwood habitats throughout the analysis area. Similar to magnolia warbler, increased stand conversion on the Forest will be countered by loss of habitat to development outside the Forest. A larger proportion of the regional population would be found on the Forest over time.

Alternative 2

Direct and Indirect Effects

Alternative 2 would provide approximately the same amount of mature spruce-fir as Alternative 1 in the next 20 years; therefore, effects would be the same as Alternative 1.

Over time, additional stands would continue to convert to softwoods as explained in Alternative 1. However, Alternative 2 promotes that conversion faster since fewer acres are projected for even-aged management. In addition, because the proportion of softwoods is higher in MA 2.1 in Alternative 2 compared to MAs 2.1 and 3.1 in Alternative 1, more habitat is expected in Alternative 2. However, when mature and old softwoods outside timber harvest management areas are included, the difference may not be enough to result in a measurable difference in population numbers.

Cumulative Effects

Cumulative effects over the entire analysis area would be similar to those described in Alternative 1.

Alternative 3

Direct and Indirect Effects

There would be fewer acres of habitat produced in Management Area 2.1 compared to the other alternatives, primarily because the overall size of the management area is so much smaller in Alternative 3. However, over the entire Forest, the same amount of habitat would be produced in Alternative 3 as the other alternatives, so direct and indirect effects would be the same as those described for Alternative 1.

Cumulative Effects

Cumulative effects over the entire analysis area would be similar to those described in Alternative 2.

Alternative 4

Direct and Indirect Effects

Effects to blackburnian warbler would be the same as described in Alternative 2.

Cumulative Effects

Cumulative effects for blackburnian warbler would be the same as described in Alternatives 2.

MIS 5. Ruffed grouse

Alternative 1

Direct and Indirect Effects

Aspen-birch is the one habitat type that has the potential to be noticeably changed, as primarily hardwood stands are converted through cutting to become more dominantly aspen or birch. Alternative 1 proposes the biggest shift to aspen-birch compared to the other alternatives, with eight percent of MAs 2.1 and 3.1 in this habitat type. This is almost 70 percent (or approximately 11,000 acres of additional habitat) more than the current amount in these two management areas. The entire shift would not occur during the first 20 years, but additional acres could be created through clearcutting and other even-aged harvest prescriptions. The magnitude of the change would be dependent on the amount of aspen and birch component within other stands being harvested. Grouse populations would be expected to increase.

Cumulative Effects

Assuming habitat objectives are met over the long term (more than 100 years), habitat for ruffed grouse would continue to increase in MAs 2.1 and 3.1 as stands are converted to aspen or birch. If habitat objectives are met, Alternative 1 would produce some 28,000 acres of aspen-paper birch in MAs 2.1 and 3.1, which is approximately 35 percent more than what currently exists in those management areas. However, habitat would be lost to succession in other management areas. Almost 75 percent of the aspen-birch habitat currently available on the Forest occurs outside of MAs 2.1 and 3.1, and these stands will gradually break down and convert to other hardwood and softwood types (depending on land capability at each site). Most of these stands are mature/old and don't provide early successional breeding habitat, but would support other needs (e.g., catkins for forage). Since grouse are currently limited by a lack of early successional breeding habitat, loss of these mature/old stands would not greatly affect population numbers. However, habitat opportunities will decrease and grouse populations will become focused onto Management areas 2.1 and 3.1.* Overall, grouse habitat may be more scattered than what currently exists, but the range in age classes

* It should be noted that this analysis applies only to ruffed grouse using aspen/birch. Ruffed grouse will also take advantage of regenerating hardwoods, so alternatives that increase this habitat type will also provide habitat for grouse.

will improve habitat quality so that grouse populations would be larger and better distributed throughout the remaining aspen-paper birch stands.

Throughout the analysis area, habitat may decrease outside the Forest. Clearcutting has been on the decline, and legislation such as the Forest Practices Act in Maine will make it less likely that habitat would be maintained. Development on private lands is also likely to reduce some acres of habitat, as mentioned in other species effects sections. Alternative 1 would allow the Forest to play a larger role in the analysis area, providing more habitat and, subsequently, a larger proportion of the population compared to the other alternatives.

Alternative 2

Direct and Indirect Effects

Over the next 20 years, the Forest would maintain aspen-birch habitats higher than current conditions, at approximately the same levels as provided by Alternative 1 in Management Area 2.1. Ruffed grouse populations would be comparable to those in Alternative 1.

Cumulative Effects

In the long term, Alternative 2 proposes a smaller percent objective for aspen-paper birch compared to Alternative 1. Therefore, where Alternative 1 would gradually increase the total amount of aspen-paper birch in MAs 2.1 and 3.1, Alternative 2 would maintain it at levels comparable to those produced during the first 20 years.

Within the analysis area, activities would be similar to Alternative 1, but since the Forest Service would harvest less, available habitat would not be as high as in Alternative 1. Ruffed grouse populations would still probably be higher than current conditions in the long term. Similarly, the Forest's proportion of the population in the analysis area would be greater than the current condition, but smaller than in Alternative 1.

Alternative 3

Direct and Indirect Effects

Alternative 3 would create the least amount of aspen-birch habitat for ruffed grouse (25 percent less than Alternative 1), primarily because the Management Area 2.1 boundary is smaller than in the other alternatives. Approximately 4,000 acres (25 percent) of suitable habitat in current MAs 2.1 and 3.1 would be outside MA 2.1 in this alternative, and would gradually convert over time to other forest types. Outside current MAs 2.1 and 3.1, even more aspen-birch would also convert over time. Not all of this would occur during the first two decades of Forest Plan implementation; the rate would be dependent on the age of the individual stands outside Management Area 2.1.

Some habitat would still be maintained through timber harvest, but ruffed grouse numbers would be the smallest of any alternative, and would probably be similar to or slightly higher than current levels.

Cumulative Effects

Assuming habitat objectives are met, in time (more than 100 years), Alternative 3 would produce approximately half the aspen-paper birch acres as in Alternative 1. Cumulative effects would be similar in type to those described in Alternatives 1 and 2, but because much less habitat is created in Alternative 3, grouse populations would be correspondingly lower and the Forest would play only a minor role in supporting populations throughout the analysis area.

Alternative 4

Direct and Indirect Effects

Alternative 4 would result in habitat conditions similar to Alternative 2, so effects would be similar.

Cumulative Effects

Effects would be the same as those described for Alternative 2.

Ecological Indicators

Like Management Indicator Species, Ecological Indicators are used to gauge effects of Forest Plan implementation on biological resources. Ecological Indicators may be individual species, communities, or special habitats. However, unlike MIS, their focus is to evaluate ecosystem condition rather than vegetation composition or age class.

Ecological Indicators were selected to evaluate concerns related to the recreation issue, specifically that changes in recreation use levels may result in ecological impacts. Ecological Indicators were used rather than MIS because concerns center on recreation use levels as opposed to the amount of vegetative habitat. In addition, a single suitable representative species could not be identified for these areas, so the MIS concept was not applicable. Ecological Indicators were not selected to address every possible recreation activity. Instead, selection focused on the most critical ecological communities of the Forest that are anticipated to experience increased demand for recreation use opportunities: the alpine zone, the spruce-fir community above 2,500 feet elevation, and cliffs.

The alpine zone contains more plants of viability concern than any other habitat type on the Forest. At the same time, it is one of the Forest's most heavily visited areas and risk of trampling may be high. Similarly, high elevation spruce-fir provides preferred habitat conditions for many bird species (including Bicknell's thrush, the top priority bird species for conservation in the Northeast (Rosenberg and Hodgman, 2000)), but also receives heavy human use. Recent discoveries about the significance of rare plants on cliffs, along with increasing interest in rock climbing activities, warrant the inclusion of this community type as an ecological indicator.

For each of these areas, a single species could not be found to adequately represent the other species with the same concerns, therefore, a community approach was chosen to evaluate potential effects. In this way, similar changes in population trends, productivity, etc. over several species may prove more conclusive than evaluating an individual species.

The ecological indicators selected are listed in Table 3-45. Detailed information on their selection can be found in the project file.

Table 3-45. Ecological Indicators Selected and the Condition Being Evaluated.

Ecological Indicator	Condition Being evaluated
Alpine Alpine dry-mesic heath/meadow plant community Alpine snowbank/wet ravine plant community	Trampling or other direct habitat loss in alpine
High Elevation Spruce-Fir Bicknell's thrush (*Catharus bicknelli*), blackpoll warbler (*Dendroica striata*), yellow-bellied flycatcher (*Empidonax flaviventris)*, boreal chickadee (*Poecile hudsonica*), spruce grouse (*Falcipennis canadensis*)	Human disturbance levels in high elevation (>2500') spruce-fir
Cliffs Peregrine falcon (*Falco peregrinus*) Amount of vegetative cover	Cliffs

Affected Environment

EI 1a. Alpine snowbank/wet ravine (alpine)

EI 1b. Alpine dry-mesic heath meadow (alpine)

Together, these two communities create a habitat mosaic in the alpine zone. Dry-mesic heath meadows are characterized by well-drained, thin, acidic soils, low nutrient availability, drying weather conditions, and are often exposed to harsh weather. The snowbank/wet ravine community occurs in patches where heavy, late melting snows provide more moist conditions than the surrounding area. See additional details in the Affected Environment for Rare and Unique Features.

For the alpine indicators, the area of analysis will be the Forest's Alpine Zone, plus State of New Hampshire lands containing alpine conditions in Crawford Notch, Franconia Notch, and on Mt. Washington (Map 3-02, Vegetation section). This collectively creates a discrete unit separated from similar habitat.

The greatest threat to both communities is human disturbance, primarily trampling and possibly winter camping in areas that are used repeatedly. The current condition for hiking and winter camping activities is found in the Affected Environment for Recreation.

EI 2. High elevation bird suite (spruce-fir >2500')

All five of these species are found in the high elevation spruce-fir zone of the White Mountains, although only Bicknell's thrush is found exclusively at high elevations. The breeding range for this group tends to follow the northern conifer forests of Canada, although Bicknell's thrush is the most restricted to the Northeast. Spruce grouse and boreal chickadee are considered resident; the others migrate to Mexico and Central America, South America, or the Caribbean.

All prefer dense or stunted spruce and fir stands. Because no timber harvest is allowed in high elevations, changes to vegetation would result from natural disturbance events and recreation activities. Comparison of effects will focus on changes in recreation use, which potentially can impact these species (WMNF, 2002a).

Bicknell's thrush has the most restricted habitat of the group, nesting in the United States only in fir-dominated mountainous forests above 300 feet in elevation (Rimmer et al., 2001). At least ninety percent of the global breeding population of Bicknell's thrush nests in the northeastern United States (Rimmer et al., 2001), with the White Mountains making up the core of this habitat. The effects analysis area for high elevation birds is land base encompassing the five ecological subsections described by McNab and Avers (1994) and mapped by Keys et al. (1995); (Map 3-01, Vegetation section).

All five species have been found on high elevation bird surveys completed on the Forest. Spruce grouse is the most uncommon, although the survey technique used is not the most appropriate for recording this species. A cursory look at the high elevation bird data shows stable trends for blackpoll warbler and boreal chickadee during the 1990s, but declining trends for Bicknell's thrush and yellow-bellied flycatcher. The Bicknell's thrush result is consistent with Rimmer et al. (2001), who specifically evaluated data for Bicknell's thrush on the White Mountain National Forest. However, Deming et al. (2001) evaluated the Forest high elevation bird data for relative abundance but did not find any obvious trends for any species.

In order to evaluate differences in human disturbance, effects analysis will focus on how much human use levels are expected to change in each alternative. Activities that could indirectly influence these species include trail construction, construction of facilities (e.g., shelters, huts) at backcountry sites, allowing new uses in high elevation (e.g., mountain bike trails), and permitting outfitter/guides. See the Affected Environment for Recreation for the current condition of these activities.

EI 3a. Peregrine falcon (cliffs)

The peregrine falcon (*Falco peregrinus*) ranges over much of northern North America. Following protection under the Endangered Species Act, it has increased in numbers throughout its range (DeGraaf and Yamasaki, 2001) and was removed from the Endangered Species list in 1999 (U.S. Fish and Wildlife Service, 1999). Peregrine falcons are found nesting in all of the northern New England states (Martin, 2002; Northeast Natural Resource Center et al., 2002; Todd, 2002).

Breeding habitat is typically rocky cliffs, with ledges overlooking open habitats having an abundance of bird prey. In cities, they may nest on tall buildings (DeGraaf and Yamasaki, 2001).

The area of effects analysis is the same as that described for MIS above (Map 3-02, Vegetation section). Peregrines are widespread and capable of traveling great distances. The issue for this Ecological Indicator is rock climbing, which is also a widespread activity beyond the White Mountain National Forest. Expanding the effects analysis beyond the Forest's boundaries will allow for an evaluation of rock climbing and peregrine

recovery in a more appropriate context. Rock climbing is of concern because peregrines are sensitive during the breeding season. Rock climbing on the White Mountain National Forest is expected to increase in the future. See the Affected Environment for Recreation for additional details on rock climbing activity.

The peregrine falcon population has increased dramatically after being extirpated in the 1960s. Reintroduction efforts have proven successful, as demonstrated by the removal of the species from the Endangered Species list. This success is reflected by the population trend within the analysis area, which includes some 23 extant pairs (WMNF, 2002).

Habitat within the analysis area is not yet saturated, as there are a number of historic nest sites not currently occupied (WMNF, 2002).

EI 3b. Amount of vegetative cover (cliffs)

There are a number of plant species that occupy open, rocky habitats such as cliffs, some of which are of viability concern. They may be found on cliff faces (e.g., *Dryopteris fragrans, Rhodiola rosea*), or on the open summits at the top of cliffs (e.g., *Paronychia argyrocoma, Minuartia glabra*). Recent studies have found some cliff sites in the White Mountain National Forest are more unique floristically than was previously realized (Bailey and Sperduto, 2003). The concern regarding these species is the increasing interest in rock climbing, which is expected to grow substantially in the near future.

The area of effects analysis for this ecological indicator is the White Mountain National Forest. Cliffs and large rock outcrops are distinct habitats, often separated from each other so that activities at one do not alter plant populations at a different site. Therefore, a larger analysis area would not show measurable effects from Forest Service actions. Because of the difficulty in monitoring individual occurrences of single species, the approach for this indicator will be an assessment of vegetative cover on the cliff face and at the summit. In this way, monitoring can be reasonably accomplished and still be an effective indicator of the amount of suitable habitat being affected.

Environmental Effects

EI 1a and 1b. Alpine snowbank/wet ravine and alpine dry-mesic heath meadow (alpine)

Alternative 1

Direct and Indirect Effects

No new facilities or infrastructure are expected in the alpine zone; therefore, construction would not be a threat to alpine communities. The risk of harming individual plants in these communities may increase over the next planning period because recreation use is expected to increase (see Recreation section). More people using the area means the likelihood of off-trail use would be proportionally higher. Digging snow caves for winter camping and hiker traffic would be a continued threat, although alpine education programs and snow depth requirements for camping would help reduce the magnitude of these effects. New direction that requires action if

monitoring demonstrates declines in alpine communities would also help reduce potential negative impacts. Isolated loss of individual plants in these communities is likely over the next 20 years, as is loss or degradation of local colonies, although the expected effect is not so great that community viability would be jeopardized.

Cumulative Effects

The area of cumulative effects analysis is the same as that used to describe direct and indirect effects above; therefore, effects would be similar. Past trail construction and human use has undoubtedly resulted in loss of patches of these communities over the landscape, although the SVE Alpine Plants Panel (2002) considered the current state of these communities to be viable. No future actions are known at Crawford Notch, Franconia Notch, or Mt. Washington state parks that would cause a change to projected effects described above, although use would be expected to increase similar to projected increases on the Forest. Similar management techniques (e.g., education programs) at these locations would also help reduce trampling effects.

Over the next 50 to 100 years, use will likely continue to increase as the population in the Northeast increases and more people look to the White Mountains for outdoor recreation. The risk of hiker trampling, especially near established trails, will increase, although construction of scree walls or other barriers, increased patrols, trail closures, and other mitigation would be available if effects became considerably worse. Other factors outside of Forest Service control, such as air pollution, acid rain, and global warming and its associated climate change, may become more influential than increased human use levels in determining whether these alpine communities remain viable.

Alternative 2

Direct and Indirect Effects

Facilities and infrastructure in the alpine zone would be maintained at current levels, so additional impacts from construction would not occur. Recreational use would be expected to increase the same as in Alternative 1, with similar effects. Although Alternative 2 proposes to protect low use areas, which might result in additional use targeted in high use areas, management direction specifically to protect the alpine zone would limit expansion here.

Cumulative Effects

Cumulative effects would be the same as those described for Alternative 1.

Alternative 3

Direct and Indirect Effects

Effects would be the same as those described in Alternative 2.

Cumulative Effects

Cumulative effects would be the same as Alternatives 1 and 2.

Alternative 4

Direct and Indirect Effects

In Alternative 4, recreation use would be allowed to increase to meet demand, provided other resources are not compromised. However, while this is the intent on a Forest-wide basis, Forest Plan direction for the alpine zone would limit activities here. For example, regardless of demand, standards and guidelines prohibit construction of new facilities and trails in the alpine zone, so the expansion of use to new areas in the alpine zone is somewhat limited. Use levels would still be expected to increase, but probably not noticeably different than in the other alternatives. Therefore, the effects of Alternative 4 would be similar to those described above in Alternatives 1, 2, and 3.

Cumulative Effects

Cumulative effects would be the same as those described in Alternatives 1, 2, and 3.

EI 2. High elevation bird suite (spruce-fir >2500')

Alternative 1

Direct and Indirect Effects

Under Alternative 1 it is assumed that recreation use levels would continue to increase as they have over the last decade (See Affected Environment for Recreation). Additional trail construction to the level that effects could be measured is unlikely because so many trails currently exist in this habitat type. In addition, a guideline to maintain a Bicknell's thrush habitat would limit additional trails in this habitat. However, whether or not current use is contributing to population declines of species such as Bicknell's thrush is unknown. In theory, increased recreation use may lead to more dogs in high elevation habitats, which if not restricted to the trail can harass local wildlife. People are also known to attract (through food handouts) more generalist species such as red squirrels, which are known to eat birds' eggs and are considered a significant predator on Bicknell's thrush. Studies in Wyoming found increased human intrusion in an area lead to sometimes significantly higher numbers of gray jays (*Perisoreus canadensis*) being present (Gutzwiller et al., 2002). Gray jays are a known nest predator on many bird species, so increased human activity may lead to increased rates of nest predation, especially along trails. Loss of productivity, displacement to suboptimal habitat, and unnecessary energy consumption are all known wildlife responses to recreationists (summarized by Vaske et al., 1983). The level to which any of these effects is currently occurring is unknown, but given the high use levels in these habitats, some level of effect would be expected. Additional studies are needed to determine specifically the extent to which recreation activity along trails contributes to negative impacts on high elevation birds.

Cumulative Effects

There are no other future actions known in this habitat type beyond the projected increasing recreation use. During the planning period, the Forest would continue to support a large proportion of habitat within the region, but whether or not the quality of that habitat would change relative to other areas is unknown. If monitoring studies show that population declines are tied to increased human use in this habitat, then as use increases over time, populations would be expected to decline more substantially than in the recent past.

Alternative 2

Direct and Indirect Effects

Effects would be the same as those described in Alternative 1 because recreation use is expected to be the same.

Cumulative Effects

Cumulative effects would be the same as those described in Alternative 1.

Alternative 3

Direct and Indirect Effects

Effects would be the same as those described in Alternatives 1 and 2 because recreation use would be the same as in Alternative 1.

Cumulative Effects

Cumulative effects would be the same as those described in Alternatives 1 and 2.

Alternative 4

Direct and Indirect Effects

Effects from Alternative 4 would be the same as those described in Alternatives 1, 2, and 3.

Cumulative Effects

The Forest is a stronghold of summer habitat for Bicknell's thrush. Other habitat exists elsewhere in New England, but not to the extent it occurs on the Forest. Thus, significant negative impacts here potentially have significant effects to the regional population. Depending on the magnitude of the increase in recreation use, habitat quality may be reduced to the point where population declines occur. However, until monitoring determines the exact cause of the population decline, effects are unknown.

MIS 3a. Peregrine falcon (cliffs)

Alternative 1

Direct and Indirect Effects

As the peregrine falcon population on the Forest continues to grow, additional cliff sites will be needed to accommodate nesting birds. Alternative 1 would incorporate direction to manage rock and ice climbing

in an effort to protect TES species and other resources. Specifically, mitigation for route closures, route development, and climbing party size would provide more consistent guidance at sites where rare resources and climbing activities coexist. This should improve chances of continued reproductive success for peregrine falcons by keeping human disturbance levels low during critical breeding periods.

Cumulative Effects

Within the larger analysis area, many known peregrine nest sites are on public lands and are afforded some level of protection already. Others are on private land, and while most landowners have been very cooperative in the past regarding peregrine protection, future actions here are unknown. It is anticipated that past levels of protection (e.g., temporary route closures) would continue throughout the analysis area. Combined with the additional standards and guidelines proposed in Alternative 1, peregrine falcons should be even more likely to continue their increasing trend, with the National Forest supporting a core area of habitat in the region.

Alternative 2

Direct, Indirect, and Cumulative Effects

All alternatives address cliff resources in the same manner, therefore direct, indirect, and cumulative effects to peregrine falcons would be the same as in Alternative 1.

Alternative 3

Direct and Indirect Effects

Effects would be the same as those described for Alternatives 1 and 2.

Cumulative Effects

Cumulative effects would be the same as those described for Alternatives 1 and 2.

Alternative 4

Direct and Indirect Effects

Effects to peregrine falcon would be the same as those described in Alternatives 1, 2 and 3. Although demand for climbing may increase, mitigation proposed in Alternative 4 would protect nest sites in the same manner regardless of use levels.

Cumulative Effects

Cumulative effects would be the same as those described in Alternatives 1, 2 and 3.

EI 3b. Amount of vegetative cover (cliffs)

Alternative 1

Direct and Indirect Effects

Rock climbing has the potential to reduce the viability of these populations

because some methods prescribe scraping vegetation and soil out of cracks and ledges in order to provide better hand- or footholds. Once soil is removed, it is unlikely that re-colonization of at least some species could occur until additional substrate material accumulates (over many years). It may be possible that levels of rock climbing could occur that do not impact these species, but as interest in the activity increases, the likelihood for potential negative effects also increases.

Similar to peregrines, additional direction in Alternative 1 would protect rare cliff plants from climbing activity. Mitigation to close routes if unacceptable resource damage occurs, limiting climbing party size, and specifically protecting vegetation at the cliff edge and base would help protect rare plants, although individual plants may be lost (see the Rare and Unique Features section for additional details).

Cumulative Effects

Because the analysis area for cliff plants is the same as that used to describe direct/indirect effects, the cumulative effects are essentially the same. In the past, no protection has been provided for these species. The advent of new equipment and the increasing popularity of rock climbing may lead to more and more cliffs being investigated for climbing potential and increased climbing activity at each site. The new direction proposed in Alternative 1 would improve protection for rare cliff plants, although it is likely that climbing activity will result in loss of some individuals.

Alternative 2

Direct and Indirect Effects

Similar to the peregrine falcon, effects would be the same as described in Alternative 1.

Alternative 3

Direct and Indirect Effects

Effects would be the same as those described for Alternatives 1 and 2.

Cumulative Effects

Cumulative effects would be the same as those described for Alternatives 1 and 2.

Alternative 4

Direct and Indirect Effects

Cliff plants would be affected in the same was as in Alternatives 1, 2, and 3 for the same reason as described for peregrine falcon.

Cumulative Effects

Cumulative effects for cliff plants would be same as those described for Alternatives 1, 2 and 3.

Forest Fragmentation

The MIS and EI described above focus primarily on stand-level characteristics that relate to the issues. Many species also require some level of habitat connectivity at a larger scale in order for populations to be sustainable. Actions such as timber harvest and conversion of mature forest for agriculture, highway construction, and land development may influence connectivity and habitat conditions across the landscape.

Affected Environment

American marten (*Martes americana*) will be used to evaluate effects on landscape-scale fragmentation and habitat connectivity. Marten, which are widespread in the boreal forest region, have a home range of two to ten square kilometers. They are very mobile and use their entire home range daily, making them especially vulnerable to trapping and sudden habitat changes. They cannot use a portion of their home range for a few days and then utilize a different patch. Marten will occupy coniferous, deciduous, and mixed forest types if conditions are suitable (Chapin et al., 1997). Marten may only occur in regions with heavy snowfall (SVE Mammal Panel, 2002; Krohn et al., 1995). While stand-level factors, such as coarse woody debris, conifer saplings, and trapping may affect stand use and survival of individual marten, landscape conditions determine if marten will occur in an area.

Marten are often portrayed as old growth specialists in western states, but in the East, it is the configuration and height of the forest that defines marten habitat. Hargis et al. (1999) recommended that clearcuts and natural openings should comprise less than 25 percent of the landscape, and areas meeting this criterion should be at least nine square kilometers in size. Marten will expand their winter home range if partial harvests occur and reduce the residual basal area below 60 square feet per acre (Fuller, 1999), indicating more open areas are potentially less suitable. Although marten will travel through such open areas, several studies have determined that in the Northeast, 80 percent of a marten's home range must be over 30 feet tall, with a basal area of at least 80 square feet per acre, to be considered suitable habitat (SVE Mammal Panel, 2002; Chapin et al., 1998; Fuller, 1999).

Marten are wide-ranging animals and in order to evaluate habitat suitability on a landscape scale, the area of effects analysis will include the two full ecological sections (McNab and Avers, 1994; Keys et al., 1995) that encompass the White Mountain National Forest (Map 3-02, Vegetation section). This area covers approximately fourteen million acres. Since the Forest is at the southernmost extent of the heavy snow region (SVE Mammal Panel, 2002), analysis will focus primarily on the Forest northward. The primary activities that may disrupt landscape connectivity are those that reduce stand basal area (i.e., make the landscape more open). In this analysis, the main potential contributors would be timber harvest and land development. In addition, large, high volume roads, such as interstate 93 and Route 2, can become barriers to travel and result in direct mortality to marten and other species.

Currently, marten are considered extirpated in Vermont, following an unsuccessful reintroduction attempt (VNNHP, 2001). Marten are known to occur on the White Mountain National Forest based on snow tracking surveys (WMNF unpublished data) and data collected from the New Hampshire Department of Fish and Game (J. Kelly, New Hampshire Fish and Game Department, pers. com.). In northern Maine, marten populations have expanded, although numbers fluctuate greatly (SVE Mammal Panel, 2002).

On the National Forest, forests typically reach 30-40 feet tall at 15-30 years old, and 80 square feet per acre of basal area at 40-60 years old, depending on habitat type, soils, and browsing intensity. Therefore, almost all forested stands would be suitable as marten habitat by age 60. Currently, 87 percent of the Forest is in forested habitat that is at least 60 years old. About ten percent of the Forest is in forest habitat that is currently less than 60 years old; the rest is in open habitat, such as alpine, that also is not suitable for marten. Therefore the Forest as a whole meets the landscape needs of marten. However, there are likely areas where unsuitable conditions (alpine, young forest) are concentrated that would not be suitable as marten home ranges because fragmentation at the smaller landscape scale would be too high.

As shown in Table 3-11, about 54 percent of the Forest is in MAs in which timber harvest, developed recreation, and permanent road construction are usually not allowed (MAs 2.1a, 5.1, 6.1, 6.2, 6.3, 8.1, 9.1, 9.3, and 9.4), providing relatively unfragmented habitat. Currently, about 60 percent of suitable marten habitat is in these management areas. Map 2-01 shows that there are large areas of the Forest in which roads are limited or absent.

In the analysis area, basal area is not tracked, but 22 percent of the total forested area is in the seedling or sapling size classes and, therefore, probably not marten habitat (Northeastern Forest Research Station, 1995; 1997). The majority of timber harvests in Maine and New Hampshire are partial harvests (Fuller, 1999; Thorne and Sundquist, 2001). Some partial harvests result in residual basal area below the marten threshold, while others maintain habitat suitability. It is unknown what portion of the poletimber and sawtimber forest in the analysis area (78 percent of forested area) meets the habitat criteria for marten.

There are a number of interstate and two-lane highways in the analysis area that received a high volume of traffic year-round or seasonally. None of these are within the National Forest's jurisdiction, though several cross part of the Forest and some of the traffic is from Forest visitors. Most of the roads managed by the WMNF are relatively narrow with conditions that limit speeds. In Maine, where trapping of marten is allowed, Forest roads can provide access to trappers. Many of the 26 Inventoried Roadless Areas on the Forest include large areas that lack roads that are open to motorized use (Map 2-01).

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

Forest-wide, expected management under all alternatives should result in no new through roads, few new roads permanently open to public traffic, and decommissioning of some existing roads (see Appendix D). Road construction would be limited to roughly one mile per year in all alternatives Therefore, most areas that currently lack roads, including Inventoried Roadless Areas, will remain in this condition for the foreseeable future. Increased use is expected on most roads that remain open, but the Forest Service does not manage the larger roads that are most likely to be barriers to travel or sources of mortality. Overall the potential for Forest System roads to impact martens or fragmentation and habitat suitability are minimal.

Cumulative Effects

Most of the high-traffic roads are in the western portion of the analysis area, in close proximity to the Forest (e.g., I-93, I-91, and U.S. Routes 2, 3, and 302). In this part of the analysis area, road rights-of-way have reduced habitat and numerous vehicles traveling year-round at relatively high speeds prevent movement by wildlife and result in mortality, all signs of habitat fragmentation. In New Hampshire, road widening and increasing traffic volume is likely to continue into the future, intensifying the effects to wildlife. The WMNF provides some of the only large blocks of essentially unroaded land in this part of the analysis area. The Maine portion of the analysis area still has large areas with limited road access and low traffic levels, so roads do not substantially increase fragmentation effects. The condition in Maine is not likely to change in the foreseeable future.

The Forest Service does not have jurisdiction over major roads in the analysis area, and increases in tourists to the Forest account for only a portion of the expected increase in traffic volumes. Therefore there is little the Forest Service could do to minimize fragmentation effects from roads, and nothing proposed in the revised Forest Plan should increase expected off-Forest effects. The Forest Service will continue to provide large blocks of unroaded land, which will benefit species that prefer solitude or are at-risk from road impacts.

Alternative 1

Direct and Indirect Effects

Under this alternative, about 60 percent of the marten habitat on the Forest would remain in MAs that prohibit commercial timber harvest except for salvage. Almost all of this habitat would continue aging and growing, providing marten habitat into the foreseeable future. Only natural disturbance, any resulting salvage harvest, and recreation development could impact habitat conditions in these MAs. Most natural disturbance on the Forest is small in scale, not altering enough of the landscape to reduce habitat connectivity (see Vegetation section). Large-scale disturbance is rare

and should not limit marten habitat except at a very local level. If salvage harvest is proposed, the area is likely already below the 80 square feet of basal area threshold, so harvest would not increase fragmentation. Recreation development is addressed below for all Forest lands. However, effects would still be considered at the site-specific level during project NEPA analysis.

Timber harvest would occur in some of the 277,000 acres of marten habitat in MAs 2.1 and 3.1. On the White Mountain National Forest, thinning harvests and uneven-aged harvest methods typically leave about 80 square feet per acre of basal area. Therefore, only even-aged regeneration harvests would make forest habitat unsuitable for marten. Alternative 1 proposes the most acres of even-aged regeneration harvest of all the alternatives, about 34,600 acres in the first 20 years. This would leave about 655,000 acres of marten habitat on the Forest, which is 82 percent of the Forest. There would continue to be areas unsuitable as marten home ranges because fragmentation at the local scale would be too high, such as near large alpine areas or in some parts of MAs 2.1 and 3.1. This alternative would result in the most regeneration and young forest, and therefore would have the highest level of fragmentation. However the Forest would continue to meet the habitat requirements for marten, indicating a relatively low fragmentation level across the landscape as a whole.

Development on the Forest would include developed recreation facilities, backcountry recreation facilities, ski areas, communication facilities, utility corridors, roads, and trails. Alternative 1 would result in increased capacity at existing recreation facilities, and could involve development of new facilities. Except for new ski runs, these facilities usually only impact a few acres and should not cause an area to become unsuitable for marten. New downhill ski runs could reduce forest habitat on larger areas, but they would be within existing patches of MA 7.1 that are already highly fragmented, and therefore they should not further limit marten distribution.

Cumulative Effects

Timber harvest across much of the analysis area limits habitat suitability for marten. In the New Hampshire portion of the analysis area, almost 20 percent of harvests are even-aged regeneration harvests or land clearing for development (Thorne and Sundquist, 2001). Seedling and sapling forest levels across the analysis area indicate that even-aged regeneration harvests are still abundant (see Affected Environment). Based on this information, more forest habitat is being reduced below marten thresholds off-Forest than on. Implementation of the recent Maine Forest Practices Act could result in increased fragmentation on the landscape scale and reduced habitat suitability for marten because it encourages thinning and shelterwoods to minimize clearcutting (SVE Mammal Panel, 2002).

Development of all types is more prevalent off-Forest than on. It is expected to continue to increase across most of the analysis area throughout the next 50 years (Sundquist and Stevens, 1999). Development likely will result in expansion of existing developed areas, and creation of whole new developed areas where there is currently only forest. In the New Hampshire portion of the analysis area, almost 10 percent of harvests are land clearing for development (Thorne and Sundquist, 2001).

Implementation of this alternative could slightly reduce habitat suitability in parts of the Forest where regeneration and young forest habitat or open habitat is concentrated, but the majority of the Forest would remain suitable for marten. Harvest activity and increasing levels of development off-Forest make the Forest, with its relatively low levels of timber harvest and development, more important as a source of contiguous forest habitat. If off-Forest activity results in population declines of marten, which is possible, the White Mountain National Forest could become an important area, even though it is at the southern edge of the species' range due to snow conditions.

Alternative 2

Direct and Indirect Effects

Under this alternative, about 59 percent of the marten habitat on the Forest would occur in MAs that prohibit commercial timber harvest except for salvage. This is essentially the same level as Alternative 1, and effects on these lands would be the same as for Alternative 1.

Timber harvest would occur in some of the 278,000 acres of marten habitat in MA 2.1. The types of harvest that would affect suitability as marten habitat are described in Alternative 1. Alternative 2 proposes about 21,400 acres of even-aged regeneration harvest in the first 20 years. This would leave about 668,000 acres of suitable marten habitat on the Forest, which is 84 percent of the Forest. The types of effects of this timber harvest on marten and habitat connectivity would be the same as Alternative 1. This alternative would result in more stands meeting the height and basal area requirements for marten than Alternatives 1 and 4, and therefore would have less potential for fragmentation at the landscape scale than those alternatives, but more than Alternative 3. Alternative 2 and Alternative 4 are essentially the same, with only 1,200 acres (less than one percent) difference.

This alternative would result in less development on the Forest than Alternative 1. However ski area development would be the same, so impacts to marten and habitat fragmentation from development would be the same as in Alternative 1.

Cumulative Effects

The potential for habitat loss from timber harvest and development within the analysis area is the same as described for Alternative 1. The cumulative effects, and consequences of those effects, would be less for this alternative than for Alternatives 1 and 4 because the direct and indirect effects from timber harvest would be less.

Alternative 3

Direct and Indirect Effects

Under this alternative, about 67 percent of the marten habitat on the Forest would occur in MAs that prohibit commercial timber harvest except for salvage. This is more than any other alternatives. Effects on these lands would be the same as for Alternative 1, but would apply to more of the Forest.

Timber harvest would occur in some of the 224,000 acres of marten habitat in MA 2.1. The types of harvest that would affect suitability as marten habitat are described in Alternative 1. Alternative 3 proposes about 9,600 acres of even-aged regeneration harvest in the first 20 years. This would leave about 679,900 acres of suitable marten habitat on the Forest, which is 86 percent of the Forest. This alternative would result in very little change in habitat suitability for marten compared to the current condition. More stands would meet the height and basal area requirements for marten than with any other alternative, so there would be less fragmentation at the landscape scale than under other alternatives.

Development levels and the potential for development to impact marten and habitat fragmentation would be the same as Alternative 2.

Cumulative Effects

The potential for habitat loss from timber harvest and development within the analysis area is the same as described for Alternative 1. The cumulative effects, and consequences of those effects, would be less for this alternative than for all other alternatives because the direct and indirect effects from timber harvest would be less.

Alternative 4

Direct and Indirect Effects

Under this alternative, about 59 percent of the suitable marten habitat on the Forest would occur in MAs that would prohibit commercial timber harvest except for salvage. This is essentially the same level as Alternative 1, so effects on these lands would be the same as for Alternative 1.

Timber harvest would occur in some of the 285,000 acres of marten habitat in MA 2.1. The types of harvest that would affect suitability as marten habitat are described for Alternative 1. Alternative 4 proposes about 22,700 acres of even-aged regeneration harvest in the first 20 years. This would leave about 666,800 acres of suitable marten habitat on the Forest, which is 84 percent of the Forest. The types of effects of this timber harvest on marten and habitat connectivity would be the same as for Alternative 1. This alternative would result in more stands meeting the height and basal area requirements for marten than Alternative 1, and therefore would have less potential for fragmentation at the landscape scale than that alternative, but more than Alternative 3. Alternative 2 and Alternative 4 are essentially the same, with only 1,200 acres (less than one percent) difference.

This alternative would result in more development on the Forest than under Alternative 1, but it would still be limited to small areas that would not reduce habitat suitability at a landscape scale. Given that ski area development is the same as Alternative 1, the potential for development to impact marten and habitat fragmentation would be essentially the same as other alternatives.

Cumulative Effects

The potential for habitat loss from timber harvest and development within the analysis area is the same as described for Alternative 1. The cumulative

effects, and consequences of those effects, would be essentially the same as for Alternative 2.

Migratory Birds

Affected Environment

The White Mountain National Forest provides habitat for more than 100 bird species at one time of the year or another. Most species breed on or near the Forest in the summer. Others pass through during spring or fall migration, staying on the Forest only for a brief time. Another small group spends only the winter months here.

The Forest is part of Bird Conservation Region 14 (BCR 14), which encompasses the Adirondack Mountains of New York, most of Vermont, New Hampshire, and Maine, all of New Brunswick, Nova Scotia, and Prince Edward Island, and small pieces of western Massachusetts, Connecticut, and southeastern Quebec. A group of experts from the BCR developed a list of priority species, or bird species most needing conservation action in the BCR (USFWS, 2003). This list includes migratory and non-migratory bird species.

There are 52 species identified as "highest" or "high" priority for conservation in BCR 14. Of these, 30 occur on the Forest at some time of the year (21 during the breeding season, 1 during winter, and 8 pass through during migration). Of the 22 highest and high priority species that use the Forest during the breeding or winter season, three were identified as species of potential viability concern through the Species Viability Evaluation process (Table 3-46). Concern for the others is not great or immediate enough to qualify them as a potential viability concern over the next 20 years, however, conservation of these species is important at the Forest level to help meet North American Bird Conservation Initiative and Partners in Flight program goals.

Effects to all but three of the 22 species are discussed in other sections of this EIS and are not repeated here (see Table 3-46 for the location of these discussions). Habitat needs of species that occur on the White Mountain National Forest only briefly during migration are not addressed, because migratory habitat needs are not well understood for most species and potential effects are often time-specific and difficult to predict. Therefore, of the priority species in the BCR, only the bobolink, common nighthawk, and chimney swift are covered in detail here.

The analysis area for these species is the five ecological subsections in which the Forest occurs (Map 3-02, Vegetation section). Since these subsections cover an area that contains habitat similar to that found on the Forest, it should encompass populations that might influence or be influenced by on-Forest conditions.

Bobolink and Common nighthawk

These two species are typically found in large grassland openings, a habitat type that is naturally limited on the White Mountain National Forest. Most managed wildlife openings are less than four acres in size, and few large

Table 3-46. BCR 14 Highest and High Priority Species occurring on the WMNF during breeding or winter seasons.

Habitat	**Species**	**Where Habitat (H) or Species (S) is Addressed in DEIS**						
		MIS subsection	EI subsection	Migratory Bird subsection	Vegetation	Rare and Unique Features	Stream Habitats	Water Resources
Wetlands and/or aquatic habitats	American black duck						H	H
	Barrows goldeneye						H	H
	Rusty blackbird					H,S		
Young deciduous forests, riparian thickets, and/or old fields	American woodcock				H			
	Canada warbler				H			
	Chestnut-sided warbler	H,S			H			
Mature deciduous or mixed forest	Wood thrush				H			
	American redstart				H			
	Black-throated blue warbler				H			
	Eastern wood-pewee				H			
	Veery				H			
	Yellow-bellied sapsucker				H			
Mature coniferous or mixed forest	Bay-breasted warbler				H	H,S		
	Bicknell's thrush		S		H	H,S		
	Boreal chickadee		S		H			
	Cape May warbler				H			
	Long-eared owl				H			
	Olive-sided flycatcher				H			
	Purple finch				H			
Large grasslands, open fields	Bobolink			H,S				
	Common nighthawk			H,S				
Unused chimneys and buildings near towns; large hollow trees	Chimney swift			H,S				

wet meadows occur. Although identified on the Forest's bird checklist as summer residents, these species are not likely to breed on the Forest, and neither has been detected during breeding bird surveys on National Forest lands.

In the analysis area, agricultural land is fairly abundant in the Connecticut River Valley, and provides habitat for these species. Wildlife openings elsewhere are limited and widely scattered. Both species occur in grasslands, farmlands, and towns in the analysis area. Breeding Bird Survey (BBS) data from 1966 to 2002 show annual averages of 3.22 to 37.1 bobolinks per route (see project file for data). These averages are much lower in more recent years compared to 30 or 40 years ago. Although bobolinks were seen on every route in the analysis area, most were found in northwestern Vermont. Common nighthawks, on the other hand, have only been documented on 5 of the 17 routes in the analysis area, and in only 4 of the 37 years, which is to be expected for a species not usually seen during the day. However, none have been recorded since 1979 (see project file for data).

Chimney swift

Chimney swifts have been documented on the Forest in every year (1992 to 2002) at low levels (less than 0.5 birds per 15-point transect), with a higher detection rate in 1996 (MacFaden and Capen, 2000). BBS data show annual averages of 1.2 to 5.21 swifts per route surveyed, with no obvious changes in abundance in the analysis area over time.

This species has adapted to human presence. Historically, they used large, hollow trees for nesting. Since European settlement, they primarily use chimneys, building walls, and other human-created structures (DeGraaf and Yamasaki, 2001), and are more abundant near towns than in forest habitats (Natureserve, 2001). The Forest has a few buildings that might have suitable nesting structures for this species, although some are used heavily during summer months, reducing suitability. Others are storage facilities that receive limited use, or historic buildings that are preserved but rarely used. Much more habitat exists off-Forest in adjacent towns and inholdings. In addition, the Forest has scattered, large, hollow trees that provide suitable nesting habitat. The abundance of these trees is unknown, but undoubtedly it has decreased as a result of intensive logging near the turn of the century. Structures are abundant in towns throughout the analysis area. Availability of large, hollow trees is unknown, but they are likely scattered in small numbers throughout the analysis area.

Environmental Effects

Effects Common to All Alternatives

As previously stated, all the birds identified as highest or high priority for conservation in the BCR are addressed in other sections of this EIS, except the bobolink, common nighthawk, and chimney swift. The effects analyses for these species indicate that management on the Forest would not result in a loss of viability under any alternative. Monitoring is proposed to

determine population trends for MIS, and to evaluate whether Forest management is causing the apparent decline of Bicknell's thrush on the Forest.

Bobolink and Common Nighthawk

Direct and Indirect Effects

There are no direct or indirect effects. The Forest Service does not manage large grasslands, and has few large, grassy wetlands. As a result, no bobolinks or common nighthawks are likely to breed on the Forest and management would not affect individuals or populations.

Cumulative Effects

There would be no cumulative effects because there are no direct or indirect effects.

Chimney Swift

Direct and Indirect Effects

Under all alternatives, a few new shelters or cabins could be constructed as part of providing backcountry facilities to accommodate additional hikers. These buildings would be used by recreationists throughout the breeding season, so they might not be suitable for chimney swift breeding. Even if they were suitable, adding so few structures across almost 800,000 acres would be a negligible effect to habitat. The difference between alternatives of one or two additional structures would not result in different effects when considered at the Forest level.

Standards and guidelines would retain a moderate level of snag and cavity tree habitat in timber harvest areas, including some of the largest available snags and cavity trees. The four alternatives would result in timber harvest of different amounts of land. However, at a landscape scale, with standards and guidelines to protect snags and cavity trees, the difference of a few thousand acres of harvest across two decades should not result in different effects on this species among the alternatives.

Some suitable snag and cavity habitat would be lost to recreational development, but when spread across the entire Forest, the loss of a few snags each year should have negligible impacts to the species. Again, the difference of a few new sites more or less across the Forest should not result in different impacts among the alternatives. Loss of snag and cavity habitat would be balanced by the continued aging of more than half the Forest outside MAs 2.1 and 3.1.

Four designated communication sites would be identified, all at existing ski areas (MA 7.1). These sites would consist of one or more cell towers, and cell towers would not be allowed elsewhere on the Forest. Wind towers/ turbines would be allowed within MAs 2.1, 3.1, 7.1, and 9.2. Forest habitat loss associated with these structures should be less than 3 acres per turbine (Strickland, 2004). However, studies have shown that wind and communication towers can result in mortality to birds from collisions with the towers, turbine blades, and guywires (USFWS, 2004; Erickson et al., 2001; Osborn et al., 1999) and displacement of migrating and breeding birds

(Stickland, 2004). Whether chimney swifts are particularly susceptible to mortality or displacement from towers is unknown. All alternatives address these structures in the same way: They include a guideline requiring surveys prior to construction to ensure key migratory routes or breeding sites are not affected. Another guideline in all alternatives states that mitigation to reduce mortality of birds and bats should be implemented for any structure that would extend above tree canopy. The Forest Service does not expect a large number of towers to be established, as such activity should occur off-Forest whenever feasible. With the guideline for mitigation at the project level, towers could result in mortality of individual birds, but should not change population levels.

Cumulative Effects

Off-Forest development is expected to continue to increase throughout most of the analysis area and into the foreseeable future (Sundquist and Stevens, 1999). While development would reduce forestland and snag and cavity tree habitat across the area, it also would create new habitat in the form of buildings, some of which should have chimneys or other structures suitable for nesting.

Timber harvest off-Forest is not required to protect snags and cavity trees, although there are recommended best management practices in both New Hampshire and Maine that many managers implement. As a result, off-Forest harvest likely will reduce suitable habitat for this species in the analysis area.

Over the next few decades, as demands for new and improved technology and cleaner energy increase, cell and wind towers are likely to increase substantially in number on the landscape. Based on research indicating high mortality levels at some towers, agencies and interest groups concerned about birds and bats have begun pushing for legislation and regulations at local, state, and federal levels to require that reasonable measures be taken to minimize potential impacts, especially on migration routes. It is likely that over the next decade these mitigation measures will become standard and mortality rates associated with wind and cell towers should decrease, though impacts will never be eliminated. Placement of these towers on the Forest may result in mortality of individual birds, but there is no reason to believe the impact would be greater than if the towers were placed off-Forest.

Protection of snag and cavity habitat during timber harvest on the Forest, and allocation of a majority of lands to MAs that will result in continued aging of the forest, should prevent any impacts over the next 50 years beyond those described in direct and indirect effects. Overall, this species should not lose habitat across the analysis area. The loss of natural snag habitat would be mitigated by the increase in human-created habitat. Individuals may be lost on- and off-Forest, but not in numbers sufficient to cause population declines.

Effects on Non-priced Benefits

See page 3-70.

Summary of Key Wildlife Effects Conclusions

The Wildlife effects section, presented above, provides a great deal of information. In order to facilitate understanding, a summary of key effects conclusions is included here.

1. Relative to the total Forest landbase, the amount of even-aged regeneration harvest being created is small in all alternatives. However, natural disturbance will create additional acres of regeneration habitat in both softwoods and hardwoods.
2. Similarly, although some even-aged regeneration will occur both through timber harvest and natural disturbance, the amount of mature and old forest will be relatively large compared to the total landbase in all alternatives.
3. In all alternatives, the Forest will move closer towards the potential natural vegetation (land capability), resulting in increased levels of softwoods and decreased levels of hardwoods.
4. The majority of aspen and birch occurs outside management areas that allow timber harvest. Although each alternative promotes maintaining or enhancing aspen-birch in MAs 2.1 and 3.1, the bulk of aspen-birch will be lost to succession regardless of alternative.
5. For both magnolia warbler (regeneration softwoods) and blackburnian warbler (mature/old softwoods), the magnitude of difference in habitat being created in each alternative is so minor that there is no discernible difference in effects expected between the alternatives.
6. For Ecological Indicators, effects are either unknown and will be addressed through future monitoring, or do not differ substantially between alternatives.
7. Fragmentation effects are relatively minor across the Forest in all alternatives.

Above: White Mountain butterfly; right: Geum peckii; below: Geum peckii habitat (WMNF photos by Kathie Fife)

Rare and Unique Features

This section addresses the "fine filter" component of the White Mountain National Forest's approach to maintaining biological diversity (see the Biodiversity introduction). It includes two subsections:

- Species viability.
- Outstanding exemplary communities.

The species viability subsection discusses the current condition of and potential effects to individual rare species on the Forest. The outstanding exemplary communities subsection covers the condition of and effects to two rare communities known to occur on the Forest.

Species Viability

To help meet National Forest Management Act requirements (see the Biodiversity introduction), the White Mountain and Green Mountain National Forests conducted a Species Viability Evaluation (SVE) as part of Forest Plan revision. This was a qualitative process to identify and gather information about vertebrate, invertebrate, and plant species of potential viability concern on the Forests. It involved compilation of information from scientific literature and consultation with local wildlife and botanical experts, including state agencies, faculty at local universities, and Forest Service researchers.

As part of the process, local experts were asked to evaluate the current condition of each species and assign a viability outcome, from A to E. Outcome A indicates that habitat and populations are roughly the same as they were historically in the planning area. For Outcome C, habitat quantity, habitat quality, or population conditions are reduced from historic levels in the planning area, but not to the point where a species is no longer viable. Under outcomes D and E, conditions have been altered so much that a species may not be considered viable. These outcomes are a tool for summarizing the information available on current condition and expected changes in the next 20 years into a status that can be easily compared among alternatives. At a landscape scale, it is difficult to know the current condition of each species of concern, especially when so little is known about many species. Determining how each species' condition will change in the future and whether differences in management among the alternatives will change that outcome is a matter of professional judgment. Therefore outcomes and viability determinations are not absolutes or certainties, but the best conclusions that can be drawn based on available information. Given these limitations, current and future outcomes for a species and outcomes across species are best viewed relative to one and other, not as individual conclusions.

The SVE process used was developed by biologists and botanists on the Forests, based on Mighton et al. (2000). Other ways to address species viability were evaluated; this approach was determined to best meet the objectives of the Forests while meeting the legal requirements of the Code of Federal Regulations. This SVE process, and other approaches considered, is documented in the Administrative Record.

The SVE process identified 108 species of concern for the White Mountain National Forest. All the species can be grouped according to the broad habitat type(s) in which they occur (e.g., conifer forest or rivers and streams). Much of the current condition and potential effects for each species is based on the condition and effects for their broad habitat(s). However, most species rely on only a certain aspect or portion of the broad habitat(s) in which they occur, and many are limited by factors that do not affect the overall habitat(s). In addition, the potential for impacts to known occurrences needs to be considered when so few occurrences exist in the planning area. This document is not a site-specific analysis, but a way to evaluate the potential for populations of rare species to persist under each alternative.

The Species of Concern subsection is divided into ten broad habitats:

Alpine

Enriched upland forest

Rock and cliff

Conifer forest

Landscape-level

Hardwood and mixedwood forest

Lakes and ponds

Rivers and streams

Forested wetlands

Open wetlands

For habitats that also are discussed in the Vegetation, Riparian and Aquatic Habitats, or Water Resources sections, this subsection references or summarizes that discussion, then expands on conditions or potential effects that would apply to rare species and the niches they occupy. Individual species are not discussed in detail, but generalizations are made for the array of species of concern in each habitat. For habitats not addressed in other sections of this document, this subsection discusses the defining features, distribution, and limiting factors for, and potential effects on, the overall habitat and the microhabitats and species within them. Appendix F identifies which species of concern occur in each habitat, and gives some details on species-specific habitat needs, limiting factors, and effects not covered in this subsection. Some species of concern are strongly tied to only one of the broad habitat types, while others may occur in multiple habitats (see Appendix F). For a description of ecological sections and subsections used to define many analysis areas, see the Vegetation section of this document.

In addition to this subsection of the EIS, a Biological Evaluation (BE) was developed in accordance with Forest Service Manual (FSM 2672.42) and Section 7 of the Endangered Species Act. The BE addresses potential effects of the revised White Mountain National Forest Land and Resource Management Plan on federally endangered, threatened, and proposed species, and Regional Forester Sensitive Species, that may occur within the

Forest. It describes the current status, habitat preferences, distribution, and limiting factors for each species, and the effects of each alternative on the species.

All Habitats

Introduction

The White Mountain National Forest provides potential habitat for six federally-listed endangered or threatened species. One of these, small whorled pogonia, is currently known to occur on the Forest. The others may occur on the Forest in very limited numbers or as transients (Indiana bat and bald eagle), or occurred historically but are currently considered absent from the Forest (Canada lynx, eastern cougar, and gray wolf). The Forest Service also manages for 39 Regional Forester's Sensitive plant and animal species (sensitive species). In addition to these officially-recognized species of concern, the Forest Service has identified 58 animal and plant species of potential viability concern through the SVE, many of which are on the New Hampshire or Maine state endangered and threatened species lists. Some are known to occur on the National Forest, while others, according to local experts, are likely to occur. In total, 109 plant and animal species are addressed in this document and its appendices.

As part of the SVE process, information was gathered from literature and local experts on the status, distribution, life history, habitat needs, and limiting factors for each species of concern. This information was compiled in a Species Data Collection Form for each species, and is the basis of the analysis. It represents the best available information for every species, and includes any uncertainties or disagreements among experts. Individual sources of information are cited in the forms and in the Biological Evaluation.

Environmental Effects

The rarity of many of these species necessitates evaluation of the potential for activities to affect both broad habitats and actual occurrences of the species. Therefore, the information in this subsection is more detailed than much of what is in the Vegetation, Riparian and Aquatic Habitats, and Water Resources sections. This more intensive analysis is intended to evaluate whether Forest activities have the potential to impact occurrences of each species, and whether it is likely that enough individuals or occurrences would be affected to result in a loss of viability in the species on the Forest.

Based on the analysis of limiting factors and potential for changes to current conditions, the viability outcome for 35 species may decrease in the future (Table 3-47a; see Appendix F for outcome definitions). Some of these species may decline for reasons that are effectively outside WMNF control (e.g. disease, illegal harvest). Some species may decline as a result, at least in part, of activities that the Forest Service manages.

To meet the Forest's goals, the WMNF will do all that is reasonably possible to protect known occurrences and improve or maintain the current level of viability for all species of concern. However some species only have one occurrence on the Forest due to range, habitat, or other limitations.

Preventing the loss of a single occurrence from natural events or recreational use depends on site and species-specific conditions and may be outside the Forest Service's control. Standards and guidelines require protection of known occurrences of TES species from new land uses and surveys for TES species prior to ground-disturbing activities. Monitoring of TES species is proposed to track the status of these species. However even site closures or other protective measures may not be sufficient to prevent a decline in viability of these rare species in the planning area. Most of these species are not at risk across their range; they simply are rare on the WMNF because habitat is limited or the Forest is at the edge of their range. Therefore a reduction in viability outcome in the planning area should not result in an overall range wide reduction in viability for the species.

Viability outcomes for seven species may only decline with Alternative 1 (Table 3-47a). The viability outcome is expected to improve in one or more alternatives for four species (Table 3-47b). For one species (American marten) the viability outcome could improve or decline, depending on primary limiting factors that are outside Forest Service control: snow conditions, trapping, and competitors. For three species (Atlantic salmon, bald eagle, and Indiana bat), the viability outcomes are not applicable (see Appendix F for reasoning); the Forest will continue to provide habitat for these species in case conditions change.

Forest management would not result in an expected loss of viability for any species in any alternative. However, as previously discussed, the Forest Service's best conservation efforts may not be able to prevent loss of viability for the few species with only one occurrence on the WMNF.

The Biological Evaluation determines whether alternatives are likely to adversely affect federally endangered, threatened, and proposed species, or result in a loss of viability for Regional Forester's sensitive species (RFSS). Table 3-48 summarizes those determinations. The effects analysis and rationale for each determination are documented in the Biological Evaluation; the rationale also is provided within the habitat discussions in this subsection. Many species addressed in this SVE subsection are not evaluated in the BE and are not in Table 3-48 because they are not federally listed as endangered, threatened, proposed, or sensitive. The Regional Forester's sensitive species will be revised based on the information gathered for Forest Plan revision, once the revision is completed. At that time, species may be added to or removed from the sensitive species list. Two species that are covered in the BE are not addressed in the SVE section (timber rattlesnake and New England cottontail). The timber rattlesnake is on the RFSS list so must be addressed in the BE, but it was dropped from the SVE list because local experts indicated it is unlikely that this species still occurs on the Forest. The New England cottontail is being evaluated by the US Fish and Wildlife Service to determine if they should propose it for federal listing. They suggested it be included in the BE in case it is proposed. However local experts indicated it is very unlikely to occur on the Forest so it was not covered in the SVE.

Table 3-47a. Potential Declines in Viability Outcomes.

Species	Viability Outcomes					Risk Factors That May Affect Outcomes
	Current	Alt. 1	Alt. 2	Alt. 3	Alt. 4	
White Mountain butterfly	A/B	B/C	B/C	B/C	B/C	Climate change; increased levels of hiking, trampling; Auto road mortality
White Mountain fritillary	A/B	B/C	B/C	B/C	B/C	Climate change; increased levels of hiking, trampling; Auto road mortality
Jefferson salamander	C	C/D	C/D	C/D	C/D	Hybridization; habitat loss, road mortality
Wood turtle	C/D	C-/D	C-/D	C-/D	C-/D	Population dynamics, collection, road mortality
Eastern small-footed myotis	B/C	C	C	C	C	Establishment and cleaning of rock climbing routes
Black lordithon rove beetle	B/C	C	B/C	B/C	B/C	Even-aged regeneration harvest levels in Alternative 1
A big-headed fly	B/C	C	B/C	B/C	B/C	Even-aged regeneration harvest levels in Alternative 1
Arabis missouriensis	C	C/D	C/D	C/D	C/D	Genetic inbreeding; single population of weak plants; risk of trampling if still present at Rattlesnake Mtn.
Carex baileyi	B/C	B/D	B/D	B/D	B/D	Single occurrence on Forest, so stochastic events, trampling, etc are greater risk despite expected protections
Carex cumulata	C	C/D	C/D	C/D	C/D	Single occurrence on Forest, so stochastic events, trampling, etc are greater risk despite expected protections
Carex exilis	B/C	B/D	B/D	B/D	B/D	Single occurrence on Forest, so stochastic events, trampling, etc are greater risk despite expected protections
Carex scirpoidea	B/C	B-/C-	B-/C-	B-/C-	B-/C-	Increased levels of hiking, trampling; establishment and cleaning of rock climbing routes

*See Appendix F for viability outcome definitions.

Table 3-47a. Potential Declines in Viability Outcomes (continued).

Species	Viability Outcomes					Risk Factors That May Affect Outcomes
	Current	Alt. 1	Alt. 2	Alt. 3	Alt. 4	
Corallorhiza odontorhiza	B/C	B/D	B/D	B/D	B/D	Single occurrence on Forest, so stochastic events, trampling, etc are greater risk despite expected protections
Cypripedium parviflorum var. *pubescens*	C	C-	C	C	C	Even-aged regeneration harvest levels in Alternative 1
Dicentra canadensis	B	B-	B	B	B	Even-aged regeneration harvest levels in Alternative 1
Dryopteris goldiana	B	B-	B	B	B	Even-aged regeneration harvest levels in Alternative 1
Epilobium anagallidifolium	B-/C	B-/D	B-/D	B-/D	B-/D	Single occurrence on Forest, so stochastic events, trampling, etc are greater risk despite expected protections
Galium kamtschaticum	B	B/C	B/C	B/C	B/C	Potential for timber harvest near seep habitats
Juglans cinerea	C	D	D	D	D	Disease
Minuartia glabra	B	B/C	B/C	B/C	B/C	Increased levels of hiking, trampling
Oligoneuron album	B	C	C	C	C	Increased levels of hiking, trampling
Omalotheca supina	C	C/D	C/D	C/D	C/D	Single occurrence on Forest, so stochastic events, trampling, etc are greater risk despite expected protections
Panax quinquefolius	C	C/D	C/D	C/D	C/D	Illegal harvest
Paronychia argyrocoma	B/C	B-/C-	B-/C-	B-/C-	B-/C-	Increased levels of hiking and trampling, climbing and route cleaning
Pinus banksiana	B	B-	B-	B-	B-	Lack of adequate disturbance
Piptatherum canadense	B/C	B/D	B/D	B/D	B/D	Single occurrence on Forest, so stochastic events, trampling, etc are greater risk despite expected protections

*See Appendix F for viability outcome definitions.

Table 3-47a. Potential Declines in Viability Outcomes (continued).

Species	Viability Outcomes					Risk Factors That May Affect Outcomes
	Current	Alt. 1	Alt. 2	Alt. 3	Alt. 4	
Polygonum douglasii	B	B/C	B/C	B/C	B/C	Increased levels of hiking, trampling
Pyrola asarifolia	C	C-/D	C/D	C/D	C/D	Even-aged regeneration harvest levels in Alternative 1
Rhododendron lapponicum	B	B/C+	B/C+	B/C+	B/C+	Recreation use
Sanicula trifoliata	C/C-	C/D	C/D	C/D	C/D	Single occurrence on Forest, so stochastic events, trampling, etc are greater risk despite expected protections
Saxifraga paniculata ssp. *neogaea*	B/C	B/D	B/D	B/D	B/D	Single occurrence on Forest, so stochastic events, trampling, etc are greater risk despite expected protections
Sibbaldia procumbens	C	C/D	C/D	C/D	C/D	Natural disturbance; trampling of single population
Silene acaulis var. *exscapa*	C	C/D	C/D	C/D	C/D	Auto road use and management; trampling by ice climbers
Symphyotrichum ciliolatum	B/C	B-/C	B/C	B/C	B/C	Even-aged regeneration harvest levels in Alternative 1

*See Appendix F for viability outcome definitions.

Table 3-47b. Potential Improvement in Viability Outcomes.

Species	Viability Outcomes					Reason for Improvement
	Current	Alt. 1	Alt. 2	Alt. 3	Alt. 4	
American peregrine falcon	B	B+	B+	B+	B+	Recovering from past declines; well-protected
Triphora trianthophora	C	C	C+	C+	C+	Improved habitat quality from thinning and uneven-aged harvest

Table 3-48. Determinations of Effects for Endangered (E), Threatened (T), and Regional Forester's Sensitive Species (S).

No Effect	**May affect, not likely to adversely affect**	**May impact individuals, but not likely to result in a trend towards federal listing or loss of viability (all S)**	
Bald eagle (T)	Small whorled pogonia (T)	Arnica	American ginseng
Gray wolf (E)	Indiana bat (E)	Dwarf white birch	Silverling
Eastern cougar (E)		Pond reed bent-grass	Sweet coltsfoot
Canada lynx (T)		Alpine bitter cress	Wavy bluegrass
Timber rattlesnake (S)		Piled-up sedge	Robbins' cinquefoil
New England cottontail		Wiegand's sedge	Boott's rattlesnake root
Bailey's sedge (S)		Squirrel corn	Pink wintergreen
		Goldie's woodfern	Livelong saxifrage
		Oakes' eyebright	Moss campion
		Proliferous red fescue	Nodding pogonia
		Northern comandra	Boreal blueberry
		Mountain avens	White Mountain fritillary
		Butternut	White Mountain butterfly
		Auricled twayblade	Wood turtle
		Broad-leaved twayblade	Bicknell's thrush
		Heartleaf twayblade	American peregrine falcon
		Alpine cudweed	Common loon
		Canada mountain ricegrass	Eastern small-footed myotis
		Mountain sweet-cicely	Northern bog lemming

Unless otherwise stated, the timeframe for direct, indirect, and cumulative effects is the next 20 years. For direct and indirect effects, this is the time covered by the revised Plan, with activities proposed for the first decade and identified as probable for the second decade. For cumulative effects, 20 years is the foreseeable future — the period for which it is reasonable to estimate likely management off-Forest. Beyond that, for most activities, determinations of likely actions and resulting effects would be too speculative. For those activities where future actions are more certain or where effects can only be seen in the long-term, longer timeframes are used.

Effects Common to All Alternatives

Direct and Indirect Effects

Roads, ski area development, wind turbines, and communication towers have the potential to impact habitat conditions or individual plants or animals in almost all habitats. Ski areas, wind turbines, and communication towers are treated the same in all alternatives. Roads vary by alternative, but the differences, when considered at a landscape-scale with applicable standards and guidelines, would not result in noticeably different habitat conditions or impacts to populations. Therefore, potential effects of these activities are evaluated here as common to all alternatives, and would apply to most or all habitats (Table 3-49).

Table 3-49. Habitats affected by each activity evaluated as common to all alternatives.

Habitat	Roads	Ski Area Development	Wind Turbines	Communication Towers
Alpine	N/A	X	X	X
Enriched hardwood forest	X	X	X	X
Rock and cliff	X	X	X	X
Conifer forest	X	X	X	X
Landscape level	X	X	X	X
Hardwood and mixedwood forest	X	X	X	X
Lakes and ponds	X	X	N/A	N/A
Rivers and streams	X	X	N/A	N/A
Forested wetland	X	X	N/A	N/A
Open wetland	X	X	N/A	N/A

Road construction and reconstruction are proposed for timber harvest in all alternatives. These activities could occur in or adjacent to, and therefore affect, all habitats except alpine. Potential for changes in habitat abundance or quality are addressed in the Vegetation, Riparian and Aquatic Habitats, and Water Resources sections. To summarize, because of standards and guidelines, the temporary nature of these roads, and the prevalence of winter logging, small amounts of terrestrial and riparian habitat could be directly affected, but the overall quality of the surrounding habitat and the condition of adjacent aquatic habitats should not be noticeably reduced.

Road construction or reconstruction can result in trampling of individual plants and disturbance of wildlife, especially in the summer (Trombulak and Frissell, 2000). Ruts and pools in and adjacent to roads can become breeding traps for amphibians (DiMauro and Hunter, 2002), including the Jefferson salamander. In addition, road construction, reconstruction, and use increase the risk from non-native invasive species (see Vegetation

section), which alter habitat quality and compete with some species of concern. Standards and guidelines, species surveys and protection, and the prevalence of winter logging should reduce potential impacts. Since almost all the work proposed in all alternatives is reconstruction of existing roads, the differences among alternatives should not result in a noticeable difference in impacts.

Highways and other major roads can be barriers to travel by species with large home ranges (Claar et al., 1999), as well as amphibian migration (deMaynadier and Hunter, 2000), and they often result in increased mortality from vehicle-animal collisions. Roads of all types increase human use of an area, which increases the potential for trampling of plants, disturbance and direct mortality of wildlife, and human-wildlife interactions (Trombulak and Frissell 2000, Hodgman et al., 1994). No new major roads would be constructed by the Forest Service in any alternative, which would limit the impact of major roads to those already in existence. Recreational, commercial, and commuter use of roads would increase in all alternatives as recreational use of the Forest and populations around the Forest increase, and as roads are improved to meet safety standards. This may result in impacts to or loss of individual animals and plants. These roads are already heavily used, however, so any increase in use should not result in population changes leading to a loss of viability. Use of new and reopened roads during harvest would increase the risk of vehicles colliding with or crushing wildlife and other human-wildlife interactions until the roads are closed again. Proposed road decommissioning would reduce road density and associated risks in some areas. In all alternatives, large areas across the Forest would continue to be unroaded, affording areas in which species can escape these threats.

Land allocated to ski area and ski area expansion MAs (7.1 and 9.2) would be essentially the same as the current situation under all alternatives, although in all alternatives there could be new or expanded facilities within those areas to allow for increased use and new uses. MAs 7.1 and 9.2 include some of almost all types of habitat, though enriched hardwoods, alpine, lake, and wetland habitats are limited. The potential for facility expansion to impact habitats would be proportional to their abundance in these MAs, and is limited for all but conifer and hardwood/mixedwood forest. Ski area development would result in loss of these forest habitats to structures or openings. A guideline would protect Bicknell's thrush habitat, maintaining levels of some high elevation conifer forest. These MAs encompass less than one percent of the Forest. Therefore, when compared to the amount of conifer, mixedwood, and hardwood forests on the Forest, losses to ski area development would be negligible, and should not impact populations or viability of any species.

Wind towers would be permitted in several MAs on the Forest in all alternatives. Large wind farms are not likely in the next 20 years, because they would not be allowed on much of the Forest's high elevation land and this kind of activity should occur off-Forest, if possible (per standards and guidelines). However, some turbines are likely to be constructed, and habitat could be lost to these facilities. This activity should only impact terrestrial habitats, as wind towers are unlikely to be proposed and approved in

wetland or aquatic habitats. Very little alpine habitat occurs in the MAs in which wind turbines would be allowed, so effects to alpine habitat would be minimal. Impacts to other habitats would be limited to small patches directly impacted by facilities. Complete habitat loss would likely be less than an acre per turbine, with temporary construction-related impacts affecting up to another 3 acres per turbine (Strickland, 2004). Direction requiring TES surveys prior to ground-disturbing activity should limit facility construction to locations that would not adversely affect species of concern.

New communication towers would only be allowed in designated communication sites, which would be limited to existing ski areas. As with wind turbines, communication towers should only affect small patches of terrestrial habitats. Most of these areas have already been impacted by other facilities in ski areas, so additional habitat loss would be negligible.

In addition to habitat impacts, wind turbines and communication towers may affect individual birds and bats. Research has shown that mortality can result from collisions with the towers, guywires, and turbine blades (USFWS, 2004; Erickson et al., 2001; Osborn et al., 1999). All alternatives address these structures in the same way. Direction recommending surveys of airspace prior to tower construction should reduce the chance of placing a tower or turbine in a migratory flyway. A guideline recommending use of mitigation measures to reduce mortality of birds and bats for any structure that would extend above tree canopy also would reduce potential impacts.

In addition to direct mortality, research has shown that wind turbines can cause some birds to avoid an area during migration and breeding season. Displacement distances vary by species, ranging from <100 meters to roughly 3 kilometers (Strickland, 2004). The same may be true of other animal groups. Survey recommendations should limit the potential for displacement effects to negatively impact populations of species of concern. Given the limited number of wind and cell towers expected, and the inclusion of management direction for surveys and mitigation in all alternatives, there may be impact to individual plants, birds, and bats, but this should not alter populations or affect viability of any species.

No alternative would affect the potential for global warming or acid deposition, nor the impact of these processes on any habitat.

Alternative 1

Direct and Indirect Effects

Under this alternative, mountain bikes would be allowed anywhere on the Forest except in Wilderness and along the AT, including off-trail. While most mountain bike use would occur on roads and trails, there would, presumably, be more cross-country riding than with other alternatives, under which off-trail biking is prohibited. Riders could legally go through streams and wetlands, or along lakeshores, which could result in trampling, disturbance, rutting, and sedimentation. Trampling and disturbance of some wildlife species are the key concerns in upland habitats, and are more likely with off-trail use. Site-specific closures could be implemented if use occurs near

species of concern or resource damage is noted. However, for some species of concern, loss of a few individuals could reduce viability on the Forest. As mountain bike use increases in the future, the risk to species of concern also would increase.

Alternatives 2-4

Direct and Indirect Effects

These alternatives would restrict mountain bike use to existing Forest System trails and roads and some other identified travel corridors. Mountain bikers should cross streams only at established trail and road crossings, and should not ride through wetlands or shoreline habitats. Keeping bikers on existing trails would limit the potential for trampling of plants, increased disturbance of wildlife, and sedimentation of aquatic habitat to the minimal levels associated with increased trail use and maintenance. Therefore, effects from mountain biking on species of concern in these alternatives would be less than for Alternative 1.

Cumulative Effects

Specific plans for new roads off-Forest are not known, but with increasing development throughout the analysis area (Sundquist and Stevens, 1999), it is likely that some roads will be constructed. Impacts would be similar to those described for direct and indirect effects. As development increases and more recreationists travel to the area, road-related mortality of wildlife and spread of non-native invasive species are likely to increase.

State parks and private lands also provide mountain biking opportunities, but no proposals for additional mountain biking trails are known, although it is likely that use will increase both on- and off-Forest. In either location, the effects would be the same.

Ski areas located on the White Mountain National Forest include off-Forest lands, and other ski areas exist off-Forest within the analysis area. Expansion of existing facilities and construction of new ones is likely to occur at all ski areas in the next 20 years to meet the needs of more people and allow for new activities. This development could reduce habitat quality and quantity for some species, and result in direct impacts to plants and disturbance of wildlife species.

More wind turbines and cell towers are likely to be constructed off-Forest than on to meet public demands for power and cellular service. Their construction may result in the loss of small patches of habitat and direct impacts to individuals. However, their greatest impact could be mortality of birds and bats. Effective mitigation to avoid these impacts has not been developed, though this may change in the future.

Global warming and acid deposition may have a substantial influence on viability of alpine and subalpine communities and their associated species in the long-term, but Forest management will not alter their potential threat.

All these activities have the potential to directly affect individual plants and animals off-Forest in all habitats. Some activities also would affect small patches of various habitats scattered across the analysis area. These impacts

could reduce off-Forest populations of species of concern and thereby alter metapopulation dynamics for populations on the Forest. Whether these activities will be pervasive or impactive enough to alter viability of any species is uncertain, but possible. The requirement for surveys and protection of species viability on the Forest will be critical to ensuring that WMNF actions do not exacerbate off-Forest concerns.

Alpine (32 species, see Appendix F)

Affected Environment

The White Mountain National Forest manages the largest and most diverse alpine and subalpine habitats in the northeastern US The alpine zone encompasses about 7,000 acres of the Forest, much of it concentrated in the Presidential and Franconia Ranges with small patches scattered elsewhere. Of the 108 species of concern, 35 are restricted to the alpine zone (Appendix F). Others that occur in a certain habitat (such as rocks or bogs) both in the alpine zone and at lower elevations, are addressed within their primary habitat, not the alpine zone.

The analysis area for alpine habitats and species restricted to those habitats includes the area within the Forest proclamation boundary plus Franconia Notch, Crawford Notch, and Mt. Washington State Parks. This area encompasses almost all known occurrences of these species in New Hampshire. Occurrences in Maine are not on, or near, the National Forest, and are not included in the analysis area.

Alpine habitats in New Hampshire have been categorized into five groups of communities that correspond to different combinations of soil moisture and substrate, longevity of snowpack, elevation, and degree of exposure (SVE Alpine Plant Panel, 2002; Sperduto and Nichols, 2004). All the alpine species of concern for the Forest occur in two of these: alpine dry-mesic heath/meadow habitats and alpine snowbank/wet ravine habitats.

Alpine dry-mesic heath/meadow habitats

The dry to mesic heath/meadow alpine habitats are widespread in much of the alpine zone, with small patches on lower summits. These habitats are primarily found in four natural communities including Diapensia shrubland, alpine heath snowbank, Bigelow's sedge meadow, and sedge-rush-heath meadow natural communities (Sperduto, 2004). These are among the primary communities that comprise the alpine tundra natural community system (Sperduto and Nichols, 2004) that dominates alpine ridges and summits.

Exposure to the elements, especially in winter, is a defining aspect of these habitats. They contain a spectrum of species, ranging from those needing very exposed sites with intense wind disturbance to those that benefit from exposure and wind but need some sheltering. At the extreme end of the spectrum, cold, wind, and snow and ice blast result in harsh environmental conditions in which few species can survive, thus reducing competition. The whole range of habitats in this grouping typically have dry to mesic moisture conditions, well-drained, thin, acidic soils, desiccation, and low

nutrient availability. They are usually associated with stony areas and convex landforms that are more exposed.

Loiseleuria procumbens, *Diapensia lapponica*, and *Rhododendron lapponicum* reflect the more exposed end of this system of alpine communities (Diapensia shrubland). Bigelow's sedge meadow community is characterized by an abundance of *Carex bigelowii*. A mix of heaths, *Carex bigelowii*, and *Juncus trifidus* indicates sedge-rush-heath meadow communities. Alpine heath snowbanks occur in more protected locations, and have less sedge and rush, and more heaths and lowland plants. Trampling is the primary threat to the dry-mesic heath/meadow alpine communities and their associated species, especially along trails and on ridges and peaks where hikers go "view seeking." As a result, this system is at greater risk on "lesser summits," where use and plants are concentrated in a small area, than in the Presidential Range, where extensive areas of these communities occur away from trails and use sites.

Global warming and acid deposition are threats to the dry-mesic heath/ meadow alpine system, but the threat is difficult to assess (Dirnböck et al., 2003; Dullinger et al, 2004; Walther et al 2002) and outside WMNF control. Most local experts in these communities and associated species believe that the threat from increasing recreational use is greater in the foreseeable future.

Alpine snowbank/wet ravine habitats

These alpine habitats include herbaceous snowbank, streamside, wet ravine, and wet to mesic heath and meadow communities. They typically occur as patches where heavy, late melting snows are prevalent and are primarily found in three communities: alpine herbaceous snowbank/rill, moist alpine herb – heath meadow, and alpine ravine shrub thicket (Sperduto and Nichols, 2004).

Hydrology is important to the plants in these habitats — they need a certain amount of moisture throughout the growing season. Stagnant water and desiccation are both detrimental. Many communities are sheltered, so heavy snows melt late and provide moisture over a longer period than in the more exposed habitats. Snow loading also is important, because it provides protection from harsh winter conditions and fluctuations in spring temperatures. In streamside and wet ravine communities, seepage is an important moisture source. These habitats have a relatively thick organic layer by alpine zone standards.

Hiking, winter camping, and late spring use are the external factors having the greatest affect on the snowbank/wet ravine habitats. Trampling is a concern near trails and huts. The threats from winter camping are not well documented, but several experts believe that compaction and loss of snow load could occur if snow caves are built on top of less than one-to-two feet of snow. Snowbank community patches, because of their suitability as winter camping sites, are at risk from concentration of waste and repeated use as campsites. Late spring off-trail use can result in the compaction of thin snows — which may directly impact plants or alter local hydrology, or in the trampling of nearly exposed patches of habitat.

Changes to the hydrology of streamside or wet ravine communities could impact patches of these habitats. Global warming and acid rain are threats, but the threat is difficult to assess (Dirnböck et al., 2003; Dullinger et al, 2004; Walther et al., 2002) and outside WMNF control. Most local experts believe that the threat from increasing recreational use is greater in the foreseeable future.

Environmental Effects

Alpine dry-mesic heath/meadow habitats

Effects Common to All Alternatives

Direct and Indirect Effects

Recreational use of the alpine zone can result in trampling, the collection of plants, and the alteration of habitats from trail and facility maintenance and human waste. All alternatives include standards and guidelines that apply to the alpine zone and to patches of alpine habitat that exist outside the alpine zone. They would limit off-trail use, winter camping, trail development, expansion of existing facilities (including huts), and other surface-disturbing activities, and prohibit new facilities and summer camping. The SVE Alpine Plants Panel (2002) felt that current levels of impact would not result in a reduction in viability for most species, given that they have persisted for the last century, but substantial increases in use and impacts could be detrimental. Backcountry recreation use is expected to increase substantially in the future (see Recreation section). Peak-bagging, in particular, may focus impacts on these communities. The alpine zone standards and guidelines would help reduce the potential for trampling and other direct impacts to these communities and the species in them, but individual plants or occurrences may still be impacted. Monitoring is proposed to evaluate the effects of recreation on alpine communities, and to determine if impacts are within acceptable parameters, or if additional efforts are needed to limit use and effects.

Education about an alpine ethic, and the presence of alpine stewards, would be emphasized in the recreation program in all alternatives. This should increase the effectiveness of stay-on-the-trail and waste disposal education efforts, thus benefiting these communities and their species by reducing the potential for trampling and other impacts.

Nothing should reduce the amount of alpine habitat available on the Forest in the foreseeable future. Even small isolated patches of alpine habitat are protected by the standards and guidelines for the alpine zone. Expected increases in recreational use of the alpine zone could result in more direct and indirect impacts from trampling and habitat alteration. However standards, guidelines, and education efforts should minimize the increase in impacts and prevent loss of viability for species in this habitat. Trampling of vegetation has the potential to cause a decline in viability outcome for the White Mountain butterfly and *Arctostaphylos alpina*. Natural limitations could result in a decline in outcome for *Rhododendron lapponicum*.

Table 3-50 summarizes the rationale for the determination made in the BE for each TES species from both alpine habitats (see BE, Appendix G, for more details).

Table 3-50. Rationale for TES species.

Species	Determination	Rationale Summary
Common to all species	N/A	1. Mitigation to protect alpine plants and increase public education/awareness of rare alpine communities should minimize impacts in all alternatives. Not every scenario can be anticipated, but many alpine species have persisted for years with heavy hiker traffic and little or no protection, so it is unlikely that a significant decline would occur during the next 20 years.
White Mountain butterfly	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Habitat has remained stable for this species and should be maintained in the future. 2. The population appears to have persisted throughout the last 200 years; although future use may increase in the alpine/subalpine zone, it is not expected to impact habitats to the point where wildlife species should be measurably affected. 3. Global warming may be the biggest factor in determining the persistence of the White Mountain butterfly and other alpine species, but this is outside Forest Service control.
White Mountain fritillary	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Habitat has remained stable for this species and should be maintained in the future. 2. The population appears to have persisted throughout the last 200 years; although future use may increase in the alpine/subalpine zone, it is not expected to impact habitats to the point where wildlife species should be measurably affected. 3. Global warming may be the biggest factor in determining the persistence of the White Mountain fritillary and other alpine species, but this is outside Forest Service control.

Table 3-50. Rationale for TES species (continued).

Species	Determination	Rationale Summary
Arnica lanceolata, Betula minor, Cardamine bellidifolia, Euphrasia oakesii, Geum peckii, Nabulua (Prenanthes) bootii, omalotheca supina, Poa laxa ssp. *fernaldiana, Vaccinium boreale*	May impact individuals, but would not result in a trend towards federal listing or loss of viability	See rationale common to all species.
Festuca prolifera	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. The SVE Alpine Plants Panel (2002) indicated that the rarity of this subspecies may be a reflection of its confusing taxonomy rather than a result of threats. It may be that in time, the species as it's currently known (*Festuca prolifera*) may actually disappear as taxonomic issues are cleaned up.
Potentilla robbinsiana	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Given this species' recent recovery from Endangered Species listing, the focus for monitoring in the next decade will be relatively intense. The likelihood of any planned activity resulting in impacts to this species is virtually non-existent. The only way impacts could occur would be inadvertently through hiker trampling. Given the inaccessibility of the sites and clear markers instructing people to avoid the Monroe Flats area, this is more unlikely than for other alpine species.
Silene acaulis var. *exscapa*	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Although this species is rare in the Northeast, it is much more abundant to the North. 2. The occurrences along the Auto Road are threatened more by plowing and maintenance activities than other alpine species, but the Auto Road has been in place for many years with the same level of activity. The situation is certainly not optimal, but recent NHNHI descriptions of the occurrence indicate it is has good viability. 3. Mitigation to protect alpine plants and increase public education/awareness of rare alpine communities should minimize impacts in all alternatives. Not every scenario can be anticipated, but many alpine species have persisted for years with heavy hiker traffic and little or no protection, so it is unlikely that a significant decline would occur during the next 15 years.

Cumulative Effects

On- and off-Forest, past trail and facility construction and human use undoubtedly resulted in the loss of patches of alpine communities across the landscape. The SVE Alpine Plants Panel (2002) considered these communities, and rare species in them, to be currently viable, so past impacts did not exceed the viability threshold.

Studies of climate change rates and likely effects on alpine habitats continue. Both observational studies and models show a variety of potential responses, from insignificant to dramatic shifts in alpine vegetation. Expected change in alpine condition varies with the intensity and magnitude of climate change, the adaptability of individual alpine species and communities, and whether it is assumed that disturbance factors change with changes in climate (Dirnböck et al, 2003; Dullinger et al, 2004; Walther et al 2002). Overall, it is likely that alpine habitat will eventually decline and become more fragmented, but these changes will not occur in the near-term. Nor are they likely to be affected by management of the WMNF.

The only on-going, proposed, and probable activities for the alpine zone on the Forest in the next 20 years are maintenance of existing trails and facilities, issuance of outfitter/guide and similar special use permits, and management to protect known rare plant sites (e.g., by improved trail definition).

Off-Forest, the Cog railway is expected to propose changes that would enable trains to run year-round, bringing more people to the alpine zone through the winter and spring. This could increase winter camping and late-spring skiing and their associated effects. No other proposed activities are known on Mt. Washington or in Crawford and Franconia notches except continued recreation use and trail and facility maintenance. The Appalachian Mountain Club (AMC) recently opened a visitor and conference center, just off-Forest north of Crawford Notch. Recreational use was expected to increase even without the new facility, and whether the center will change use levels in the alpine is unknown, especially since it is located near low elevation trails.

The privately-managed Auto Road could result in a decline in or even loss of viability for *Silene acaulis* var. *exscapa* and loss of individual White Mountain butterflies and White Mountain fritillaries. Cumulative effects to this habitat could result in impacts to patches of this community and to individual plants and animals on- and off-Forest, but should not result in a loss of viability of any other species of concern.

Alpine snowbank/wet ravine habitats

Effects Common to All Alternatives

Direct and Indirect Effects

The potential for trampling impacts would be the same for this habitat as for the alpine dry-mesic heath/meadow habitats, because the standards and guidelines would apply to all alpine habitats in all alternatives.

All alternatives include a standard restricting winter camping in the alpine zone to conditions where 2 or more feet of snow exist, and this would reduce compaction and loss of snow load that might otherwise adversely impact these communities. Concentration of waste resulting from winter camping may alter local nutrient levels and pose a concern for some species, especially in snowbank communities that are used repeatedly as campsites. Monitoring is needed to determine if this is a real threat and, if it is, how to limit the impact. This would be part of the monitoring proposed in Chapter 4 of the Plan.

Late-spring skiing would not be restricted by any alternative, except as needed to protect known occurrences of TES species. Although spring skiing is increasing, and occurring in new places on the Forest, conditions are not suitable for late skiing in much of the alpine, so impacts would continue to be isolated. Winter hikers usually try to stay on existing trails, so impacts from this activity should be nominal as well. The potential for direct and indirect effects from late-spring use would remain, but impacts to species should be minimal if known occurrences are protected.

Local experts indicated that the viability outcomes for species in this habitat would likely decline if known sites were not protected (SVE alpine panel 2002), because distribution of these species within this community is sporadic (Sperduto, pers. comm., 2002). All alternatives include standards requiring surveys prior to ground-disturbing activities, and protection of TES species; therefore, known sites and viability, should be protected.

Nothing should reduce the amount of alpine habitat available on the Forest in the foreseeable future. Expected increases in recreational use of the alpine zone could result in more direct and indirect impacts from trampling and habitat alteration. However standards, guidelines, and education efforts should minimize the increase in impacts and prevent loss of viability for species in this habitat. Trampling of vegetation has the potential to cause a decline in viability outcome for the White Mountain fritillary, White Mountain butterfly, and *Sibbaldia procumbens*. Single known occurrences put *Epilobium anagallidifolium* and *Omalotheca supina* at risk from stochastic events or recreational use impacts.

Cumulative Effects

Off-Forest activities that could alter all alpine habitats and associated species are described under Cumulative Effects for dry-mesic heath habitats. Therefore, the potential for cumulative effects is the same as described for dry-mesic heath alpine habitats.

Enriched upland forest (13 species; see Appendix F)

Affected Environment

Most occurrences of these habitats in New Hampshire are small patches (SVE Upland Plant Panel, 2002) within forested habitats that are not enriched, such as northern hardwood forest. Some aspects of these habitats are unique enough that enriched upland forest is considered separately from other forest types that are discussed in the Vegetation section. Sugar maple is usually

the dominant tree species, with white ash and basswood often present. These habitats are found primarily in two natural communities: rich mesic forest and rich red oak rocky woods (Sperduto and Nichols 2004) Some occurrences of the species of concern correspond to semi-rich mesic sugar maple forest. The herbaceous layer tends to be lush, and usually includes species that are indicative of rich hardwood conditions, such as blue cohosh and maidenhair fern. Many spring ephemeral species live in the understory of these habitats.

Availability of calcium and other nutrients, and mesic conditions, are the key habitat features. Forests in which species of concern occur are usually mature. A relatively closed canopy with small gaps allows light to the forest floor without impacting the mesic soil conditions. There is typically a thick, humus-rich A soil horizon and litter layer. Patches of this habitat often occur at the toe of steep slopes where organic matter accumulates. Many of the rare species in this habitat are often found at the base of trees, indicating a possible connection to stem flow.

Because this habitat is not defined solely by overstory vegetation or soil conditions, it is difficult to know how much of it occurs on the National Forest. In New Hampshire, enriched forests are mainly found in situations where soil and organic matter collects, such as on concave hillsides and at the bases of ledges or slopes, talus slopes, ravines, or drainages. Enriched forest also can be found where calcium-rich or circumneutral bedrock is near the surface or on calcareous or circumneutral till.

Based on professional knowledge, it is estimated that rich hardwood forest occurs on only a few thousand acres, much less than one percent of the total Forest (Fay, pers. comm.). Known occurrences of five species that prefer rich hardwoods were compared to MA maps using Arcview, and showed about 30 percent of known occurrences outside MA 2.1 and 3.1 lands, with a similar percentage definitely within MAs 2.1 or 3.1. The rest are mapped near an MA edge, so position could not be certain. The equal numbers inside and outside MAs 2.1 and 3.1 are noteworthy because surveys have been concentrated in timber sale areas and much of the hardwood forest is in MAs 2.1 and 3.1, so more occurrences would be expected in MAs 2.1 and 3.1.

In New Hampshire, these habitats are limited by the natural lack of nutrient-rich soils. Development, timber harvest, invasive species, and herbivory are the primary threats impacting these habitats and the rare species that use them.

The analysis area for species in this habitat includes the ecological subsections in which the White Mountain National Forest exists and the subsection that covers the Connecticut River Valley (Map 3-02a, Vegetation section), where most patches of this habitat in New Hampshire occur. These are subsections M212Ad, M212Ae, M212Ba, M212Bb, and M212Bc.

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

Several activities have the potential to affect individual plants within enriched hardwood forest habitats, though usually only small patches scattered across the Forest. Standards to survey for, and protect, TES species would reduce the potential for impacts to species of concern. Factors largely outside Forest Service control (genetics, disease, illegal collection) may result in declines and reduced viability of *Arabis missouriensis*, *Juglans cinerea*, and *Panax quinquefolius*. Increases in recreational use of the Forest could result in a reduced viability outcome for *Polygonum douglasii*. Populations and viability outcomes for all other species are expected to remain stable (Appendix F). *Osmorhiza berteroi*, *Sanicula trifoliata* and *Cardamine concatenata* would remain stable, with an outcome of C-D due to apparent past declines in local populations. *Cynoglossum virginianum* var. *boreale* would remain stable with an outcome of D-E due to low site fidelity and apparent past extirpations.

Table 3-51 summarizes the rationale for the determination made in the Biological Assessment (BE) for each TES species from this habitat (see BE for more details).

Alternative 1

Direct and Indirect Effects

All harvest techniques reduce canopy closure and could, therefore, alter the moisture and temperature regimes, reducing habitat suitability for some enriched hardwood forest species. Even-aged regeneration harvest reduces canopy closure more than other methods, and Alternative 1 proposes even-aged regeneration harvest on the most acres of all alternatives. Based on age class objectives, the majority of even-aged regeneration harvest would occur in northern hardwood and mixedwood forest (see Vegetation section). Although high quality hardwood stands, such as enriched sites, are usually managed with uneven-aged methods, some even-aged regeneration harvest could occur in enriched hardwood forest habitats. Such harvest could attract deer, moose, and other species in an area, increasing the risk of herbivory compared to other alternatives. Thinnings and uneven-aged harvests also would occur in enriched hardwood habitats and could alter habitat suitability, though not as much as even-aged regeneration harvest would. A guideline is in place to conserve the enriched upland forest outstanding exemplary community, and would reduce the potential for impacts in old patches of this habitat. Summer logging is more likely to directly impact individual plants than winter logging, thus a majority of harvest on the Forest is done in winter, reducing the potential for direct impacts. Standards to survey for, and protect, TES species are proposed and would reduce the potential for harvest to impact species of concern.

Table 3-51. Summary of Rationale for TES Species Determinations.

Species	Determination	Rationale Summary
Common to all species	N/A	1. Although timber harvest and road/trail construction have the potential to directly and indirectly impact individuals, mitigation to protect TES species would be in place to reduce those impacts.
Dicentra canadensis	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. This species has a number of extant occurrences that are considered stable, including some in active timber sale areas and some that have been discovered after timber sale operations were completed. While timber harvesting obviously has the potential to negatively impact this species and its habitat, it would appear that the species has sometimes been able to persist and even increase numbers within active units.
Dryopteris goldiana	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. This species has a number of extant occurrences that are considered stable, including some in active timber sale areas and some that have been discovered after timber sale operations were completed. While timber harvesting obviously has the potential to negatively impact this species and its habitat, it would appear that the species has sometimes been able to persist and even increase numbers within active units. 2. The SVE Pteridophyte Panel (2002) considers the habitat of Goldie's woodfern to be broadly distributed and of sufficient quality now and in the future to support population interaction. It was given the highest ranking available for the viability exercise.
Juglans cinerea	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. The determination is based on the effects of Forest Service management, not actions outside Forest Service control. Butternut is declining because of the butternut canker, not because of any management activities. If a treatment is not devised to mitigate the effects of this disease, it is unlikely the species will recover on its own. 2. The majority of WMNF butternut are planted or are likely progeny of planted trees. There is some question whether these trees would be considered native.

Table 3-51. Summary of Rationale for TES Species Determinations (continued).

Species	Determination	Rationale Summary
Osmorhiza berteroi	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Although timber harvest and road/trail work have the potential to directly and indirectly impact individuals, mitigation to protect TES species and habitat features would be in place to reduce those impacts. This occurrence is located in a very restricted area, so the risk of losing this occurrence to a stochastic event is high, and declining populations in general are cause for concern. However, we assume that declines would not be a result of Forest Service actions and that Forest occurrences would continue to persist. 2. The occurrences on the Forest seem to be stable. The NH occurrence in particular has at least 200 individuals at last count, despite repeated past disturbance.
Panax quinquefolius	May impact individals, but would not result in a trend towards federal listing or loss of viability	1. The northeast population is fairly stable, with a number of extant occurrences. The occurrences are spread across a number of ownerships, so that the population is not entirely on or off the Forest. This helps spread any potential threats that may predominate at certain sites. 2. Although collecting is a potential threat, it is much more of an issue in the core of the range. 3. Hiking pressure will undoubtedly continue to threaten individual occurrences, but these would be limited primarily to those adjacent to trails. Even if individual occurrences are lost, others are likely to persist over time in all alternatives.
Pyrola asarifolia	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Forest Plan direction for Stream Habitats and Water Resources would help protect some wet habitats near which pink wintergreen might be found. 2. This species has a number of extant occurrences outside the WMNF that are considered stable. 3. In addition, habitat along the Wild River (where the one WMNF occurrence is located) is not likely to be substantially impacted in any alternative.

Expanding facilities to increase capacity at existing campgrounds, picnic areas, and backcountry facilities could reduce habitat availability and quality slightly. It also would bring more people to these areas that could result in increased trampling of nearby plants. Development of new campgrounds or day-use areas in enriched hardwood habitat would directly reduce habitat suitability and increase the potential for trampling of plants. How much developed or backcountry recreation is, or would be, in enriched hardwood forest habitat is unknown. This habitat is not abundant on the White Mountain National Forest, but is widely scattered, so it is likely that some existing and new facilities would impact it. However, recreation facilities typically impact small areas and the total amount of habitat affected would be minimal. Standards to survey for, and protect, TES species are in place and would reduce the potential for impacts to species of concern.

Creation of up to 60 miles of summer ATV trail also could result in alteration of small areas of habitat if trails go through enriched hardwood habitats. The standard requiring surveys for TES species prior to ground-disturbing activities should limit the potential for trails to be placed near species of concern. Individual plants that are not detected by surveys could be affected by illegal off-trail ATV use. Monitoring of effects and enforcement of rules would be important to mitigating long-term impacts from such use.

There would be greater risk of non-native invasive species spread with Alternative 1 than under all other alternatives (see Vegetation section), due to higher levels of even-aged regeneration harvest and road work. This means there would be more risk to species of concern from competition with this alternative. Standards and guidelines for prevention and control of invasive species in all habitats should reduce, but not eliminate, the potential for indirect impacts to species of concern. Some non-native invasive species could be introduced to enriched hardwood forest habitats by logging or construction equipment or recreationists and adversely impact habitat quality and survival of species of concern.

Because surveys cannot cover every acre, most hardwood forest habitat is in MA 2.1 (and 3.1 in Alternative 1), and regeneration age habitat would be concentrated in hardwood forest, even-aged regeneration harvest proposed in Alternative 1 could result in a slight decrease in the viability outcome for four species of concern: *Cypripedium parviflorum* var. *pubescens*, *Dicentra canadensis*, *Dryopteris goldiana*, and *Pyrola asarifolia*. Outcomes for other species are common to all alternatives.

Cumulative Effects

The naturally patchy distribution of these habitats across most of the analysis area makes it difficult to determine overall impacts. It is not tracked separately from general hardwood forest by most landowners, and NH Natural Heritage Bureau probably does not know of all the occurrences of these habitats. Timber harvest and development are both more prevalent off the Forest than on it.

Timber harvest of all types would continue across the analysis area. It is reasonable to assume that timber harvest in areas comprised primarily of hardwood forest would impact patches of enriched hardwood forest habitat

and associated species in ways similar to those described as direct and indirect effects. In the New Hampshire portion of the analysis area, almost 20 percent of all timber harvests are even-aged regeneration harvests for timber or land clearing for development (Thorne and Sundquist, 2001). Similar percentages may be true in Vermont and Maine. Currently, more hardwood forest is in regeneration and young age classes off-Forest than on it (Northeastern Forest Research Station, 1995; 1997). Assuming these conditions will continue over the next 20 years, more mature hardwood forest, which could include pockets of enriched hardwoods, would be cleared off-Forest than on.

Off-Forest development is expected to continue to increase throughout most of the analysis area into the foreseeable future (Sundquist and Stevens, 1999). This likely will result in expansion of existing areas and creation of new developed areas where there is currently only forest. The types of effects development would have on these habitats and their species are the same as described for direct and indirect effects. How much of this habitat would be impacted is unknown, because it is so patchy and poorly identified on the landscape.

The cumulative effects of harvest and development on and off the Forest would likely be a reduction in the availability and quality of enriched hardwood forest habitat on the landscape. Whether this reduction would impact viability of species of concern is uncertain. The patchy and limited distribution of this habitat means that loss of a few patches could affect species distribution and metapopulation interactions, but it also makes it less likely that harvest and development would actually impact suitable acres. The requirements to survey for and protect TES species on the Forest should prevent a loss of viability within the planning area unless off-Forest actions cause regional loss of viability, which would be beyond the Forest Service's control.

Alternative 2

Direct and Indirect Effects

The types of effects on these habitats and their species from timber harvest would be the same as for Alternative 1, because standards and guidelines are the same and a majority of the even-aged regeneration harvest would occur in hardwood forest habitats. Alternative 2 proposes even-aged regeneration harvest on fewer acres in the first 20 years than Alternatives 1 and 4, but more than Alternative 3. It includes timber harvest on the fewest overall acres. The risk of negative impacts to habitat and individuals from timber harvest would be less than for Alternatives 1 and 4, based on less harvest of all types, and more than for Alternative 3 because of the higher level of even-aged regeneration harvest.

The types of effects recreational development would have on these habitats and their species would be the same as described for Alternative 1, except that no new campgrounds would be established. This alternative proposes creation of fewer new campsites and backcountry sites than in Alternative 1, which should result in less acres of habitat impacted and reduced potential for direct impacts to plants.

Summer motorized trail use would be prohibited, so there would be no potential for impacts from this activity.

The standards and guidelines for prevention and control of non-native invasive species would be the same under this alternative as for Alternative 1. Therefore, the type of impacts would be the same as for Alternative 1. However, the risk of spread and competition from these species is less under Alternative 2 (see Vegetation section) because fewer acres would be impacted by timber harvest, roads, and skid trails.

Proposed even-aged regeneration harvest levels in hardwood forest are half to two-thirds of those proposed in Alternative 1, so the potential for declines in populations of *Cypripedium parviflorum* var. *pubescens*, *Dicentra canadensis*, *Dryopteris goldiana*, and *Pyrola asarifolia* is less. Viability outcomes are not expected to decrease for these species as a result of timber harvest in this alternative. Viability outcomes for other species are common to all alternatives.

Cumulative Effects

The type and amount of off-Forest effects from timber harvest and development within the analysis area are the same as described for Alternative 1. The cumulative effects and consequences of those effects would be less for this alternative than Alternative 1, because direct and indirect effects from timber harvest and recreation development would be less. Expected changes in viability outcomes in the planning area would be the same as for direct and indirect effects.

Alternative 3

Direct and Indirect Effects

Alternative 3 proposes even-aged regeneration harvest on the fewest acres of all alternatives, and on noticeably less hardwood forest habitats than all other alternatives. Even so, some of this type of harvest could occur in enriched hardwood forest habitat. Standards and guidelines would be the same as described for Alternative 1. Overall habitat quality could be reduced on a few small patches of this habitat, and individuals could be impacted by habitat alteration or direct impacts from summer logging, but the risk of negative impacts would be minimal. Based on the low level of even-aged regeneration harvest proposed, the impacts from herbivory would be the lowest of all alternatives.

The types of effects recreational development would have on these habitats and their species would be the same as described for Alternative 1, except that no new campgrounds would be established. This alternative proposes creation of fewer new campsites and backcountry sites than any other alternative, which should result in the fewest acres of habitat impacted and reduced potential for direct impacts to plants.

The direct and indirect impacts from summer motorized recreation and invasive species would be the same as for Alternative 2.

Proposed even-aged regeneration harvest levels in hardwood forest are one-quarter or less of those proposed in Alternative 1, so declines in populations

of *Cypripedium parviflorum* var. *pubescens*, *Dicentra canadensis*, *Dryopteris goldiana*, and *Pyrola asarifolia* are less likely. Viability outcomes are not expected to decrease for these species as a result of timber harvest in this alternative. Viability outcomes for other species are common to all alternatives.

Cumulative Effects

The type and amount of off-Forest effects from timber harvest and development within the analysis area are the same as described for Alternative 1. The cumulative effects and consequences of those effects would be less for this alternative than for any other alternative, because direct and indirect effects from timber harvest and recreation development would be less. Expected changes in viability outcomes in the planning area would be the same as for direct and indirect effects.

Alternative 4

Direct and Indirect Effects

The types of effects on these habitats and their species from timber harvest would be the same as for Alternative 1, because standards and guidelines are the same and a majority of the even-aged regeneration harvest would occur in hardwood forest habitats. Alternative 4 proposes even-aged regeneration harvest on fewer acres than Alternative 1 in the first 20 years, but slightly more than Alternative 2 and more than twice that proposed in Alternative 3. This alternative includes timber harvest on the most overall acres. The risk of negative impacts would be less than under Alternative 1, based on less even-aged regeneration harvest, and more than Alternatives 2 and 3, due to more even-aged regeneration harvest and more acres impacted by harvest overall.

The types of effects recreational development would have on these habitats and their species would be the same as described for Alternative 1. Alternative 4 proposes creation of more new campsites, picnic sites, and backcountry sites than all other alternatives, and could result in construction in more new areas. Less summer ATV trail would probably be constructed than in Alternative 1. Even with more sites and new campgrounds likely, as well as summer ATV use, the change in habitat abundance on the Forest from the current condition would be minimal and should not alter population levels at the landscape-scale.

The standards and guidelines for prevention and control of non-native invasive species would be the same under this alternative as for Alternative 1. The risk of spread of these species would be less than under Alternative 1 and more than under Alternatives 2 and 3 (see Vegetation section for rationale).

The direct and indirect effects to these habitats and associated species would be more than under Alternatives 2 and 3, due to higher harvest and development levels. The risk of missing species of concern during surveys and impacting small patches of suitable habitat set within northern hardwood forest would be greater for timber harvest activities that occur on tens of acres at a time than for small recreation developments. Therefore,

direct and indirect effects from this alternative likely would be less than under Alternative 1, despite larger increases in recreational development, because there would be less even-aged regeneration harvest. However because surveys cannot cover every acre, most hardwood forest habitat is in MA 2.1, and regeneration age habitat would be concentrated in hardwood forest, even-aged regeneration harvest proposed in Alternative 4 could result in a slight decrease in the viability outcome for four species of concern: *Cypripedium parviflorum* var. *pubescens*, *Dicentra canadensis*, *Dryopteris goldiana*, and *Pyrola asarifolia*. Outcomes for other species are common to all alternatives.

Cumulative Effects

The type and amount of off-Forest effects from timber harvest and development within the analysis area are the same as described for Alternative 1. The cumulative effects and consequences of those effects likely would be slightly less for this alternative than Alternative 1, because direct and indirect effects would be less. Changes to viability outcomes in the planning area would be the same as for direct and indirect effects.

Rock and cliff (18 species of concern, see Appendix F)

Affected Environment

These habitats include cliffs, rock outcrops, rocky ridges, and subalpine summits. They tend to be small, widely scattered patches, surrounded by or included in forest of various types. Most of the species of concern for the Forest occur in open to semi-open rock and cliff habitats, which may be interspersed among patches of trees. These habitats range in elevation from less than 2,000 feet to the alpine zone. Wind, fire, and human disturbance may affect these habitats regularly.

There are fourteen different natural communities on the Forest that contain rock and cliff habitats (Sperduto and Nichols, 2004). These correspond to four systems of communities: montane cliff, montane rocky ridge, montane acidic talus, and subalpine heath-krummholz/rocky bald systems (Sperduto, 2004). Acidic cliffs and outcrops and red spruce ridges are relatively abundant on the Forest and in surrounding ecological subsections. Red pine ridges and circumneutral to calcareous rock and cliff habitats are uncommon to rare on the Forest and in much of New Hampshire and western Maine, but are somewhat more abundant in western Vermont. The Forest has at least 60 climbing cliffs and numerous rock outcrops, especially at summits and along ridgelines.

Direct impact from hikers and rock and ice climbers is the primary threat affecting species in these habitats, especially species that inhabit climbing cliffs. On rocky ridges and some rock outcrop communities, succession to a closed canopy can limit habitat suitability. Development and invasive species could affect some occurrences of these habitats, but they are less important as limiting factors than direct impacts and succession.

The analysis area for animals in this habitat is the ecological subsections that encompass the Forest (M212Ad, M212Ae, M212Ba, and M212Bc; Map

3-02a, Vegetation section). Because these species are highly mobile, management across the ecological subsections could affect populations. For plants, the analysis area is the White Mountain National Forest proclamation boundary, plus adjacent state parks and the Appalachian National Scenic Trail corridor outside the proclamation boundary that is managed by the Forest Service (Map 3-02b, Vegetation section). Plants do not travel long distances the way birds do; in addition, cliffs and large rock outcrops are distinct habitats that are usually relatively isolated, so the management of one does not usually alter populations of plants at a different site.

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

View seekers may create their own trails and trample sites, so recreation use is a concern in all alternatives. Sperduto and Cogbill (1999) documented trail impacts in some of the alpine and subalpine areas, noting that most peaks have localized trampling of vegetation, a few areas are trailless and unimpacted, and several are nearly denuded due to historic and recent use. It is likely that non-alpine rock ridges and outcrops are similarly impacted. Hiking use is expected to increase in all alternatives. Therefore, the potential for trampling of plants is expected to increase.

Rock climbing also is expected to increase in all alternatives over the next two decades (see Recreation section). Standards and guidelines will prohibit clearing of vegetation at cliff edges and bases, and limit group size for rock-climbing special use permits. They also allow for area-specific climbing plans, use limitations, and closure of climbing sites when these restrictions are needed to protect resources. For species that occur at the top or base of cliffs, or that are well documented, this direction would reduce the potential for climbing to remove individuals or alter their habitat. However, cleaning of climbing routes and establishment of new routes would still be allowed on all cliff habitats unless an area is specifically closed, with no requirement for rare species surveys. An inventory of cliff sites known or likely to be climbed is proposed in the Monitoring Guide to identify rare plant occurrences and determine what protection is needed to maintain these species. Establishment and cleaning of routes often results in removal of vegetation and soil, and could directly impact rare plants and small-footed myotis, and reduce habitat suitability. If monitoring showed an impact to TES species from climbing, climbing plans would be developed and routes or cliffs could be closed to stop the impacts.

All alternatives would allow prescribed fire and wildland fire use in several MAs (see Fire section) to meet resource objectives, which could include limiting succession in these habitats. Given the small amount of prescribed fire done each year, the low natural fire interval, the scattered distribution of this habitat and lightning-ignited fires, and the small size of wildland fires that is expected (see Fire section), fire use may not alter much of this

habitat on the Forest. However, prescribed fire could be used expressly to maintain oak and oak-pine habitat for species of concern. The difference in land allocation to MAs that allow fire uses, when considered across the landscape, would not change overall effects to these species, especially given the small amount of each fire use expected on the Forest.

Rock habitats do not provide the best sites for developed, backcountry or dispersed camping sites, so recreation facilities development on the Forest is not likely to noticeably impact these habitats or associated species.

On the Forest, the risk of non-native invasive species is roughly proportional to the amount of harvest and road work proposed (see Vegetation section). These activities would be limited in rock habitats due to logistical challenges. Therefore, risks to rock habitat species from non-native invasive species would be low.

Although levels of direct and indirect effects may vary slightly (see effects by alternative), all rock-dwelling species should remain viable for the foreseeable future with all alternatives. However, impacts from rock climbing and hiking that occur before monitoring indicates a need for mitigation could reduce the viability outcome for six species in all alternatives: eastern small-footed myotis, *Carex scirpoidea*, *Minuartia glabra, Oligoneuron album*, *Paronychia argyrocoma*, and *Polygonum douglasii.* Factors outside Forest Service control (risks associated with small populations, lack of natural disturbance) may result in a decline in the viability outcomes for *Arabis missouriensis* and *Pinus banksiana* in all alternatives. Populations and viability outcomes for all other species are expected to remain stable (see Appendix F). *Cardamine concatenata* would remain stable at the identified viability threshold, with an outcome of C-D, due to apparent past declines in local populations. *Cynoglossum virginianum* var. *boreale* would remain stable below the threshold, with an outcome of D-E, due to low site fidelity and apparent past extirpations. Table 3-52 summarizes the rationale for the determination made in the BE for each TES species from this habitat (see BE, Appendix G, for more details).

Cumulative Effects

Specific plans for new hiking and summer motorized trails, climbing areas, or residential or commercial development are not known in either analysis area for this habitat. Increased use of hiking trails, summer ATV trails, and rock climbing sites is likely outside the Forest, and could result in impacts to species of concern or their habitat if species occur at popular sites. It is likely that rural and urban development will continue to expand within both analysis areas, and some of it could eliminate suitable rock habitat. Because even-aged regeneration harvest may be decreasing across the analysis area (see Vegetation section), succession may limit species more, making their viability more susceptible to management impacts. All alternatives would keep some habitat open, but even-aged regeneration harvest of less than 2,000 acres per year would not measurably alter this concern at a landscape scale. Invasive species also are increasing on non-Forest lands within the proclamation boundary and likely will continue to expand; this expansion increases the risk of invasive species infecting rock habitats on and off the Forest.

Table 3-52. Summary of rationale for TES species determinations.

Species	Determination	Rationale Summary
American peregrine falcon	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. New standards and guidelines that restrict outfitter/guide climbing group size should help limit the number of people using cliff habitats. 2. Historically, the climbing community has been very supportive of seasonal route closures, which have proven effective in promoting successful reproduction. 3. Suitable, unoccupied habitats are available on the Forest and within the analysis area. 4. If food resources are available, peregrines are known to nest on tall buildings, bridges, and other manmade structures with surrounding human disturbance that far exceeds levels on the WMNF. It may be possible for them to adapt over time to greater numbers of people, as long as it is a gradual increase and prey is abundant.
Eastern small-footed myotis	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Rock climbing will continue to increase, but standards and guidelines to limit use and protect resources should help to limit effects somewhat. In addition, other rock habitats not used for climbing should still provide ample habitat opportunities. 2. There is some risk of direct mortality from timber harvest operations. However, the chance of this occurring is relatively small compared to the number of trees that will be cut and the number of suitable roost trees available. 3. The current road system is not expected to increase in the future, although increased use on existing roads could result in some direct mortality. Guidelines to limit road upgrades that result in increased speed levels would also help mitigate this effect. 4. Tower structures would increase the risk of bat collisions, but mitigation measures would help lessen this effect.

Table 3-52. Summary of rationale for TES species determinations (continued).

Species	Determination	Rationale Summary
Calamagrostis stricta var. *inexpansa (Calamagrostis lacustris)*	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Pond reed bent-grass occupies a variety of wet habitat types, including many which rely on disturbance to be perpetuated. The one known occurrence of this species on the Forest is located in a meadow that is influenced by river flooding. There is no direction in any alternative that would result in a change to that condition. 2. Road maintenance operations may create habitat for this species, although site-specific direction would likely be needed if pond reed bent-grass individuals ever colonized this kind of habitat on the Forest.
Paronychia argyrocoma	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Standards and guidelines limit outfitter/guide climbing party size, which should help limit the number of climbers removing vegetation and soil from suitable habitat. New direction to restrict removal of vegetation at cliff summits should also help protect habitats. 2. Standards and guidelines for protecting TES species should help mitigate proposed construction of new trails and trigger action when resource damage is confirmed by existing activities. 3. Riparian standards and guidelines are in place to protect riverbank habitats, although these sites may be subject to natural disturbance events that may impact future occurrences.
Piptatherum (Oryzopsis) canadensis	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. The one WMNF occurence appears to have persisted for some number of years, despite being located adjacent to a hiking trail. 2. Canada mountain rice-grass uses a variety of habitats, including some that are periodically disturbed and could be improved through management. 3. The biggest concern for this species is the lack of occurrences nearby.

Table 3-52. Summary of rationale for TES species determinations (continued).

Species	Determination	Rationale Summary
Saxifraga paniculata ssp. *neogaea*	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Standards and guidelines limit outfitter/guide climbing party size, which should help limit the number of climbers removing vegetation and soil from suitable habitat. 2. Standards and guidelines for protecting TES species should help mitigate proposed construction of new trails and trigger action when resource damage is confirmed by existing activities. 3. Effective mitigation measures are known that can be implemented at the project level to limit impacts. 4. Known occurrences on the WMNF are very persistent, having survived for almost 100 years. 5. New Forest Plan direction to slow the spread of invasive species will reduce the risk of indirect impacts.

These impacts could reduce or eliminate off-Forest populations of species of concern, and thereby alter metapopulation dynamics for populations on the Forest, which could reduce their ability to recover from the described direct and indirect effects. Loss of populations near the Forest, if it occurred, also would increase the importance of the Forest populations for maintaining the species' distribution. Given the limited number of known populations of some species, and the potential for direct, indirect, and cumulative effects, the viability of some species in the analysis area would decrease in all alternatives, as described for direct and indirect effects common to all alternatives.

Alternative 1

Direct and Indirect Effects

Alternative 1 proposes up to 40 miles of new non-motorized trail across the Forest in the next 20 years. The majority of these trails are not likely to cross rock habitats, given the sporadic distribution of these habitats, but rock outcrops and summits, which are popular with view seekers, may become more accessible. Standards and guidelines require plant surveys prior to construction of a new trail, and protection of sensitive species. Recreation education to protect resources would be emphasized, which should reduce the potential for trampling. Therefore, the increase in trails in these habitats would be minimal, and any increases in risk to species should not reduce viability.

This alternative could result in the greatest amount of summer ATV trails, and so has the greatest potential for trampling and habitat alteration. As with hiking trails, it is unlikely that trails would be placed in rock habitats,

but they could bring people to new areas containing such habitat. Standards requiring plant surveys prior to ground-disturbing activities and protection of TES species should prevent direct impacts from ATV trails to rare plants. Illegal and off-trail use may occur in all alternatives, and could result in trampling of plants.

Even-aged timber harvest and group selection harvest could prevent succession and help maintain these open habitats and associated species. This alternative includes even-aged regeneration harvest on more acres than any other alternative, but it is unlikely that much of this harvest will occur on rocky habitats, due to their sporadic distribution and challenges in harvesting on them. However, harvest may be used in some locations to benefit surrounding oak-pine or pine habitats by opening the canopy and understory. This alternative has the potential to reduce succession through timber harvest more than any other alternative.

Alternative 2

Direct and Indirect Effects

Alternative 2 proposes construction of 25 miles of new hiking trails, the majority which are not likely to cross rock habitats, given the sporadic distribution of these habitats. However, some rock habitats may become more accessible. Increased hiking use is expected in all alternatives, regardless of new trails.

Summer ATV use would be prohibited, so impacts would be limited to those from illegal use.

Alternative 2 proposes fewer acres managed through even-aged regeneration harvest methods than in Alternatives 1 and 4. However, requirements to protect TES species could result in use of limited harvest to prevent succession if needed to maintain populations or suitable habitat. Therefore, the effect from harvest to species of concern in these habitats should be the same among the alternatives.

Alternative 3

Direct and Indirect Effects

This alternative proposes only 10 miles of new hiking trail over the next 20 years. The potential for new trails to cross rock habitats, when so few would be constructed, is minimal.

Alternative 3 proposes the least acres of even-aged regeneration harvest of all the alternatives, and thus would allow the most areas to mature with a relatively closed canopy, which could reduce habitat suitability for species in rocky, forested habitats. However, requirements to protect TES species could result in use of limited harvest to prevent succession if needed to maintain populations. Therefore, the effects of succession on known occurrences may not be noticeably less than in other alternatives, though less suitable habitat may be available in the future.

Alternative 4

Direct and Indirect Effects

Alternative 4 would result in the construction of up to 100 miles of new non-motorized trails, which is more than any other alternative. The majority of these trails are not likely to cross rock habitats, given the sporadic distribution of these habitats. However, some undoubtedly would cross or bring people near rock habitats., and this would increase the potential for trampling above that for Alternative 1.

Neither proposed ATV area includes known rock climbing cliffs, but they may contain smaller rock habitats. Standards requiring plant surveys prior to ground-disturbing activities, and protection of TES species, should prevent direct impacts from ATV trails to rare plants. Illegal off-trail use of ATVs could occur in any habitat, and may result in trampling of individual plants or occurrences.

This alternative proposes harvest through even-aged regeneration methods on fewer acres than in Alternative 1 and more than in Alternatives 2 and 3. Requirements to protect TES species could result in use of limited even-aged regeneration harvest to prevent succession, if needed to maintain populations or suitable habitat. Therefore the effect from harvest to species of concern in these habitats should be the same among the alternatives.

Conifer Forest (8 species of concern, see Appendix F)

Affected Environment

This is a broad habitat category that includes all forest types that are made up primarily of conifers - spruce, fir, hemlock, and pine. In northern New Hampshire, most of this habitat is spruce-fir forest, which may contain scattered deciduous trees. Some of it, especially at high elevations, is dry, upland forest; some, especially at low elevations, is moist to wet forest. High elevation conifer forest habitats correspond to two dominant natural communities: high-elevation spruce-fir and high elevation balsam fir forest (Sperduto and Nichols, 2004). Low elevation conifer forest habitats on the Forest relate primarily to two natural communities: lowland spruce-fir and hemlock-spruce-northern hardwood forest (Sperduto and Nichols, 2004). Truly wet coniferous forest is addressed in the forested wetland habitat discussion. Some species of concern prefer young conifer forest habitat, but most rely on mature conifer forest. See the Vegetation section for information on the distribution and condition of, and potential effects of natural disturbance and management on, these habitats on the White Mountain National Forest

These habitats are widespread, so changes to nearby off-Forest habitats or populations could affect Forest habitats or populations. Therefore, the analysis area for species that use these habitats is the ecological subsections that encompass the Forest (M212Ad, M212Ae, M212Ba, and M212Bc, Map 3-02a, Vegetation section). In the analysis area, conifer forest is concentrated on the Forest and in northern areas.

Past even-aged regeneration timber harvest on certain ecological land types has resulted in conversion of some conifer forest to mixedwood or hardwood forest, making it currently unsuitable for species in this group. Harvest of all types alters forest age and canopy conditions, which may positively or negatively affect habitat suitability for some species. Urban and rural development have removed areas of low elevation conifer forest, and recreation and commercial development have altered high elevation habitat in some areas. Acid deposition and global climate change may reduce these habitats in the long-term.

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

In all alternatives, most of the conifer forest habitat on the White Mountain National Forest would be in MAs that would not allow commercial timber harvest except salvage. Almost all this habitat is currently mature forest, and would continue aging. Timber harvest would occur in existing softwood habitat in MA 2.1 (and 3.1 in Alternative 1). Since age class objectives in all alternatives call for very little regeneration age habitat, most harvest would be through uneven-aged methods. Therefore, almost all of the conifer forest habitat on the Forest would be in the mature or old age classes at any given time, and would provide suitable habitat for most species of concern in this habitat. Species that use or depend on young softwood habitat would have only a few hundred acres of harvested land at any given time, plus whatever is created through natural disturbance, which would be 3 to 6 percent of the habitat on the Forest (Lorimer and White, 2003). See the Vegetation section for additional information on expected management and impacts to softwood forest habitat, which encompasses most of the conifer forest on the WMNF.

Several activities have the potential to directly affect individual plants and animals within conifer forest habitats. Some activities also would affect small patches of habitat scattered across the Forest in all alternatives. Standards to survey for, and protect, TES species would reduce the potential for impacts from these activities to species of concern. Timber harvest may affect seep habitats within conifer forest, which could result in a decline in viability outcome for *Galium kamtschaticum* in all alternatives. Hybridization, road use, and habitat alteration may result in declines in Jefferson salamander in all alternatives. Viability outcomes for all other species of concern in conifer forest habitats are expected to remain stable and viable in all alternatives (see Appendix F). The outcome for the wood turtle remains stable at a low level (Outcome C-D), due to dramatic declines off-Forest. Table 3-53 summarizes the rationale for the determination made in the Biological Evaluation (BE) for each TES species from this habitat (see BE, Appendix G, for more details).

Table 3-53. Summary of rationale for TES species determinations.

Species	Determination	Rationale summary
Common to all species	N/A	1. Although timber harvest and road/trail construction have the potential to directly and indirectly impact individuals, mitigation to protect TES species would be in place to reduce those impacts.
Bicknell's thrush	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Nothing is specifically planned to promote increased use in high elevation spruce-fir habitats and as yet, recreation use impacts have not yet been proven, but it is suspicious that the breeding bird data from the WMNF shows such a rapid decline while other areas in the Northeast are stable or increasing. It is assumed that if recreation use levels were proven to contribute to significantly declining trends on the Forest, action would be taken to mitigate the effects.
Northern bog lemming	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Northern bog lemmings have apparently persisted for the last century despite much more habitat altering activities than are proposed here. Although habitat conditions may be altered locally, there is no reason to believe the subspecies would not continue to persist regardless of alternative.
Wood turtle	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. There are few wood turtles known from the Forest and few areas of suitable habitat. Mitigation to protect riparian habitats would be implemented in all alternatives, and pre-project surveys would be conducted to identify potential upland habitat. Project mitigation, such as seasonal harvest restrictions, would then help to limit impacts to wood turtles, so the likelihood of affecting an individual wood turtle is small.
Geocaulon lividum	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. It is unlikely that additional trails would be constructed in bog habitats 2. Population viability for this species is expected to be maintained, although some individuals or occurrences could be lost.

Table 3-53. Summary of rationale for TES species determinations (continued).

Species	Determination	Rationale summary
Listera convallarioides	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Some potential habitat for this species (seeps) may be overlooked during timber sale activities, but it is assumed that pre-project surveys would make a reasonable effort in identifying new occurrences. 2. Hiker traffic may result in the trampling of some individuals, but occurrences away from trails should remain protected and site-specific mitigation (e.g., trail reroutes, educational signs) can help mitigate effects. 3. Deer herbivory may be a threat, but the chance that deer would destroy entire colonies and result in viability losses seems unlikely given that historically deer populations were much higher than today.
Listera cordata	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Some potential habitat for this species (seeps) may be overlooked during timber sale activities, but it is assumed that pre-project surveys would make a reasonable effort in identifying new occurrences.

Alternative 1

Direct and Indirect Effects

Uneven-aged timber harvest includes group selection harvest, which could impact populations of mature forest plants by removing small patches of nearby overstory. Standards requiring surveys of stands prior to ground-disturbing activity, and protection of known populations, would reduce the potential for group selection harvest to alter habitat upon which rare plant populations depend. However, surveys cannot reach every acre, so some unknown populations could be affected by changes to habitat. This alternative proposes uneven-aged harvest on the second-fewest acres, slightly above Alternative 2. Whether this would result in less impact to species in this habitat than Alternatives 3 and 4 is uncertain, because the distribution of uneven-aged harvest among habitat types is not detailed in the alternatives. It is assumed that the amount of conifer forest impacted by uneven-aged harvest would be proportional to the amount of such harvest conducted overall.

Harvest of any type could directly impact individuals, since surveys might not find all populations of rare species despite reasonable effort. If individuals occur, but are not known, summer harvest could result in trampling of plants by workers and machinery. Breeding birds could lose their nests and eggs or nestlings. A majority of harvest on the Forest is done in winter, which reduces potential impacts for some species, especially those

in moist habitats. Summer or winter logging could result in compaction of soil or snow, which could impact bog lemmings and their habitat. Surveys would further reduce the potential for impacts. Riparian standards and guidelines, which protect wetlands and springs, should protect individuals associated with the wettest coniferous habitats. The potential for direct impacts from timber harvest to occur is assumed to be proportional to the number of acres on which timber is harvested. Alternative 1 proposes harvest on the second highest number of acres (after Alternative 4). However given the season of most harvest, and the standards and guidelines, the risk of harvest reducing populations is low.

How much construction of recreation facilities would occur in conifer forest habitat is uncertain, but it is likely that some would occur in this habitat and the amount would be proportional to the total amount of construction on the Forest. Recreational development could result in loss of small patches of conifer forest habitat (see Vegetation section). In addition, development could impact understory conditions and would bring more people to certain areas, increasing the risk of trampling of nearby plants. Use of a new area also could result in increased disturbance to bird species of concern. The standards and guidelines requiring surveys for, and protection of, TES species would reduce the potential for direct impacts to species of concern.

Creation of summer ATV trails could result in alteration of small areas of conifer forest habitat. The standards requiring surveys for, and protection of, TES species prior to ground-disturbing activities should limit the potential for trails to go in near species of concern. Illegal off-trail ATV use will continue to be a concern in all alternatives, and could result in trampling or disturbance of species of concern.

Overall, the potential to impact conifer forest habitat and associated species in Alternative 1 is more than in Alternatives 2 and 3 because it has more development, allows ATV use, and has more timber harvest. It is slightly less than in Alternative 4, because it has less recreation development and harvest acres.

Cumulative Effects

Assuming management continues as proposed in this alternative over the next 150 years, management and natural processes would result in an increase in the amount of softwood forest habitat on the Forest as mixedwood forests on softwood ecological land types gradually convert (see Vegetation section). These additional lands would support increased populations of most conifer forest species of concern. Because this conversion would occur over many decades, changes in species populations would be gradual.

The potential for timber harvest and development off-Forest to alter conifer forest habitats in the analysis area is discussed in the Vegetation section. The higher levels of even-aged harvest and development off-Forest make the Forest even more important as habitat to mature softwood forest species. Retention of more than 90 percent of softwood habitat on the Forest in mature and old age classes would benefit these species and provide them with extensive habitat to rely on as development increases off-Forest. The White Mountain National Forest objective of increasing softwood habitat in the

long-term also would make the Forest more important to species that rely on softwood habitat, as management for hardwoods continues off-Forest. The trampling and disturbance effects of harvest and development on species in these habitats would be the same off-Forest as described for on-Forest, but more extensive, because harvest and development would be more extensive.

Off-Forest effects could result in further concentration of mature conifer forest associated species on the Forest as habitat quantity and quality is reduced on the surrounding landscape, and maintained or increased on the Forest. Viability outcomes for all species on the Forest would remain stable, but populations may decrease off-Forest, making the Forest more important as a stronghold for these species. Loss of habitat off-Forest probably will prevent viability outcomes from increasing, despite improved habitat on the Forest.

Alternative 2

Direct and Indirect Effects

This alternative would result in the fewest acres of uneven-aged management of all the alternatives. Therefore it is assumed that the potential for direct impacts from group selection harvest is the smallest.

The types of effects from increased capacity and development of new recreation facilities and trails would be the same as described for Alternative 1. The potential for effects on species in this habitat type would be less than Alternatives 1 and 4, because no new campgrounds or day use areas would be constructed, new areas would not be accessed by motorized and non-motorized trails, and summer ATV use would be prohibited. There would still be potential for impacts from illegal use of ATVs.

Cumulative Effects

Assuming management continues as proposed in this alternative over the next 150 years, management and natural processes would result in a greater increase in the amount of softwood forest habitat on the Forest than described for Alternative 1 (see Vegetation section). These additional lands would support greater increases in populations of most conifer forest species of concern than in Alternative 1 in the long-term. Because this conversion would take at least 150 years, changes in species populations would be gradual.

Off-Forest timber harvest and development within the analysis area, and resulting loss of habitat, would be the same as described for Alternative 1. The cumulative effects, and consequences of those effects, would be less for this alternative than for Alternatives 1 and 4, because the direct and indirect effects from harvest and development would be less, and the long-term increase in habitat would be greater than Alternative 1.

Viability outcomes for all species on the Forest would remain stable, but populations may decrease off-Forest, making the Forest more important as a stronghold for these species. Loss of habitat off-Forest probably will prevent viability outcomes from increasing, despite improved habitat on the Forest.

Alternative 3

Direct and Indirect Effects

This alternative would result in more than twice as much uneven-aged management as Alternative 1 in the first two decades. Given the low level of even-aged regeneration harvest in hardwood and mixedwood habitats proposed in this alternative, and the desire for hardwood sawtimber in local timber markets, the increase in uneven-aged harvest could mean greater impacts to coniferous forest species, or management of more hardwood and mixedwood forest through uneven-aged methods. Therefore, whether harvest proposed in this alternative would have more impacts on species that prefer conifer forest is unknown.

The types of effects from increased capacity and development of new recreation facilities and trails would be the same as described for Alternative 1. The potential for effects on species in this habitat type would be less than any other alternative, because fewer new campsites are proposed, no new campgrounds or day use areas would be constructed, new areas would not be accessed by motorized and non-motorized trails, and summer ATV use would be prohibited. There would still be potential for impacts from illegal use of ATVs.

Cumulative Effects

Softwood habitat composition objectives would be the same as in Alternative 2, so the effects of forest habitat conversion should be the same. Off-Forest timber harvest and development within the analysis area, and resulting loss of habitat, would be the same as described for Alternative 1. Because direct and indirect effects might be more from uneven-aged harvest, but effects from recreation facilities would be less, the cumulative effects from this alternative would be essentially the same as for Alternative 2. Viability outcomes for all species on the Forest would remain stable, but populations may decrease off-Forest, making the Forest more important as a stronghold for these species. Loss of habitat off-Forest probably will prevent viability outcomes from increasing, despite improved habitat on the Forest.

Alternative 4

Direct and Indirect Effects

This alternative proposes uneven-aged management on about twice as many acres as Alternatives 1 and 2, and slightly less than Alternative 3. Because even-aged management is proposed on a moderate portion of the hardwood habitats, the increase in uneven-aged management could not occur entirely in hardwood habitats. Therefore, at least some of the additional acres of uneven-aged harvest would occur in conifer forest habitat. As a result, timber harvest in this alternative likely would have a greater impact on species of concern in these habitats than Alternatives 1 and 2. How it would compare to Alternative 3, which has a higher level of uneven-aged management, is unknown.

The types of effects from increased capacity and development of new recreation facilities and trails would be the same as described for Alternative

1. Although fewer miles of summer ATV trail may be proposed, the potential for effects on species of concern would be greater than in all other alternatives, because more new campgrounds, day use areas, and backcountry sites likely would be constructed, and more new areas would be accessed by non-motorized trails.

If this alternative is selected, the decision will include which ATV area to pursue. The proposed Landaff area includes about 2,000 acres of conifer forest habitat, which is about 27 percent of the area. The proposed Moat Mountain area contains only about 80 acres of conifer forest habitat, which is about 2 percent of the area. Since the expected trail mileage would be similar regardless of the area chosen, the potential for impacts to species of concern in this habitat would be greater in the Landaff area.

Landscape-level Habitat (4 species of concern, see Appendix F)

Affected Environment

Some wildlife species use a variety of habitat types, but only if those habitats are available in the appropriate amounts or conditions across a large landscape. These species are typically predators with large home ranges. They cover square miles of territory on a regular basis. Some have a strong habitat preference, needing more of one habitat type on the landscape, while others prefer a wide variety, and just need to avoid roads and people.

The analysis area for species that use large landscapes is the two ecological sections that encompass the White Mountain National Forest (M212A and M212B, Map 3-02a, Vegetation section). Sections are large enough to encompass whole populations of these species, while subsections may not be.

For three species (wolf, lynx, and cougar), abundance of large and small prey, such as deer and snowshoe hare, is important. On the Forest, prey populations are low, due to limited regeneration and young forest habitat. In New Hampshire, moose and hare densities are highest in the northern counties (Snyder, 2003; 2003a). In Maine and New Hampshire, deer densities are highest in southern counties, where winter survival is easier (Lavigne, 2003). Given similarities in human population distribution and climatic conditions among the states, these relative state distributions probably apply to the whole analysis area. Low human density is important to most of these species. Human density is low on much of the Forest, although recreation areas can be densely populated at times. Across the analysis area, human densities are typically highest to the south and lowest in the north (Sundquist and Stevens, 1999). There are extensive areas with only scattered, small towns and limited recreational use. Snow depth also is important to the marten and lynx. Snow depth is greatest in the analysis area at high elevation, such as much of the Forest, and in northern areas; it is lowest in the Connecticut River Valley, most of Vermont, and southern New Hampshire (Hoving, 2001).

Development and road construction are the primary threats to wide-ranging species, fragmenting natural habitats with buildings and pavement, and

increasing the potential for human-wildlife interactions. Many people dislike or are afraid of large predators, so harassment and killing are threats as people occupy more land.

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

New campsites and backcountry sites would be created at existing use areas under all alternatives. Increased capacity at existing sites would bring more people to these areas, and could result in increased disturbance of wildlife and more human-wildlife interactions. This can indirectly reduce habitat suitability and increase the potential for mortality (Claar et al., 1999). However, if people are already using an area, the habitat is already of lower quality, and increased use is not likely to increase disturbance enough to alter the viability of these species. For this reason, the difference in number of new sites among alternatives would not change effects.

In all alternatives, almost all harvest in softwood forest would be through uneven-aged methods. Therefore softwood regeneration would be limited in all alternatives. This would result in low populations of snowshoe hare, which are key prey for several of these species. Lack of prey could limit populations of lynx, wolves, and cougars if they were to return to the Forest.

The potential for impacts to individuals described here and for the alternatives are moot for the three federally-listed species until they return to the area. Habitat quantity and quality may be affected, but since these species are considered extirpated from the National Forest area, these changes would not affect populations. Viability outcome levels will remain at E until species return naturally or through reintroduction. If monitoring indicates that a species returns to the area, surveys would be requires prior to development or other management to prevent conflicts with den sites, etc. The outcome for American marten could go up or down from the current estimate of C, but local experts believe this would be due to climate change, fisher populations, and trapping — not Forest management. An evaluation of fragmentation levels on the Forest (see Wildlife section) indicates that the majority of the Forest would remain suitable for marten under all alternatives. Table 3-54 summarizes the rationale for the determination made in the Biological Evaluation (BE) for each TES species from this habitat (see BE, Appendix G, for more details).

Alternative 1

Direct and Indirect Effects

Alternative 1 allows management that would disperse recreational use from high use areas into currently low use areas. This could increase the number of areas with high human use, and therefore high levels of disturbance reducing habitat suitability of some areas for species that prefer to avoid humans.

Table 3-54. Summary of rationale for TES species determinations.

Species	Determination	Rationale summary
Canada lynx	Now: No effect. If species returns: May affect, not likely to adversely affect.	Now: There is no evidence of Canada lynx currently occuring on the Forest. If species returns: 1. Implementation of standards and guidelines would be implemented to conserve lynx and their habitat. 2. The core foraging habitat for lynx is in the high elevation softwoods. This habitat would be conserved in all alternatives. The opportunity exists to create additional foraging habitat in lower elevations, although the magnitude of what would be created here is minimal in all alternatives. 3. Denning habitat will continue to increase in all alternatives, especially in the core high elevation zone. 4. The standard to allow no net increase in trails should minimize increases in snow compaction and subsequent interspecific competition.
Eastern cougar	Now: No effect. If species returns: May affect, not likely to adversely affect.	Now: Eastern cougars do not occur on the Forest If species returns: 1. Deer, moose, and beaver are all present on the Forest, albeit at numbers approaching minimal levels to support cougars. The NH Fish and Game Department hopes to increase deer and moose herds in the region that encompasses the WMNF. 2. Forest Plan direction would protect and enhance deeryards, probably the most limiting habitat factor for deer on the Forest. 3. Open road densities on the Forest are expected to remain low. Although road improvement projects are likely on existing roads, there are no proposals to add more than a few miles of permanent roads to the current system. 4. Environmental education could increase levels of public support for cougar recovery, if needed. 5. It is assumed that the number of people in high use areas on the Forest would be a factor in cougar success and that potential negative effects would come from unintentional harassment.

Table 3-54. Summary of rationale for TES species determinations (continued).

Species	Determination	Rationale summary
Gray wolf	Now: No effect. If species returns: May affect, not likely to adversely affect.	Now: Gray wolves do not occur on the Forest. If species returns: 1. Deer, moose, and beaver are all present on the Forest, albeit at numbers approaching minimal levels to support wolves. The NH Fish and Game Department hope to increase the size of the deer and moose herds in the region that encompasses the WMNF. 2. Forest Plan direction would protect and enhance deeryards, probably the most limiting habitat factor for deer on the Forest. 3. Open road densities on the Forest are expected to remain low. Although road improvement projects are likely on existing roads, there are no proposals to add more than a few miles of permanent roads to the current system. 4. Environmental education efforts have worked well in the Lake States and other regions to improve attitudes towards wolves. Similar programs in the Northeast could increase levels of public support for wolf recovery, if needed. 5. Although a clear source population does not occur within the analysis area, a number of wolves have been sighted recently. Genetic swamping with coyotes will continue to be an issue outside Forest Service control. 6. Past studies on wolf recolonization focused primarily on prey base; no area supported the recreation levels currently present or anticipated on the WMNF. How much recreation use levels in the White Mountains would influence habitat suitability is somewhat unknown. It is assumed that the numbers of people in high use areas on the Forest would be a factor in wolf success and that potential negative effects would come from unintentional harassment.

Under Alternative 1, new campgrounds and backcountry facilities could be constructed in areas where people do not regularly go now. This development could directly reduce habitat suitability by removing vegetation, increase disturbance of wildlife and the potential for human-wildlife interactions, and bring people to an area that lacked prolonged disturbance previously. This alternative should not result in more than a few new recreation areas, however, since some of the proposed increase would be at existing facilities. If the federally-listed species of concern return to the Forest, surveys would be required in advance for all types of development to prevent conflicts with dens sites, etc. At a landscape scale, these activities should not reduce species viability if den sites are protected.

Alternative 1 includes construction of up to 40 miles of non-motorized trail on the Forest. These new trails would provide access to new areas and increase access to other areas, increasing the potential for disturbance of wildlife and human-wildlife interactions. The disturbance to wildlife associated with hiking trails may be more than that from use of roads or motorized trails (Vaske et al., 1983; Jordan, 2000). If the federally listed species return to the Forest, surveys would be required in advance of trail construction to prevent conflicts with dens sites, and other key areas. At a landscape scale, construction of up to 40 miles of new non-motorized trail, when almost 1200 miles currently exist, would have minimal impacts and should not reduce species viability if den sites are protected.

This alternative would allow for new or extended snowmobile trails, but Canada lynx standards and guidelines would prevent a net increase in trail miles in lynx habitat to avoid increased competition from bobcat and coyotes. New summer motorized trails would be considered, and up to two self-contained trail systems could be developed, totaling up to 60 miles of summer motorized trail. New motorized trails would increase disturbance of and stress on these species (Boyle and Samson, 1985; Creel et al., 2002), thereby reducing habitat suitability and potentially affecting individual animal fitness. New motorized trails also would increase potential for human-wildlife interactions, including mortality.

Overall, this alternative proposes new facilities, roads, and trails, all of which could increase the potential for disturbance and human-wildlife interactions and thereby impact individuals and reduce habitat suitability for species in this group. However, the increases are small when considered across the almost 800,000 acre Forest, so the impacts should be minimal. The greater concern with this alternative is that it allows management that would disperse recreational use from high use areas to areas that currently have low use. Given the expected large increase in recreational use of the Forest, this approach would reduce habitat suitability on even more acres than would be impacted by new facilities, and surveys, which might help avoid potential conflicts would not be required in areas to which people are dispersed.

Cumulative Effects

Development is more prevalent off-Forest than on, and it is expected to continue to increase across most of the analysis area throughout the next 20

years (Sundquist and Stevens, 1999). In the New Hampshire portion of the analysis area, almost 10 percent of harvests are land clearing for development (Thorne and Sundquist, 2001). Development likely will result in expansion of existing developed areas and creation of whole new developed areas where there is currently only forest. New roads, and hiking, snowmobile, and ATV trails could open areas that are currently undisturbed and unaccessed by humans.

Increased levels of development and use outside the Forest would likely make most lands in the southern part of the analysis area unsuitable for these species. Given slower development rates (Sundquist and Stevens, 1999), lands north and east of the Forest should remain suitable over the next 20 years, but habitat quality would decrease in areas where the development does occur. Increasing levels of development off-Forest make the National Forest and northern areas of Maine more important to species with landscape-level home ranges, because these areas would continue to provide large blocks of relatively undeveloped habitat. However, increasing development also reduces the potential for the three species that are currently not found on the Forest to move closer to it and find enough habitat to establish a viable population in the area. Therefore, conditions off-Forest may make the direct and indirect impacts on the Forest irrelevant for these species, because they would not be likely to naturally colonize the Forest.

Specific plans for new roads and summer motorized trails are not known in the analysis area, but demand is increasing and it is likely that some such development would occur in the future. At least some of the roads are likely to be wide enough, and used enough, to be barriers to movement and reduce habitat suitability. As development increases and more recreationists travel to the area, road-related mortality is likely to increase. Again, this reduces the potential for three species to return to the area. State plans to widen and straighten roads on and near the Forest would add to concerns. Closure of new Forest roads after harvest would prevent people from easily accessing new areas of the Forest, and decommissioning of roads would reduce Forest road densities. This would benefit marten and other species if they return to the Forest.

As discussed under the effects common to all alternatives, viability outcomes for all of these species are dependent on factors outside Forest Service control.

Alternative 2

Direct and Indirect Effects

Under this alternative, recreational use would not be actively dispersed from high use to low use areas. Individual users may still choose to move to areas of lower use, so some increase in use at current low-use areas is likely. However, this management approach should prevent some low use areas from increasing in use, maintaining them as suitable habitat for species in this group.

The potential for effects on these species from development of camping facilities would be less than Alternatives 1 and 4, because no new campgrounds would be constructed.

Alternative 2 proposes construction of fewer miles of new non-motorized trails. Disturbance effects associated with non-motorized trail use would be less than under Alternatives 1 and 4, but more than for Alternative 3.

Summer motorized trails would be prohibited. This would limit disturbance and interactions to illegal use, which could occur in all alternatives. This alternative proposes fewer miles of new snowmobile trails than Alternatives 1 or 4, with the same lynx standards and guidelines. The potential for effects from motorized trail use would be less than Alternatives 1 and 4, because summer use is prohibited.

Overall, this alternative would have less impact on species with large home ranges than Alternatives 1 or 4, because no new campgrounds would be created, fewer new areas would be accessed by trails, summer motorized use would be prohibited, and use would not be purposely dispersed to currently low use areas.

Cumulative Effects

The potential for increases in development and road and trail construction off-Forest within the analysis area are the same as described for Alternative 1. The cumulative effects, and consequences of those effects, would be less for this alternative than for Alternatives 1 and 4, because the direct and indirect effects from development would be less, and there would be no summer motorized trail use. Viability outcomes would remain as described in common to all alternatives.

Alternative 3

Direct and Indirect Effects

The potential effects from dispersing recreation use and summer ATV trails would be the same as for Alternative 2, because the management approaches are the same.

This alternative proposes the smallest increase in camping facilities, non-motorized trails, and snowmobile trails. Therefore, no new campgrounds would be constructed and fewer new areas would be accessed by trails. The types of effects expected from facility expansion and new trails are the same as for Alternative 1, but the overall impact to species of concern would be less than for any other alternative.

Cumulative Effects

The potential for increases in development and road and trail construction off-Forest within the analysis area are the same as described for Alternative 1. The cumulative effects, and consequences of those effects, would be less than for any other alternative, because the direct and indirect effects from development would be less and there would be no summer motorized trail use. Viability outcomes would remain as described in common to all alternatives.

Alternative 4

Direct and Indirect Effects

Alternative 4 proposes more new developed and backcountry camping sites than any other alternative. Therefore, it is likely that more new areas would be affected, making the potential for disturbance and adverse wildlife-human interactions at camping areas the highest of the alternatives.

Under this alternative, management could result in some existing low use areas getting increased use, though the Forest Service would work to keep some low use areas as low use. Given the expected large increase in recreational use of the Forest, this management approach would reduce habitat suitability on even more acres than would be impacted by new facilities, and it would not require surveys to help avoid potential conflicts. Because some low use areas would be maintained at low use levels, the effects of this management approach should be less than with Alternative 1.

Alternative 4 would result in the construction of up to 100 miles of new non-motorized trails, which is more than twice as many as Alternative 1. Disturbance effects associated with non-motorized trail use would be greater than under any other alternative.

The types of effects from motorized trails are described for Alternative 1. Alternative 4 proposes more new snowmobile trails than any other alternative. However, the Canada lynx standards and guidelines would still restrict the location of new trails, keeping large areas of the Forest unaffected. Summer motorized trails would be allowed in one of two areas, with up to 30 miles of trail. The potential for effects from motorized trail use would be greater than under Alternatives 2 and 3, in which summer motorized use is prohibited. The effects might be less than in Alternative 1, which could result in up to 2 similar-length ATV trails but fewer miles of snowmobile trail.

Overall, this alternative probably would have a greater impact on species in this group than Alternatives 2 and 3 because more new recreation areas would be created, summer ATV use would occur, and some existing low use areas would get increased use. The specific effects would be different between Alternatives 1 and 4, but the overall impact to species using whole landscapes would similar.

Cumulative Effects

The potential for increases in development and road and motorized trail construction within the analysis area are the same as described for Alternative 1. The cumulative effects, and consequences of those effects, would be essentially the same for this alternative as for Alternative 1, because the direct and indirect effects would be similar.

Hardwood and Mixedwood Forest (8 species of concern, see Appendix F)

Affected Environment

These habitats include most of the deciduous and mixed deciduous-coniferous forest in the area, excluding only the enriched hardwood forest habitat discussed earlier. Several communities are included in these habitats: sugar maple-beech-yellow birch forest, northern hardwood-spruce-fir forest, hemlock-beech-northern hardwood forest, and small amounts of hemlock-beech-oak-pine forest, beech forest, and dry red oak-white pine forest (Sperduto and Nichols, 2004). In northern New England, these habitats usually occur between 1,500-2,500 feet elevation. Some species of concern prefer young hardwood forest habitat, while many rely on mature forest habitat. See the Vegetation section for information on the distribution and condition of, and effects of natural disturbance and management on, these habitats on the White Mountain National Forest..

The analysis area for these habitats is the ecological subsections that encompass the Forest (M212Ad, M212Ae, M212Ba, and M212Bc, Map 3-02a, Vegetation section), because these habitats are so widespread that changes to nearby habitats or populations could affect Forest habitats or populations. Across the analysis area mixedwood and hardwood habitats occur in large and small patches, often at mid-elevations. Hardwood forest is more abundant in southern areas than in the north, where conifer forest dominates. Mixedwood forest is well-distributed throughout the analysis area.

Development of all types (rural, urban, recreation, etc.) has resulted in the loss of hardwood and mixedwood forest habitat across the analysis area. Timber harvest can alter forest age and canopy conditions, which may affect habitat suitability for some species, and may directly impact species. Invasive plant species are an additional threat, because they compete with native species and alter the habitat.

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

Several activities have the potential to directly affect individual plants and animals within hardwood and mixedwood forest habitats. Some activities also would affect small patches of habitat scattered across the Forest in all alternatives. Standards to survey for, and protect, TES species would reduce the potential for impacts from these activities to species of concern. Timber harvest may affect seep habitats within hardwood and mixedwood forest, which could result in a decline in viability outcome for *Galium kamtschaticum* in all alternatives (see Appendix F). Hybridization, road use, and habitat alteration may result in declines in Jefferson salamander in all alternatives. A single known occurrence puts *Corallorhiza odontorhiza* at risk from stochastic events, trampling, collection, or habitat alteration. The outcome for the wood

turtle remains stable at a low level (Outcome C-D), due to dramatic declines off-Forest. For the Indiana bat, the viability outcomes do not apply (see Appendix F for reasoning); the Forest will continue to provide habitat for this in case conditions change. Table 3-55 summarizes the rationale for the determination made in the Biological Evaluation (BE) for each TES species from this habitat (see BE, Appendix G, for more details).

Table 3-55. Summary of rationale for TES species determinations.

Species	Determination	Rationale summary
Common to all species	N/A	1. Although timber harvest and road/trail construction have the potential to directly and indirectly impact individuals, mitigation to protect TES species would be in place to reduce those impacts.
Indiana bat	May affect, not likely	1. Based on recent studies in the northeast, it seems unlikely that an Indiana bat would occur on the WMNF. The western edge of the Forest is twice the distance that Indiana bats have been known to travel from hibernacula in New York. 2. Foraging and roosting habitat exists and could be enhanced or reduced somewhat by timber harvest and other activities, but when compared to the more suitable habitat in the Champlain and Connecticut River valleys, it is extremely unlikely an Indiana bat would remain or even occur on the WMNF. Factors such as canopy closure levels and lack of optimal roosting tree species (e.g., shagbark hickory) make WMNF habitat suboptimal. 3. Since 1992, additional surveys have not documented another Indiana bat on the Forest or even east of the Green Mountain National Forest in Vermont. It is likely the one Indiana bat occurrence was a transient individual, not a member of a breeding colony. Survey data also shows a disproportionate number of male bats (of various woodland bat species), indicating a lack of breeding females. Since roosting and foraging habitat is available, it may be that the Forest's temperature and other climatic factors are not optimal for Indiana bat breeding and management direction would not influence species recovery in any alternative.

Table 3-55. Summary of rationale for TES species determinations (continued).

Species	Determination	Rationale summary
Indiana bat (continued)		4. Forest Plan direction to reserve snags and other "wildlife" trees from timber harvest would mitigate loss of roosting habitat through harvest treatments. 5. Best Management Practices and riparian standards and guidelines would protect potential foraging sources over water. 6. Roads and other travel corridors would continue to exist, as would openings (both natural and managed) that would serve as foraging sources, so these would not be considered limiting. 7. Potential effects from placement of wind turbines or cell towers are worth evaluating as an emerging issue, and mitigation is in place to consider these potential effects during site specific placement and construction. However, the chance of an Indiana bat being on the Forest is already remote; the chance that an Indiana bat would be located on the Forest and would come in contact with one of these structures is so remote as to be considered discountable.
Wood turtle	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. There are few wood turtles known from the Forest and few areas of suitable habitat. Mitigation to protect riparian habitats would be implemented in all alternatives, and pre-project surveys would be conducted to identify potential upland habitat. Project mitigation, such as seasonal harvest restrictions, would then help to limit impacts to wood turtles, so the likelihood of affecting an individual wood turtle is small.
Carex baileyi	No impact	1. There are currently no extant occurrences on the Forest. Habitat would continue to be maintained through management activities in all alternatives.
Carex cumulata	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Forest Plan direction to maintain oak should result in activities to perpetuate suitable habitat. 2. Invasive plants are a risk, but new Forest Plan direction would help focus attention on the subject and further move effective eradication treatments.

Table 3-55. Summary of rationale for TES species determinations (continued).

Species	Determination	Rationale summary
Carex cumulata (continued)		3. Hiker traffic will continue to increase in all alternatives, but site-specific mitigation is available to protect occurrences. 4. The extant occurrence on the Forest appears to have persisted during fire and other disturbance, so continuation of similar activities should not result in loss of the occurrence.
Isotria medeoloides	May affect, not likely to adversely affect.	1. The potential for management activities that could improve habitat conditions at known sites is the same in all alternatives, since known sites would continue to occur in management areas that allow vegetation management for TES habitat improvement. 2. Use of an effective predictive model and past extensive survey effort in the highest probability areas of occurrence on the Forest improve the chances that other small whorled pogonia colonies will not be missed during projects. 3. Timber harvest activities may degrade habitat through unintentional impacts to unknown colonies (which is unlikely given reliability of predictive models and survey efforts) and changes in light conditions or other habitat requirements. Harvest may also improve habitat suitability provided required fungi are are present. 4. The extant occurrences currently found on the WMNF are such a small proportion of the regional metapopulation that any change is unlikely to result in a shift in regional population viability. 5. As is common with orchids, populations seem to have fluctuated from year to year, but continue to persist.
Triphora trianthophora	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. As is common with orchids, populations seem to have fluctuated from year to year, but continue to persist. 2. Single tree selection prescriptions could also improve habitat conditions by opening canopies and providing more filtered light conditions.

Alternative 1

Direct and Indirect Effects

See the Vegetation section for information on the distribution of hardwood and mixedwood forest habitat among MAs and on expected management and impacts to hardwood and mixedwood forest habitat. Even-aged regeneration harvest makes habitat unsuitable for most species of concern in these habitats for several decades. Other methods of harvest open the canopy sufficiently to alter light, temperature, and moisture levels, which can alter habitat suitability for some species of concern until the canopy closes back in. This alternative proposes the most even-aged regeneration in these habitats and the second-largest number of acres of harvest overall, indicating potential for degradation and loss of habitat for several species of concern. However, the majority of hardwood and mixedwood habitats would remain mature and old forest, so habitat loss should not result in a loss of viability. Direct impacts to individual plants from heavy machinery and skidding during summer logging, and to individual bats and beetles from felling of trees, would be proportional to overall acres harvested, placing this alternative second in such impacts to Alternative 4. A majority of harvest on the Forest is done in winter, reducing the potential for direct impacts to all species. The standards and guidelines requiring surveys for, and protection of, TES species would further reduce the potential for direct impacts to species of concern.

How much development would be in hardwood and mixedwood forest habitat is uncertain. It is likely that some impacts would occur in these habitats, and the amount would be proportional to the total amount of construction on the Forest for this alternative. Recreational development could result in loss of small patches of conifer forest habitat (see Vegetation section). In addition, development could impact understory conditions and would bring more people to certain areas, increasing the risk of trampling of nearby plants. The standards and guidelines requiring surveys for, and protection of, TES species would reduce the potential for direct impacts to species of concern.

Creation of summer ATV trails could result in alteration of small areas of hardwood and mixedwood forest habitat. The standards requiring surveys for, and protection of, TES species prior to ground-disturbing activities should limit the potential for trails to go in near species of concern. Illegal off-trail ATV use is likely to occur in all alternatives, and could result in trampling of species of concern.

There would be a greater risk of non-native invasive species spread in Alternative 1 than in any other alternative (see Vegetation section), which means there would be more risk to species and habitats of concern. Standards and guidelines for prevention and control of invasive species should reduce the potential for indirect impacts to species of concern from non-native invasive species.

Because surveys for TES species cannot cover every acre, and regeneration habitat is concentrated in hardwood forest, the higher levels of even-aged regeneration harvest proposed in Alternative 1 could result in a slight

decrease in the viability outcome for a big-headed fly, the black lordithon rove beetle, *Cypripedium parviflorum* var. *pubescens*, and *Symphyotrichum ciliolatum*, and could prevent an improvement in the viability outcome for *Triphora trianthophora*. The even-aged regeneration harvest proposed in the alternative also could result in an improved viability outcome for *Carex cumulata* (see Appendix F).

Cumulative Effects

If management proposed in this alternative continued for the next 150 years and more, it would result in a decrease in the amount of hardwood and mixedwood forest habitat on the Forest as stands convert to aspen-birch and softwood habitat (see Vegetation section). Conversions would take many decades to centuries, so impacts to species of concern from the loss of habitat would be gradual. For some species, aspen-birch habitat may still be suitable, but softwood habitat would not be suitable for most species of concern using this habitat type. The change in habitat abundance would eventually result in lower population levels of species associated with hardwood and mixedwood habitats, but should not result in a loss of viability.

The potential for timber harvest and development off-Forest to alter hardwood and mixedwood forest habitats is discussed in the Vegetation section. Inventory data suggest that hardwood and mixedwood forests are stable or increasing off-Forest. A larger portion of these habitats is in regeneration and young age classes than on-Forest (Northeastern Forest Research Station, 1995; 1997). Therefore, the increase in hardwood and mixedwood forest may not result in more mature habitat for many species of concern. Increasing loss of habitat to development off-Forest makes the Forest, with its relatively low levels of development and even-aged regeneration harvest, more important as a source of large blocks of mature forest habitat. Invasive species also are increasing on non-Forest lands within the analysis area (see Vegetation section), which increases the risk of invasive species infecting forest habitats on the Forest.

Off-Forest impacts could reduce or eliminate populations, and thereby alter metapopulation dynamics for populations on the Forest, which could reduce their ability to recover from the direct and indirect effects described. Loss of populations near the Forest, if it occurred, also would increase the importance of the Forest populations for maintaining the species' distribution. Metapopulation concerns were considered in determining expected viability outcomes, so cumulative effects are included in the outcomes discussed as common to all alternatives and for this alternative.

Alternative 2

Direct and Indirect Effects

See the Vegetation section for information on the distribution of hardwood and mixedwood forest habitat among MAs, and on expected management and impacts to hardwood and mixedwood forest habitat resulting from this alternative. The types of effects to species of concern from timber harvest would be the same as for Alternative 1. Alternative 2 would result in fewer acres of even-aged regeneration and total harvest than Alternatives 1 and 4.

It would have more even-aged regeneration harvest than Alternative 3, but slightly less total harvest. Therefore, the amount of impact from timber harvest on species of concern in these habitats would be less than in Alternatives 1 and 4, but more than in Alternative 3.

The potential for development on the Forest to alter habitat composition is discussed in the Vegetation section. The types of effects of increased capacity and development of new facilities and trails on species of concern would be the same as for Alternative 1. The potential for effects on species of concern in this habitat type would be less than Alternative 1, because no new campgrounds would be constructed, fewer new areas would be accessed by snowmobile trails and non-motorized trails, and summer ATV use would be prohibited. The potential for impacts from illegal ATV use would still exist.

The standards and guidelines for prevention and control of non-native invasive species would be the same under this alternative as for Alternative 1. However, the risk of spread of these species is less in Alternative 2 (see Vegetation section).

The even-aged regeneration level in this alternative is lower than in Alternative 1. This reduces the potential for impacts to several species of concern. As a result, the viability outcomes for a big-headed fly, the black lordithon rove beetle, *Cypripedium parviflorum* var. *pubescens*, and *Symphyotrichum ciliolatum* would remain stable, and the outcome for *Triphora trianthophora* should improve (see Appendix F).

Cumulative Effects

If management proposed in this alternative continues through the long-term, hardwood and mixedwood forest habitat in all MAs would gradually convert to softwood forest. Conversion in most stands would take at least 150 years, so impacts to species of concern from the loss of habitat would be gradual. The change would eventually result in lower population levels of species associated with hardwood and mixedwood habitats, but should not result in a loss of viability.

The potential for increases in development, timber harvest, and invasive species off-Forest, and the effects of those increases on species of concern, are the same as for Alternative 1. The cumulative effects, and consequences of those effects, would be less for this alternative than for Alternatives 1 and 4, because the direct and indirect effects from development and timber harvest would be less. Viability outcomes would similar to those discussed under effects common to all alternatives, and under direct and indirect effects for this alternative.

Alternative 3

Direct and Indirect Effects

See the Vegetation section for information on the distribution of hardwood and mixedwood forest habitat among MAs in this alternative, and on expected management and impacts to hardwood and mixedwood forest habitat. The types of effects from timber harvest would be the same as for

Alternative 1. Alternative 3 would result in less even-aged regeneration harvest than any other alternative. It proposes timber harvest on fewer total acres in the first two decades than Alternatives 1 and 4, and slightly more than Alternative 2. As the effects of even-aged regeneration harvest are more intense and longer-term than from other types of harvest, the impacts from timber harvest on these habitats and associated species of concern would be less than in any other alternative.

The potential for development on the Forest to alter habitat composition is discussed in the Vegetation section. The types of effects of increased capacity, and development of new facilities and trails, on species of concern would be the same as for Alternative 1. The potential for effects on species in this habitat type would be less than any other alternative, because fewer new campsites are proposed, no new campgrounds or day use areas would be constructed, new areas would not be accessed by motorized and non-motorized trails, and summer ATV use would be prohibited. There would still be potential for impacts from illegal use of ATVs.

Direct and indirect effects from non-native invasive species would be the same as for Alternative 2 (see Vegetation section). Viability outcomes for species not discussed under effects common to all alternatives also would be the same as for Alternative 2.

Cumulative Effects

Habitat composition objectives would be the same as in Alternative 2, so the long-term effects of forest habitat conversion should be the same.

The potential for increases in development, timber harvest, and invasive species off-Forest are the same as described for Alternative 1. The cumulative effects, and consequences of those effects, would be less for this alternative than for any other alternative, because the direct and indirect effects from development and harvest would be less. Viability outcomes would be similar to those discussed under effects common to all alternatives, and direct and indirect effects for this alternative.

Alternative 4

Direct and Indirect Effects

See the Vegetation section for information on the distribution of hardwood and mixedwood forest habitat among MAs and on expected management and impacts to hardwood and mixedwood forest habitat. The types of effects from timber harvest would be the same as for Alternative 1. Alternative 4 would result in essentially the same even-aged regeneration harvest as Alternative 2 in the first two decades; it proposes the most total acres of harvest. As with other alternatives, the majority of mixedwood and hardwood habitats would continue aging.

The potential for development on the Forest to alter habitat composition is discussed in the Vegetation section. The types of effects from increased capacity and development of new facilities and trails would be the same as for Alternative 1. The potential for effects on species of concern in this habitat type would be greater than in Alternative 1, because more new campgrounds

and backcountry facilities likely would be constructed and more new areas would be accessed by non-motorized and snowmobile trails. This alternative may result in construction of fewer miles of summer ATV trail.

If this alternative is selected, the decision will include which ATV area to pursue. The proposed Landaff ATV area includes almost 4,300 acres of hardwood and mixedwood forest habitat, which is about 57 percent of the area. The proposed Moat Mountain area contains almost 1,900 acres of hardwood and mixedwood forest habitat, which is about 56 percent of the area. The Landaff area has more acres of hardwood and mixedwood forest habitats, but that is because the area is larger. The proportion of each area in this habitat is essentially the same. Since the expected trail mileage would be similar regardless of the area chosen, the potential for impacts to species in this habitat would be similar in the two areas.

The standards and guidelines for prevention and control of non-native invasive species would be the same as for Alternative 1. The risk of spread of these species would be less than in Alternative 1 and more than in Alternatives 2 and 3 (see Vegetation effects section for rationale).

Viability outcomes for the species not discussed as common to all alternatives would be the same as for Alternative 2.

Cumulative Effects

Habitat composition objectives would be the same as in Alternative 2, so the long-term effects of forest habitat conversion should be the same.

The potential for increases in development, timber harvest, and invasive species off-Forest are the same as for Alternative 1. The cumulative effects, and consequences of those effects, would be similar to, but less than, under Alternative 1 due to fewer acres of even-aged regeneration. The cumulative effects would be greater than under Alternatives 2 and 3, because the direct and indirect effects from harvest and development would be greater. Viability outcomes would not be different than discussed under effects common to all alternatives, and direct and indirect effects for this alternative.

Lakes and Ponds (6 species of concern, see Appendix F)

Affected Environment

See the Water Resources section for information on abundance and distribution of these habitats. The primary natural communities associated with lakes and ponds in which species of concern are likely to occur are aquatic bed and deep emergent marsh-aquatic bed. Size, depth, temperature, acidity, and adjacent vegetation are some of the traits that determine whether a species of concern can use a given lake or pond. Some species live their whole life in the water, while others spend some or all of their time at the water’s edge or in terrestrial habitats. The analysis area for species using these habitats is watersheds that encompass the White Mountain National Forest, as described in the Water Resources section (see also Map 3-02b, Vegetation section).

Lakeshore development, changes to hydrology, runoff and pollution, human use, and invasive species are the primary threats facing species of concern in these habitats. In recent decades, rural, urban, and recreational development of lakes and ponds has altered water quality, water quantity, adjacent habitat, and solitude, making many places unsuitable for some species. Changes in hydrology, runoff, pollution, human use, and invasive species are often a result of development. However, they can also impact water bodies with little or no development, altering water quality and other habitat conditions. It is uncertain whether acid precipitation is changing water chemistry enough to limit habitat suitability.

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

Timber harvest can result in impacts to water quality (see Water Resources section), trampling of plants by machinery, and alteration of terrestrial shoreline habitat. Standards and guidelines would mitigate trampling and shoreline habitat impacts in all alternatives by limiting removal of trees within 25 feet of a lake or pond, and recommending that trails, skid trails, and landings be at least 100 feet from these habitats. Therefore, the potential for timber harvest to impact lakeshore species and habitats would be restricted to when exceptions to guidelines apply. In addition, surveys for TES species would be required prior to project implementation, so impacts to species of concern should be rare, if they occur at all, in all alternatives.

Forest management activities might affect individual lake-associated plants or animals in all alternatives. However, standards and guidelines should limit the number of occurrences impacted, and the type and intensity of impacts, so that viability is expected to remain stable for all species. The outcome for the common loon remains below the viability threshold, at outcome D, due to dramatic past declines off-Forest from which is it still recovering. Local experts believe that National Forest populations can only return to historic levels once off-Forest populations have increased, which will probably take decades. *Salix pellita* remains stable at the threshold, with an outcome of C-D, due to apparent loss of historic populations. Additional surveys may locate new occurrences that would change the outcome. For the Atlantic salmon and bald eagle, the viability outcomes do not apply (see Appendix F for reasoning); however, the Forest will continue to provide habitat for them in case conditions change. All other species of concern are expected to remain stable above the identified viability threshold in all alternatives (see Appendix F). Table 3-56 summarizes the rationale for the determination made in the Biological Evaluation (BE) for each TES species from this habitat (see BE, Appendix G, for more details).

Table 3-56. Summary of rationale for TES species determinations.

Species	Determination	Rationale Summary
Bald eagle	No effect	1. Implementation of any alternative would result in effects to bald eagles that are so small as to be immeasurable. Nesting has never been documented on the Forest, and while roosting occurs, the stretch of Forest Service land along the Androscoggin River is so limited that the chance of affecting an eagle there is extremely small.
Common loon	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Standards and guidelines to protect key TES habitat features and Riparian and Aquatic Habitats standards and guidelines would protect lakes with loon nesting. Existing recreation activity may result in some harassment towards loons, but this is predicted to occur infrequently. 2. Outside influences, such as banning lead fishing tackle, will help promote improved reproduction.

Alternative 1

Direct and Indirect Effects

The potential for recreation development and summer ATV use to occur near, and impact, these habitats is discussed in the Water Resources section. Standards requiring surveys for, and protection of, TES species should minimize the potential for direct effects from development and expansion of existing facilities. Lakeshore trails can lead to trampling of lakeshore vegetation. Although new motorized and non-motorized trails, campsites, campgrounds, and backcountry facilities should not occur along lakeshores, they could bring people closer to these habitats, resulting in illegal off-trail use, user-created trails, and impacts to shoreline habitat and species. The potential for this type of impact is assumed to be proportional to the amount of new trail proposed for construction. Increased use at existing facilities and on existing trails could result in more trampling of nearby plant species of concern, and increased disturbance of wildlife species of concern.

There would be greater risk of non-native invasive species spread with Alternative 1 than with any other alternative (see Vegetation section), which means there would be more risk to species and habitats of concern. Standards and guidelines for prevention and control of invasive species should reduce the potential for indirect impacts to species from non-native invasive species. Boat use on lakes and ponds poses a concern, as some invasive species are transported from lake to lake on boat propellers and trailers; this risk would not change between alternatives.

Cumulative Effects

Increasing levels of development off-Forest (Sundquist and Stevens, 1999) are likely to result in loss of vegetation along lakeshores, alteration of hydrology feeding these habitats, and degradation of water quality. These effects make the Forest, with its low levels of lakeshore development, important as a source of undisturbed lake and pond habitat for species such as loons. Timber harvest off-Forest is allowed right up to some lake or pond shores, so there is potential for habitat alteration and direct impacts to plants. Many lakes and ponds have already been affected by these activities, so impacts from future activities may not alter populations substantially. Since standards and guidelines should minimize impacts from Forest management, the Forest would continue to provide some of the least altered lake and pond shore habitat in the analysis area.

Viability outcomes would be as discussed under effects common to all alternatives. Off-Forest development and other management has caused the decline in loons that has resulted in a viability outcome, on and off-Forest, of D. Forest management would not make that outcome worse, but it cannot improve the outcome, either, because the Forest has insufficient lake and pond habitat. Similarly, off-Forest management has resulted in dramatic declines in Atlantic salmon and bald eagles in the past. Both species are recovering from those declines; off-Forest management will determine the success of those recoveries, but will not affect viability on the Forest, since neither species reproduces on the Forest.

Alternative 2

Direct and Indirect Effects

The types of effects from recreation development would be the same as for Alternative 1. However, Alternative 2 would result in less construction of camping sites, non-motorized trails, and snowmobile trails than Alternatives 1 and 4, and no new campgrounds. In addition, summer ATV use would be prohibited, so impacts would be limited to illegal use. Therefore, the amount of effects from these activities would be less than for those alternatives. Use of existing developed sites and trails near lakes and ponds would increase as in Alternative 1, with similar effects.

The standards and guidelines for prevention and control of non-native invasive species would be the same as for Alternative 1. However, the risk of spread of terrestrial non-native invasive species is less (see Vegetation section). Potential for transporting of aquatic non-native invasive species between lakes and ponds would be the same as for Alternative 1.

Cumulative Effects

The potential for increases in development and timber harvest off-Forest is the same as for Alternative 1. Cumulative effects to individual plants and animals would be slightly less for this alternative than for Alternative 1, because direct and indirect effects to these habitats would be slightly less. Viability outcomes are common to all alternatives.

Alternative 3

Direct and Indirect Effects

The types of effects from recreation development would be the same as for Alternative 1. However, Alternative 3 would result in less construction of camping sites, non-motorized trails, and snowmobile trails than any other alternative, and no new campgrounds. In addition, summer ATV use would be prohibited, so impacts would be limited to illegal use. Therefore, the amount of effects from these activities would be less than for other alternatives. Use of existing developed sites and trails near lakes and ponds would increase as in Alternative 1, with similar effects.

Impacts from non-native invasive species would be essentially the same as in Alternative 2 (see Vegetation section).

Cumulative Effects

The potential for increases in development and timber harvest off-Forest is the same as for Alternative 1. Cumulative effects to individual plants and animals would be less than for any other alternative, because direct and indirect effects to these habitats would be less. Viability outcomes are common to all alternatives.

Alternative 4

Direct and Indirect Effects

Alternative 4 would result in more recreational development of almost all types than Alternative 1. Therefore, the effects from these activities would be similar to, but greater than, those for Alternative 1. Use of existing developed sites and trails near lakes and ponds would increase as in Alternative 1, with similar effects.

If this alternative is selected, the decision will include which ATV area to pursue. While standards and guidelines should protect these habitats and associated species, there is always potential for short-term effects from construction and unexpected impacts. The proposed Landaff ATV area has one small (less than 1 acre) isolated pond. The Moat Mountain area has one larger (8 acre) pond. The potential for impacts to species of concern in this habitat is higher in the Moat Mountain area than in Landaff, because there is more of this habitat; however, it is low in both areas because so little of this habitat is present, and standards and guidelines would restrict this use in riparian areas.

The standards and guidelines for prevention and control of non-native invasive species would be the same for this alternative as for Alternative 1. The risk of spread of terrestrial species would be less than in Alternative 1 and more than in Alternatives 2 and 3 (see Vegetation effect section for rationale). Potential for spread of aquatic non-native invasive species between lakes and ponds would be the same as for Alternative 1.

Cumulative Effects

The potential for increases in development, summer motorized use, and timber harvest within the analysis area is the same as described for

Alternative 1. Cumulative effects to individual plants and animals would be slightly more than for other alternatives, because there would be more recreation development. Viability outcomes would be common to all alternatives.

Rivers and Streams (11 species of concern, see Appendix F)

Affected Environment

See the Riparian and Aquatic Habitats section for information on classification, abundance, and distribution of these habitats. Rivers and streams in the WMNF are diverse and variable, with at least 12 natural communities documented in the area (Sperduto and Nichols, 2004). Stream size, water flow, temperature, and adjacent soils and vegetation are some of the traits that determine whether a species of concern can use a given stream or river. Some species that require rivers or streams live their whole life in the water, while others spend some, or most, of their time at the water's edge or in terrestrial habitats. The analysis area for species using these habitats is ten-digit watersheds (e.g., Swift River or Baker River watersheds) that include White Mountain National Forest lands, as described in the Water Resources section (see also Map 3-02b, Vegetation section).

Development, changes to hydrology, runoff and pollution, human use, and invasive species are the primary threats facing species of concern in these habitats. Development can eliminate riparian habitat and alter water quality and quantity. Roads, trails, dams, and other management can change stream flow and channel conditions, making habitat more or less suitable for some species. They also form barriers to movement of some species and are a source of direct mortality. Sedimentation and pollution alter water quality and streambed conditions. Water withdrawal reduces water quantity. Other human uses, including recreation, result in disturbance, changes to habitat conditions, and collection. Management often increases potential for invasive species, which alter aquatic and riparian vegetation and water chemistry.

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

Timber harvest can result in sedimentation and runoff from roads, skid roads, and loss of soil-anchoring vegetation (see Water Resources section). It also can alter riparian habitat if adjacent trees are removed (see Riparian and Aquatic Habitats section), and result in trampling of plants by machinery. Standards and guidelines would mitigate sediment potential and trampling impacts by limiting removal of trees within 25 feet of a perennial stream and recommending that trails, skid trails, and landings be at least 100 feet from these features. Since a relatively closed canopy should be retained within the riparian zone of most rivers and streams (see Riparian and Aquatic Habitats section), habitat for most species of concern should be maintained in all alternatives. Snag and downed log retention guidelines would help

maintain this important habitat feature in and adjacent to streams and riparian habitats. Therefore, potential for timber harvest impacts on these habitats and species of concern would occur only when exceptions to guidelines apply. In addition, surveys for TES species would be required prior to project implementation, so impacts to species of concern should be rare in all alternatives.

Water withdrawals and stream impoundments for municipal uses or ski areas can alter the hydrology of an area and reduce in-stream water levels. In all alternatives, in-stream flows documented in state and federal agreements must be maintained, so withdrawals and impoundments should not negatively impact species of concern. Potential for new impoundments would be substantially limited in all alternatives by goals, standards, and guidelines to protect the ecological function of streams. If new impoundments are approved, surveys for TES species would minimize the potential for impacts, but there could be affects up or downstream beyond survey areas.

Standards and guidelines restrict fish and wildlife habitat management to certain stream types or locations where current conditions do not meet natural stream habitat potential. Based on these requirements, and the standards to survey for and protect TES species, habitat management could impact individuals and populations of riparian species of concern, but impacts should be minimal and not result in a loss of viability.

Forest management activities might affect individual plants or animals in all alternatives. However standards and guidelines should limit the number of occurrences impacted and the type and intensity of impacts. Impacts from rock climbing and hiking, that occur before monitoring indicates a need for mitigation, could reduce the viability outcome for *Paronychia argyrocoma* in all alternatives, though this is unrelated to its use of stream habitats. Single known occurrences put *Ameletus browni* and *Ameletus tertius* at risk from stochastic events or habitat alteration. For the Atlantic salmon and bald eagle, the viability outcomes do not apply (see Appendix F for reasoning); the Forest will continue to provide habitat for them in case conditions change. Viability outcomes are expected to remain stable for all other species (see Appendix F). The outcome for the wood turtle remains stable at a low level (Outcome C-D), due to dramatic declines off-Forest. *Salix pellita* also remains stable at the threshold, with an outcome of C-D, due to apparent loss of historic populations. Additional surveys may locate new occurrences, which would change the outcome. Table 3-57 summarizes the rationale for the determination made in the Biological Evluation (BE) for each TES species from this habitat (see BE, Appendix G, for more details).

Table 3-57. Summary of rationale for TES species determinations.

Species	Determination	Rationale Summary
Bald eagle	No effect	1. Implementation of any alternative would result in effects to bald eagles that are so small as to be immeasurable. Nesting has never been documented on the Forest, and while roosting occurs, the stretch of Forest Service land along the Androscoggin River is so limited that the chance of affecting an eagle there is extremely small.
Wood turtle	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. There are few wood turtles known from the Forest and few areas of suitable habitat. Mitigation to protect riparian habitats would be implemented in all alternatives, and pre-project surveys would be conducted to identify potential upland habitat. Project mitigation, such as seasonal harvest restrictions, would then help to limit impacts to wood turtles, so the likelihood of affecting an individual wood turtle is small.
Calamagrostis stricta var. *inexpansa (Calamagrostis lacustris)*	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Pond reed bent-grass occupies a variety of wet habitat types, including many which rely on disturbance to be perpetuated. The one known occurrence of this species on the Forest is located in a meadow that is influenced by river flooding. There is no direction in any alternative that would result in a change to that condition. 2. Although hiker use will continue increasing in the future, new trail construction probably would not occur in suitable habitat and off-trail use through these habitats is not expected to be so great that effects would be seen at the programmatic level. 3. Rock climbing poses a threat, but it is assumed that Rare and Unique Features standards and guidelines would be implemented to mitigate impacts at site-specific locations.
Listera auriculata	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Standards and guidelines would be implemented to protect riparian habitats and address invasive species prevention and eradication in all alternatives. Although all suitable habitat may not be covered by this direction, it should address the vast majority of situations. 2. Flooding may play a large role in determining persistence of this species on the Forest, but natural flood events are outside Forest Service control.

Table 3-57. Summary of rationale for TES species determinations (continued).

Species	Determination	Rationale Summary
Paronychia argyrocoma	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Standards and guidelines limit outfitter/guide climbing party size, which should help limit the number of climbers removing vegetation and soil from suitable habitat. New direction to restrict removal of vegetation at cliff summits should also help protect habitats. 2. Standards and guidelines for protecting TES species should help mitigate proposed construction of new trails and trigger action when resource damage is confirmed by existing activities. 3. Riparian standards and guidelines are in place to protect riverbank habitats, although these sites may be subject to natural disturbance events that may impact future occurrences.

Alternative 1

Direct and Indirect Effects

The potential for recreation development and summer ATV use to occur near, and impact, these habitats is discussed in the Riparian and Aquatic Habitats and Water Resources sections. New motorized and non-motorized trails, campsites, campgrounds, and backcountry facilities should not be constructed adjacent to streams. However, they could bring people closer to these habitats, which could result in illegal off-trail use, user-created trails, and increased trampling, collection, and other disturbance of species of concern. The potential for these impacts is assumed to be proportional to the amount of new trails and facilities proposed for construction. Standards to survey for, and protect, TES species should prevent placement of new or expanded facilities near populations of species of concern. Increased use at existing facilities and on existing trails could result in trampling of plant species and increased collection and disturbance of wildlife. Trampling, disturbance, and sedimentation impacts from illegal summer ATV use would occur in all alternatives. However under this alternative, summer ATV trails could be placed within several hundred feet of streams, increasing the potential for impacts to species of concern.

Invasive species are a particular concern in stream habitats, because introduction of a species to one section of stream can quickly result in infestations downstream. In addition, natural flood and scour regimes result in regular disturbance that creates ideal habitat for invasive species. There would be greater risk of non-native invasive species spread with Alternative 1 than with any other alternative (see Vegetation section), which means there would be more risk to species and habitats of concern. Standards and guidelines for prevention and control of invasive species in all habitats should reduce the potential for indirect impacts to species from non-native

invasive species. In addition, standards and guidelines limiting activities near streams would reduce the potential for introduction of unwanted species to riparian areas.

Cumulative Effects

Increasing levels of all types of development off-Forest (Sundquist and Stevens, 1999) are likely to reduce water quantity and quality in streams, increase non-native invasive species, and reduce natural riparian habitats. These changes will make the Forest, with its relatively low levels of development, more important as a source of undisturbed riparian habitat. Timber harvest off-Forest is allowed right up to the stream, although certain levels of canopy retention are required. As a result, there is potential for compaction, sedimentation, and direct impacts to plants. Since standards and guidelines should minimize impacts from Forest management, the Forest would continue to provide some of the least altered riparian habitat in the analysis area.

While some off- and on-Forest activities may impact these habitats in the next 20 years, these effects will be less than declines resulting from past harvest and land conversion. However off-Forest impacts could reduce or eliminate populations and thereby alter metapopulation dynamics for populations on the Forest. This concern was considered in determining expected viability outcomes, so cumulative effects are included in the outcomes discussed as common to all alternatives. Most species are recovering from the effects of intensive habitat changes in past decades or centuries.

Alternative 2

Direct and Indirect Effects

The types of effects from recreation development would be the same as for Alternative 1. However, Alternative 2 would result in less construction of camping sites, non-motorized trails, and snowmobile trails than Alternatives 1 and 4, and no new campgrounds. In addition, summer ATV use would be prohibited, so impacts would be limited to illegal use. Therefore, the amount of effects from these activities would be less than for those alternatives. Use of existing developed sites and trails near rivers and streams would increase as in Alternative 1, with similar effects.

The standards and guidelines for prevention and control of non-native invasive species would be the same for this alternative as for Alternative 1. However, the risk of spread of terrestrial non-native invasive species is less (see Vegetation section). Standards and guidelines limiting activities near streams would reduce the potential for introduction of non-native invasive species to riparian areas.

Overall, impacts to individuals would be less than for Alternatives 1 and 4, because summer ATV use would not be allowed and fewer new recreation sites and trails would be constructed.

Cumulative Effects

The potential for increases in development and timber harvest off-Forest is the same as for Alternative 1. Cumulative effects to individual plants and animals would be slightly less for this alternative than for Alternative 1, because direct and indirect effects to these habitats would be slightly less. Viability outcomes are common to all alternatives.

Alternative 3

Direct and Indirect Effects

The types of effects from recreation development would be the same as for Alternative 1. However, Alternative 3 would result in less construction of camping sites, non-motorized trails, and snowmobile trails than any other alternative, and no new campgrounds. In addition, summer ATV use would be prohibited, so impacts would be limited to illegal use. Therefore, the amount of effects from these activities would be less than for other alternatives. Use of existing developed sites and trails near rivers and streams would increase as in Alternative 1, with similar effects.

The potential for negative effects from invasive species would be the same as described for Alternative 2. Overall, impacts to individuals would be less than for all other alternatives.

Cumulative Effects

The potential for increases in development and timber harvest off-Forest is the same as for Alternative 1. Cumulative effects to individual plants and animals would be less than for any other alternative, because direct and indirect effects to these habitats would be less. Viability outcomes are common to all alternatives.

Alternative 4

Direct and Indirect Effects

Alternative 4 would result in more recreational development of almost all types than Alternative 1. Therefore, the effects from these activities would be similar to, but greater than, those for Alternative 1. Use of existing developed sites and trails near rivers and streams would increase, as in Alternative 1, with similar effects.

If this alternative is selected, the decision will include which ATV area to pursue. While standards and guidelines should minimize impacts to these habitats and associated species, there is always potential for short-term effects from construction or impact from illegal use. In addition, bringing a new use near streams increases the risk of trampling, collection, and other disturbance of species of concern. The proposed Landaff ATV area has more than 8 miles of stream in it, which equates to almost 0.7 miles of stream per square mile of ATV area. More than half of this habitat is crossed by at least one existing road or runs parallel to a road for part of its length. The Moat Mountain area has just over 4 miles of stream, which is almost 0.8 miles of stream per square mile of ATV area. At least half of it is crossed by or parallel

to a road. Based on similar proposed trail miles, streams densities, and proximity to roads, the potential for impacts would be similar in the two areas.

The standards and guidelines for prevention and control of non-native invasive species would be the same as for Alternative 1. The risk of spread of terrestrial species would be less than in Alternative 1 and more than in Alternatives 2 and 3 (see Vegetation effects section).

Overall, impacts to individuals should be greater than for any other alternative, due to increased development.

Cumulative Effects

The potential for increases in development and timber harvest off-Forest is the same as described for Alternative 1. Cumulative effects to individual plants and animals would be slightly more than for other alternatives, because there would be more recreation development. Viability outcomes would be common to all alternatives.

Forested Wetlands (16 species of concern, see Appendix F)

Affected Environment

This broad habitat category includes obvious forested wetlands, such as floodplain forests and spruce bogs, as well as less obvious, small wetland habitats within conifer and hardwood forests, such as vernal pools and seepages. The main forested wetland natural community in the WMNF is red spruce swamp. Others that occur but are less common include black spruce-larch swamp and northern hardwood-conifer-black ash swamp. Northern hardwood seepage forests and several types of forest seeps are frequent, but occupy relatively small areas.

The Forest's Geographic Information Systems (GIS) wetlands layer documents more than 1,500 forested wetlands ranging in size from less than 1 acre to almost 250 acres, with 9,700 acres scattered across the Forest. The total on the Forest would be higher when unmapped habitats, such as vernal pools and seepages, are added. Moisture level is of primary importance to most species of concern in these habitats, and what separates these habitats from general forest habitats. Shading and tree density are variable. Most forested wetlands develop into mature forest habitat, but some swamps and alder thickets remain in shrub habitat. The analysis area for species using these habitats is watersheds that encompass the White Mountain National Forest, as described in the Water Resources section (see also Map 3-02b, Vegetation section).

Development and changes to hydrology can negatively impact all forested wetlands. Development can eliminate wetland habitat, alter water quality and quantity, and increase trampling and disturbance. Roads, trails, dams, and other management in or near forested wetlands can change the local hydrology, making habitat more or less suitable for some species. They also form barriers to movement and are a source of direct mortality of some animal species.

Other limiting factors are specific to certain forested wetland habitats. Calcareous wetlands are naturally limited in New Hampshire and Maine by soil conditions. Logging alters the moisture levels, shading, and temperature of mature forest wetlands, making them unsuitable for some species, but it can help maintain or create shrub wetlands.

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

Wildlife habitat management could include streamside harvest to encourage beaver and maintenance or removal of dams. If successful, harvest to encourage beaver could create forested wetland habitat when beaver create a dam and flood existing forest areas. Conversely if the area is already a forested wetland, encouraging beaver activity could result in conversion to an open shrub or marsh wetland. Depending on conditions, dam removal could reduce forested wetland habitat upstream and create it downstream of the structure. Existing impoundments would be maintained if they provide important habitat, including where they provide habitat for a species of concern upstream or downstream of the structure. Dam removal would be considered if an impoundment is no longer needed. None of these activities varies among alternatives.

Forest management might affect individual wetland-associated plants or animals of potential concern in all alternatives. However, standards and guidelines would limit the number of occurrences impacted and the type and intensity of impacts. Factors outside Forest Service control (disease and hybridization) may result in declines in *Juglans cinerea* and Jefferson salamander in all alternatives. Timber harvest may affect seep habitats within hardwood and mixedwood forest, which could result in a decline in viability outcome for *Galium kamtschaticum* in all alternatives (see Appendix F). *Salix pellita* would remain stable at the identified viability threshold, with an outcome of C-D, due to apparent loss of historic populations. Additional surveys may locate new occurrences which would change the outcome. For the Indiana bat, the viability outcomes do not apply (see Appendix F for reasoning); the Forest will continue to provide habitat for this in case conditions change. Populations and viability outcomes for eight other species are expected to remain stable and viable with all alternatives (see Appendix F). Table 3-58 summarizes the rationale for the determination made in the Biological Evaluation (BE) for each TES species from this habitat (see BE, Appendix G, for more details).

Table 3-58. Summary of rationale for TES species determinations.

Species	Determination	Rationale summary
Common to all species	N/A	1. Although timber harvest and road/trail construction have the potential to directly and indirectly impact individuals, mitigation to protect TES species would be in place to reduce those impacts.
Indiana bat	May affect, not likely	1. Based on recent studies in the northeast, it seems unlikely that an Indiana bat would occur on the WMNF. The western edge of the Forest is twice the distance that Indiana bats have been known to travel from hibernacula in New York. 2. Foraging and roosting habitat exists and could be enhanced or reduced somewhat by timber harvest and other activities, but when compared to the more suitable habitat in the Champlain and Connecticut River valleys, it is extremely unlikely an Indiana bat would remain or even occur on the WMNF. Factors such as canopy closure levels and lack of optimal roosting tree species (e.g., shagbark hickory) make WMNF habitat suboptimal. 3. Since 1992, additional surveys have not documented another Indiana bat on the Forest or even east of the Green Mountain National Forest in Vermont. It is likely the one Indiana bat occurrence was a transient individual, not a member of a breeding colony. Survey data also shows a disproportionate number of male bats (of various woodland bat species), indicating a lack of breeding females. Since roosting and foraging habitat is available, it may be that the Forest's temperature and other climatic factors are not optimal for Indiana bat breeding and management direction would not influence species recovery in any alternative. 4. Forest Plan direction to reserve snags and other "wildlife" trees from timber harvest would mitigate loss of roosting habitat through harvest treatments. 5. Best Management Practices and riparian standards and guidelines would protect potential foraging sources over water.

Table 3-58. Summary of rationale for TES species determinations (continued).

Species	Determination	Rationale summary
Indiana bat (continued)		6. Roads and other travel corridors would continue to exist, as would openings (both natural and managed) that would serve as foraging sources, so these would not be considered limiting. 7. Potential effects from placement of wind turbines or cell towers are worth evaluating as an emerging issue, and mitigation is in place to consider these potential effects during site specific placement and construction. However, the chance of an Indiana bat being on the Forest is already remote; the chance that an Indiana bat would be located on the Forest and would come in contact with one of these structures is so remote as to be considered discountable.
Carex baileyi	Now: No impact. If species is found on the Forest: May impact individuals, but would not result in a trend towards federal listing or loss of viability.	1. There are currently no extant occurrences on the Forest. Habitat would continue to be maintained through management activities in all alternatives.
Carex wiegandii	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Invasive species may be a threat, but new Forest Plan direction would help focus attention on the subject and further more effective eradication treatments. 2. It would appear that suitable unoccupied habitat exists, although not all habitat requirements are known. 3. Designating a summer motorized trail in an area that could impact this species is unlikely given standards and guidelines to protect threatened, endangered, and sensitive species. 4. Portions of some populations occur in disturbed wet areas near natural habitat, such as edges of hiking trails and ski roads. This may indicate that this species may tolerate or respond to these kinds of disturbance, although it is uncertain how well these stations can be maintained over time.

Table 3-58 Summary of rationale for TES species determinations (continued).

Species	Determination	Rationale summary
Dryopteris goldiana	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. This species has a number of extant occurrences that are considered stable, including some in active timber sale areas and some that have been discovered after timber sale operations were completed. While timber harvesting obviously has the potential to negatively impact this species and its habitat, it would appear that the species has sometimes been able to persist and even increase numbers within active units. 2. The SVE Pteridophyte Panel (2002) considers the habitat of Goldie's woodfern to be broadly distributed and of sufficient quality now and in the future to support population interaction. It was given the highest ranking available for the viability exercise.
Juglans cinerea	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. The determination is based on the effects of Forest Service management, not actions outside Forest Service control. Butternut is declining because of the butternut canker, not because of any management activities. If a treatment is not devised to mitigate the effects of this disease, it is unlikely the species will recover on its own. 2. The majority of WMNF butternut are planted or are likely progeny of planted trees. There is some question whether these trees would be considered native.
Listera auriculata	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Standards and guidelines would be implemented to protect riparian habitats and address invasive species prevention and eradication in all alternatives. Although all suitable habitat may not be covered by this direction, it should address the vast majority of situations. 2. Flooding may play a large role in determining persistence of this species on the Forest, but natural flood events are outside Forest Service control.
Listera convallarioides	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Some potential habitat for this species (seeps) may be overlooked during timber sale activities, but it is assumed that pre-project surveys would make a reasonable effort in identifying new occurrences.

Table 3-58 Summary of rationale for TES species determinations (continued).

Species	Determination	Rationale summary
Listera convallarioides (continued)		2. Hiker traffic may result in the trampling of some individuals, but occurrences away from trails should remain protected and site-specific mitigation (e.g., trail reroutes, educational signs) can help mitigate effects. 3. Deer herbivory may be a threat, but the chance that deer would destroy entire colonies and result in viability losses seems unlikely given that historically deer populations were much higher than today.
Listera cordata	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Some potential habitat for this species (seeps) may be overlooked during timber sale activities, but it is assumed that pre-project surveys would make a reasonable effort in identifying new occurrences.
Petasites frigidus var. palmatus	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Standards and guidelines should protect extant occurrence and most habitat types. 2. The SVE Upland Forest Panel believes the WMNF occurrence is stable despite some disturbance.
Pyrola asarifolia	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Forest Plan direction for Stream Habitats and Water Resources would help protect some wet habitats near which pink wintergreen might be found. 2. This species has a number of extant occurrences outside the WMNF that are considered stable. 3. In addition, habitat along the Wild River (where the one WMNF occurrence is located) is not likely to be substantially impacted in any alternative.

Alternative 1

Direct and Indirect Effects

Timber harvest can result in sedimentation and runoff from skid trails, alteration of habitat suitability, trampling of plants and some wildlife by machinery, and mortality or loss of reproduction in some birds if it occurs during breeding season. The risk of negative impacts is assumed to be proportional to acres of timber harvest. Standards and guidelines would reduce adverse impacts to forested wetlands (see Water Resources section). However, timber harvest could still occur in or adjacent to forested wetlands other than floodplain forest and vernal pools, and in forests surrounding vernal pools. As a result, changes to temperature, shading, and moisture retention could occur, reducing habitat quality and quantity for some species of concern. Surveys for TES species would be required prior to project implementation, which would reduce the potential for impacts. Not all acres can be surveyed, however, so some occurrences could be missed and some populations could be affected. Given the wetland standards and guidelines, prevalence of winter logging, and surveys, potential adverse impacts would be minimized; however, individual plants or animals might be lost and habitat quality might be reduced. Alternative 1 includes harvest on the second highest number of acres (after Alternative 4) overall, and so would have the second greatest risk of impacts to these habitats and species. Timber harvest also can be used to maintain shrub wetlands, such as alder thickets, that provide habitat to one or two species of concern.

The potential for recreation development and summer ATV use to occur near, and impact, these habitats is discussed in the Water Resources section. New facilities and motorized and non-motorized trails are likely to avoid direct impacts to forested wetlands, because these habitats make poor campsites and trail locations. However, they could bring more people to an area adjacent to these small, scattered habitats, which could result in illegal off-trail use, user-created trails, and other impacts to riparian habitat and species of concern. Summer ATV trails, in particular, could increase disturbance in an area substantially. The potential for these impacts is assumed to be proportional to the amount of new trail proposed for construction. Standards to survey for, and avoid impacts to, TES species should prevent placement of new or expanded facilities near known populations of species of concern. Increased use at existing facilities and on existing trails could result in trampling of plant species of concern.

Invasive species are a particular concern in wetland habitats that contain streams, because introduction of a species to one wetland can quickly result in infestations downstream. There would be a greater risk of non-native invasive species spread in Alternative 1 than in any other alternative (see Vegetation section), which means there would be more risk to species and habitats of concern. Standards and guidelines for prevention and control of invasive species in all habitats should reduce the potential for indirect impacts to species from non-native invasive species.

Three species of concern that use forested wetlands, *Cypripedium parviflorum* var. *pubescens*, *Dryopteris goldiana*, and *Pyrola asarifolia*, also use rich hardwood forests for habitat. The potential for even-aged regeneration harvest, proposed in Alternative 1, to negatively affect species in rich hardwood habitats could result in a slight decrease in the viability outcome for these species in this alternative.

Cumulative Effects

Wetland habitats are more abundant off-Forest than on National Forest land. Development and timber harvest also are more common on lands surrounding the Forest. Historically, conversion of forest to farmland, development, and intensive timber harvest altered or eliminated many wetlands, reducing habitat — and probably populations — of rare species across the analysis area. Currently, some wetlands are protected from development, while impacts to others are allowed with mitigation. Due to historic impacts, remaining wetlands are more important than ever as rare communities and habitat for species of concern. Wetlands constructed for mitigation may provide suitable habitat for some species, but they cannot replace lost populations. Surveys for species of concern are not required prior to harvest in most places off-Forest, so populations could be reduced or eliminated.

Most species of concern in these habitats are recovering from the effects of intensive habitat changes in past decades or centuries. While some off- and on-Forest activities may impact these habitats in the next 20 years, these effects will be minimal compared to declines resulting from past harvest and land conversion. Viability outcomes would remain as described for this alternative and under effects common to all alternatives.

Alternative 2

Direct and Indirect Effects

The types of effects from timber harvest, and the standards and guidelines to mitigate those effects, would be the same as in Alternative 1. This alternative proposes timber harvest on the fewest total acres; therefore, potential for effects from timber harvest would be less than all other alternatives.

The types of effects from recreation development would be the same as for Alternative 1. However, Alternative 2 would result in less construction of camping sites, non-motorized trails, and snowmobile trails than Alternatives 1 and 4. In addition, summer ATV use would be prohibited, so impacts would be limited to illegal use. Therefore, the amount of effects from these activities would be less than for those alternatives. Use of existing developed sites and trails near forested wetlands would increase as in Alternative 1, with similar effects.

The standards and guidelines for prevention and control of non-native invasive species would be the same as for Alternative 1. However, the risk of spread of terrestrial non-native invasive species is less (see Vegetation section).

Even-aged regeneration harvest in rich hardwoods would not reduce the viability outcome for *Cypripedium parviflorum* var. *pubescens* and *Dryopteris goldiana*. Therefore, viability outcomes for these species would be stable and above the identified viability threshold. Outcomes for all other species are common to all alternatives.

Cumulative Effects

The potential for increases in development and timber harvest off-Forest is the same as for Alternative 1. Cumulative effects to individual plants and animals would be less for this alternative than for Alternative 1, because direct and indirect effects to these habitats would be less. Viability outcomes are as described for direct and indirect effects.

Alternative 3

Direct and Indirect Effects

The types of effects from timber harvest and the standards and guidelines to mitigate those effects would be the same as in Alternative 1. This alternative proposes fewer total acres of harvest than Alternatives 1 and 4. Therefore, the potential for effects from timber harvest would be less than Alternatives 1 and 4, but slightly more than Alternative 2.

The types of effects from recreation development would be the same as for Alternative 1. However, Alternative 3 would result in less construction of camping sites, non-motorized trails, and snowmobile trails than any other alternative. In addition, summer ATV use would be prohibited, so impacts would be limited to illegal use. Therefore, the amount of effects from these activities would be less than for other alternatives. Use of existing developed sites and trails near forested wetlands would increase as in Alternative 1, with similar effects.

The potential for effects from invasive species would be the same as described for Alternative 2, as would viability outcomes for all species.

Cumulative Effects

The potential for increases in development and timber harvest off-Forest is the same as for Alternative 1. Cumulative effects to individual plants and animals would be less than for any other alternative, because direct and indirect effects to these habitats would be less. Viability outcomes would be the same as for Alternative 2.

Alternative 4

Direct and Indirect Effects

The types of effects from timber harvest, and the standards and guidelines to mitigate those effects, would be the same as in Alternative 1. This alternative proposes timber harvest on more acres than any other alternative; therefore, the potential for effects from harvest would be more than for any other alternative.

Alternative 4 would result in more recreational development of almost all types than Alternative 1; therefore, the effects from these activities would

be similar to, but greater than, those for Alternative 1. Use of existing developed sites and trails near forested wetlands would increase, as in Alternative 1, with similar effects.

If this alternative is selected, the decision will include which ATV area to pursue. While standards and guidelines should protect these habitats and associated species, there is always potential for short-term effects from construction and unexpected impacts. The proposed Landaff ATV area includes about 180 acres of forested and scrub-shrub wetland habitat, most of it associated with stream corridors. This equates to about 2.5 percent of the area. The proposed Moat Mountain ATV area has about 110 acres of forested and scrub-shrub wetland habitat, which is about 3.3 percent of the area. Since the miles of trail would be similar regardless of which area is selected, the potential for impacts to this habitat would be essentially the same in both areas.

The standards and guidelines for prevention and control of non-native invasive species would be the same as for Alternative 1. The risk of spread of terrestrial species would be less than in Alternative 1 and more than in Alternatives 2 and 3 (see Vegetation effect section).

Viability outcomes would be the same as for Alternative 2.

Cumulative Effects

The potential for increases in development and timber harvest off-Forest is the same as described for Alternative 1. Cumulative effects to individual plants and animals would be slightly more than for other alternatives, because more land would be impacted by recreation development and timber harvest. Viability outcomes would be the same as for Alternative 2.

Open Wetlands (20 species of concern, see Appendix F)

Affected Environment

Bogs, fens, sedge meadows, and beaver ponds are all types of open wetland habitat. While bogs and fens occupy a very small portion of the landscape, the Forest contains five of the seven peatland types in New Hampshire, and all of the regionally rare alpine/subalpine bogs and montane sloping fens. Emergent marsh-shrub swamp systems contain about ten natural communities on the WMNF, including emergent marshes and aquatic beds. The analysis area for species using these habitats is watersheds that encompass the White Mountain National Forest, as described in the Water Resources section (see also Map 3-02b, Vegetation section).

Development and agriculture can eliminate open wetland habitat and alter water quality and quantity. Roads, trails, dams, timber harvest, and other management in or near wetlands can change the local hydrology, making habitat more or less suitable for some species. Roads and dams also are barriers to movement of some animal species. Peat mining is a threat to some bogs and their species. Succession of open wetlands to shrub or forested habitat would eliminate habitat for many species of concern.

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

Succession of open wetlands to shrub or forested habitat would eliminate habitat for many species. In most open wetlands, this conversion is a slow, natural process unaffected by management. In some cases, beaver or human-created dams result in and maintain open wetlands. Wildlife habitat management could include maintenance or removal of dams. Existing impoundments would be maintained if they are known to provide habitat for a species of concern upstream or downstream of the structure. Dam removal would be considered if an impoundment was no longer needed. The requirement for TES surveys prior to project implementation should minimize the potential for dam alteration to affect species of concern. Management could encourage beaver use of an area, if conditions are appropriate, which could result in creation of open wetland habitat.

Forest management might affect individual wetland-associated plants or animals of potential concern in all alternatives. However, standards and guidelines should limit the number of occurrences impacted and the type and intensity of impacts. The single known occurrence puts *Carex exilis* at risk from stochastic events, recreational use impacts, or habitat alteration. Twenty other species of concern should remain stable and viable (see Appendix F). Table 3-59 summarizes the rationale for the determination made in the Biological Evaluation (BE) for each TES species from this habitat (see BE, Appendix G, for more details).

Table 3-59. Summary of Rationale for TES Species Determinations.

Species	Determination	Rationale Summary
Northern bog lemming	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Northern bog lemmings have apparently persisted for the last century despite much more habitat altering activities than are proposed here. Although habitat conditions may be altered locally, there is no reason to believe the subspecies would not continue to persist regardless of alternative.
Calamagrostis stricta var. *inexpansa (Calamagrostis lacustris)*	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Pond reed bent-grass occupies a variety of wet habitat types, including many which rely on disturbance to be perpetuated. The one known occurrence of this species on the Forest is located in a meadow that is influenced by river flooding. There is no direction in any alternative that would result in a change to that condition.

Table 3-59. Summary of Rationale for TES Species Determinations. (continued)

Species	Determination	Rationale Summary
Calamagrostis stricta var. *inexpansa (Calamagrostis lacustris)* (continued)		2. Although hiker use will continue increasing in the future, new trail construction probably would not occur in suitable habitat and off-trail use through these habitats is not expected to be so great that effects would be seen at the programmatic level. 3. Rock climbing poses a threat, but it is assumed that Rare and Unique Features standards and guidelines would be implemented to mitigate impacts at site-specific locations.
Carex baileyi	No impact	1. There are currently no extant occurrences on the Forest. Habitat would continue to be maintained through management activities in all alternatives.
Carex wiegandii	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Invasive species may be a threat, but new Forest Plan direction would help focus attention on the subject and further more effective eradication treatments. 2. It would appear that suitable unoccupied habitat exists, although not all habitat requirements are known. 3. Designating a summer motorized trail in an area that could impact this species is unlikely given standards and guidelines to protect threatened, endangered, and sensitive species. 4. Portions of some populations occur in disturbed wet areas near natural habitat, such as edges of hiking trails and ski roads. This may indicate that this species may tolerate or respond to these kinds of disturbance, although it is uncertain how well these stations can be maintained over time.
Geocaulon lividum	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. It is unlikely that additional trails would be constructed in bog habitats. 2. Population viability for this species is expected to be maintained, although some individuals or occurrences could be lost.
Listera auriculata	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Standards and guidelines would be implemented to protect riparian habitats and address invasive species prevention and eradication in all alternatives. Although all suitable habitat may not be covered by this direction, it should address the vast majority of situations.

Table 3-59. Sommary of Rationale for TES Species Determinations (continued).

Species	Determination	Rationale Summary
Listera auriculata (continued)		2. Flooding may play a large role in determining persistence of this species on the Forest, but natural flood events are outside Forest Service control.
Pyrola asarifolia	May impact individuals, but would not result in a trend towards federal listing or loss of viability	1. Forest Plan direction for Stream Habitats and Water Resources would help protect some wet habitats near which pink wintergreen might be found. 2. This species has a number of extant occurrences outside the WMNF that are considered stable. 3. In addition, habitat along the Wild River (where the one WMNF occurrence is located) is not likely to be substantially impacted in any alternative.

Alternative 1

Direct and Indirect Effects

Recreation development can eliminate open wetland habitat and alter water quality and quantity. Facilities are not likely to be placed in open wetlands, due to the challenges of construction and because standards and guidelines require placement of facilities outside wetland habitats. However, development could bring more people to an area adjacent to open wetland habitats, though wetlands are not as popular for recreation as lakes, ponds, and streams. Standards to survey for, and avoid impacts to, TES species should prevent placement of new or expanded facilities near known populations of species of concern. Increased use at existing facilities and on existing trails could result in trampling of plant species and increased disturbance to wildlife species of concern from more human presence.

Trails in or near wetlands can change the local hydrology, making habitat more or less suitable for some species. Standards and guidelines indicate that motorized and non-motorized trails should not be constructed adjacent to or through wetlands, and should not alter water flow into or out of a wetland. However, trails could bring people closer to these habitats, which could result in illegal off-trail use, user-created trails, and trampling of plants. Standards to survey for, and avoid impacts to, TES species should prevent placement of new trails near known populations of species of concern. Standards and guidelines also require that construction and reconstruction be done in a way to maintain water quality and quantity. Therefore, while trail work upstream or upslope of wetlands could result in short-term changes in flow and sedimentation, there should not be noticeable long-term effects on wetland habitat or species. Increased use and maintenance of existing trails in and near wetlands could result in increased sediment,

pollution, and trampling, which could affect survival of individual plants or occurrences and reduce habitat suitability for wildlife species. Standards and guidelines should mitigate most impacts from new construction.

Timber harvest, especially even-aged regeneration harvest, has the potential to affect open wetlands by altering local hydrology, nutrient flows, and sediment levels. In most cases soil conditions and riparian and watershed standards and guidelines would keep harvest away from these habitats and minimize the potential for impacts. However there may be instances in which harvest would occur near enough to an open wetland to alter habitat conditions. This is more likely in alternatives with more acres of even-aged regeneration harvest proposed. Harvest is not expected to result in reduced viability for any species, but the risk of impacts is greatest in Alternative 1.

Pyrola asarifolia also uses rich hardwood forests for habitat. The potential for even-aged regeneration harvest proposed in Alternative 1 to negatively affect species in rich hardwood habitats could result in a slight decrease in the viability outcome for this species in this alternative. Viability outcomes for other species are common to all alternatives.

Cumulative Effects

Wetland habitats are more abundant off-Forest than on National Forest land. Development also is more common on lands surrounding the Forest. Historically, conversion of forest to farmland, development, and intensive timber harvest altered or eliminated many wetlands, reducing habitat, and probably populations, of rare species across the analysis area. Currently, some wetlands are protected from development, while impacts to others are allowed with mitigation. Due to historic impacts, remaining wetlands are more important than ever as rare communities and habitat for species of concern. Wetlands constructed for mitigation may provide suitable habitat for some species, but they cannot replace lost populations. Surveys for species of concern are not required prior to harvest in most places off-Forest, so populations could be reduced or eliminated.

Most wetland species of concern are recovering from the effects of intensive habitat changes in past decades or centuries. While some off- and on-Forest activities may impact these habitats in the next 20 years, these effects will be minimal compared to declines resulting from past impacts. Viability outcomes are discussed under effects common to all alternatives.

Alternative 2

Direct and Indirect Effects

The types of effects from recreation facility and trail development would be the same as for Alternative 1. However, Alternative 2 would result in less construction of camping sites, non-motorized trails, and snowmobile trails than Alternatives 1 and 4. In addition, summer ATV use would be prohibited, so impacts would be limited to trampling and habitat alteration from illegal use. Therefore, the amount of effects from these activities would be less than for alternatives 1 and 4. Use of existing developed sites and trails near open wetlands would increase, as in Alternative 1, with similar effects.

Similarly, the types of effects from timber harvest would be the same as Alternative 1, but the potential for those effects is less because less even-aged regeneration harvest is proposed.

Viability outcomes are common to all alternatives.

Cumulative Effects

The potential for increases in development and timber harvest off-Forest is the same as for Alternative 1. Cumulative effects to individual plants and animals would be slightly less for this alternative than for Alternative 1, because direct and indirect effects to these habitats would be slightly less. Viability outcomes are common to all alternatives.

Alternative 3

Direct and Indirect Effects

The types of effects from recreation facility and trail development would be the same as for Alternative 1. However, Alternative 3 would result in less construction of camping sites, non-motorized trails, and snowmobile trails than any other alternative. In addition, summer ATV use would be prohibited, so impacts would be limited to illegal use. Therefore, the amount of effects from these activities would be less than for other alternatives. Use of existing developed sites and trails near open wetlands would increase, as in Alternative 1, with similar effects.

Similarly, the types of effects from timber harvest would be the same as Alternative 1, but the potential for those effects is less than in any other alternative because less even-aged regeneration harvest is proposed.

Viability outcomes are common to all alternatives.

Cumulative Effects

The potential for increases in development and timber harvest off-Forest is the same as for Alternative 1. Cumulative effects to individual plants and animals would be less than for any other alternative, because direct and indirect effects to these habitats would be less. Viability outcomes are common to all alternatives.

Alternative 4

Direct and Indirect Effects

Alternative 4 would result in construction of more recreation facilities and trails of almost all types than other alternatives. Therefore, the effects from these activities would be greater than for other alternatives. Use of existing developed sites and trails near wetlands would increase, as in Alternative 1, with similar effects.

If this alternative is selected, the decision will include which ATV area to pursue. While standards and guidelines should protect these habitats and associated species, there is always potential for short-term effects from construction and unexpected impacts. The proposed Landaff ATV area includes about 50 acres of open wetland habitat, much of it associated with stream corridors. This equates to about 0.7 percent of the area. The proposed

Moat Mountain ATV area has less than 3 acres of open wetland habitat, almost all of it open water near streams. This is less than 0.1 percent of the area. Therefore, the potential for impacts to this habitat are minimal in both alternatives, but slightly greater in the Landaff area.

The types of effects from timber harvest would be the same as Alternative 1, but the potential for those effects is less because less even-aged regeneration harvest is proposed.

Viability outcomes are common to all alternatives.

Cumulative Effects

The potential for alteration of open wetlands off-Forest is the same as for Alternative 1. The cumulative effects to individual animals and plants would be greater than in other alternatives, because of the increased impacts from recreational development. Viability outcomes are common to all alternatives.

White Horse Ledge Cedar Swamp (WMNF photo by Kathie Fife)

Outstanding Natural Communities

Conserving the variety of natural communities is part of maintaining biodiversity across the White Mountain National Forest. There are many perspectives on how best to accomplish this goal. Some believe that the best examples of every natural community should be placed in reserve areas that do not allow certain types of management, such as timber harvest. State Natural Heritage Programs identify exemplary community occurrences, which could be used for this purpose. Other people and organizations believe that only the rarest or most sensitive communities require preservation. For other natural communities, the assumption is that timber harvest or similarly intensive management is acceptable as long as it does not eliminate the community. The WMNF approach is to protect some high quality examples of common natural communities and most occurrences of rare natural communities from extensive changes by management through land allocation or management direction.

To achieve the Forest Service's intent for natural community conservation, rare natural communities (ranked S1 or S2 in the state in which it occurs) known to occur on the Forest and communities for which at least half the tracked exemplary occurrences (Sperduto and Nichols, 2004; Gawler, 1997) are in MA 2.1 were reviewed to determine whether any need additional protection or if existing management direction is adequate to ensure the long-term sustainability of the community on the Forest. Most of the natural communities that were considered (Table 3-60) are described in Sperduto and Nichols (2004). The Maine Natural Areas Program classifies communities slightly differently, but the actual communities should be essentially the same on the Forest because most of the Forest is in a single ecological subsection.

As a result of this evaluation, montane circumneutral cliffs and associated talus slopes, old growth enriched upland forest, northern white cedar – hemlock swamp, northern white cedar seepage forest, and pitch pine – scrub oak woodland were identified as outstanding natural communities in need of special consideration in the revised Forest Plan. Each of these communities is a subset of one of the broad habitats described in the Species Viability subsection. To properly address the concerns specific to the smaller community, they are discussed in detail in this subsection.

The other communities that were considered were not identified as needing specific protection as outstanding natural communities for a variety of reasons (Table 3-60). For some, land allocation would conserve all or a majority of occurrences. For others, Forest-wide standards and guidelines should protect the community. For other communities, identification of exemplary occurrences is difficult or is dependent on the condition of other occurrences in the state or on criteria that are not documented so that people surveying project areas for species and communities of concern could identify them. Requiring Forest-wide protection of these could place the Forest Service in a challenging position of mandating protection for something we are not able to identify. Therefore these communities were not identified as outstanding natural communities. Where seeps are known to occur, they should be protected at the project level.

Table 3-60. Communities Considered but not Identified as Needing Additional Protection.

Community	Reason not Addressed in Detail
Acidic brownwater lake/pond	• All lakes and ponds are protected by riparian and watershed standards and guidelines (S&Gs)
Acidic riverside seep	• Along shores of larger rivers, which are protected by riparian S&Gs
Alpine herbaceous snowbank/rill	• Alpine and subalpine habitats are protected by MA 8.1 S&Gs, including small patches outside MA 8.1
Alpine ravine/snowbank	• Alpine and subalpine habitats are protected by MA 8.1 S&Gs, including small patches outside MA 8.1
Alpine tundra system	• Alpine and subalpine habitats are protected by MA 8.1 S&Gs, including small patches outside MA 8.1
Alpine/subalpine bog system	• Alpine and subalpine habitats are protected by MA 8.1 S&Gs, including small patches outside MA 8.1
Appalachian oak – mountain laurel forest	• Only known exemplary occurrence on the Forest contains two species of concern, so standards and guidelines to protect those plants should prevent adverse impacts to this habitat, which is unlikely to occur elsewhere as far north as the WMNF
Balsam fir floodplain/silt plain	• Occurs in floodplains and siltplains , which should be protected by riparian and watershed S&Gs
Black spruce – balsam fir krummholz	• Alpine and subalpine habitats are protected by MA 8.1 S&Gs, including small patches outside MA 8.1
Circumneutral hardwood forest seep	• Seeps are often hard to find and identify, so requiring Forest-wide protection would be difficult; where an occurrence is known, seeps should be protected through project-level mitigation measures
Circumneutral rocky ridge	• Only known exemplary occurrence on the Forest is along AT corridor, at site with several occurrences of rare plants; AT and rare plant S&Ss will provide adequate protection
Clear softwater lake/pond	• All lakes and ponds are protected by riparian and watershed S&Gs
Cliff seep	• Seeps are often hard to find and identify, so requiring Forest-wide protection would be difficult; where an occurrence is known, seeps should be protected through project-level mitigation measures
Hemlock – beech – oak – pine forest	• Common south of the Forest; only known exemplary occurrence on the Forest is largely within the riparian management zone for the Saco River so would be protected from even-aged regeneration harvest
Hemlock – spruce – northern hardwood forest	• Relatively abundant on Forest

Table 3-60. Communities Considered but not Identified as Needing Additional Protection (continued)

Community	Reason not Addressed in Detail
Herbaceous – wooded riverbank/floodplain	• Occurs in floodplains and along rivers, and so should be protected by riparian and watershed S&Gs
Herbaceous riverbank/ floodplain	• Occurs in floodplains and along rivers, and so should be protected by riparian S&Gs
High gradient rocky riverbank system	• Occurs in along rivers and streams, and so should be protected by riparian S&Gs
Jack pine rocky ridge woodland	• Jack pine addressed through SVE; both known community occurrences are outside MA 2.1; fire allowed at one site to benefit community
Kettle hole bog system	• Open wetlands should be protected by watershed S&Gs
Labrador tea heath – krummholz	• Alpine and subalpine habitats are protected by MA 8.1 S&Gs, including small patches outside MA 8.1
Lowland spruce – fir forest	• More than half the acres in NHNHB exemplary occurrences are identified as land unsuitable for timber harvest; watershed S&Gs provide additional protection for forested wetland examples of this community
Meadowsweet alluvial thicket	• Occurs in floodplains and along rivers, and so should be protected by riparian and watershed S&Gs
Medium level fen system	• Open wetlands should be protected by watershed S&Gs
Moderate-gradient sandy-cobbly riverbank system	• Occurs in along rivers and stream, and so should be protected by riparian S&Gs
Montane heath woodland	• Greatest threat would be harvest, but three of four known exemplary occurrences are in management areas that prohibit commercial harvest
Montane sloping fen system	• Open wetlands should be protected by watershed S&Gs; in addition, both known occurrences are outside MA 2.1
NE alpine/subalpine pond	• All lakes and ponds are protected by riparian and watershed S&Gs
Northern hardwood – black ash – conifer swamp	• Watershed S&Gs provide some protection for forested wetlands; one known exemplary occurrence is ranked AB despite past partial harvest, so threat from management not certain
Northern hardwood seepage forest	• Forest associated with streams or springs will be protected by riparian and watershed S&Gs; seeps are often hard to find and identify, so requiring Forest-wide protection would be difficult; where an occurrence is known, seeps are typically protected through project-level mitigation measures

Table 3-60. Communities Considered but not Identified as Needing Additional Protection (continued).

Community	Reason not Addressed in Detail
Northern medium sedge meadow marsh	• Open wetlands should be protected by watershed S&Gs
Red maple – black ash – swamp saxifrage swamp	• Watershed S&Gs provide some protection for forested wetlands; only known exemplary occurrence is ranked AB despite clearcut harvest of substantial portion less than 30 years ago, so threat from management not certain
Red oak – ironwood – Pennsylvania sedge woodland	• Known exemplary occurrences are in designated Wilderness
Red pine rocky ridge	• Greatest threat would be timber harvest, but eight of nine known exemplary occurrences are in management areas that prohibit commercial harvest
Red spruce swamp	• Two of five known exemplary occurrences are mostly identified as land unsuitable for timber harvest; watershed S&Gs provide some protection for forested wetlands
Rich red oak rocky woods	• Greatest threat would be timber harvest, but six of seven known exemplary occurrences are in management areas that prohibit commercial harvest
Sandplain basin marsh system	• Open wetlands should be protected by watershed S&Gs
Sandy pond shore system	• All lakes and ponds are protected by riparian and watershed standards and guidelines (S&Gs)
Sedge – rush – heath meadow	• Only known exemplary occurence on the forest is in designated Wilderness
Semi-rich mesic sugar maple forest	• Not rare on Forest; some sites identified as exemplary by NHNHB have been harvested in within last century, some much more recently, so threat from harvest is uncertain
Short graminoid – forb emergent marsh/mud flat	• Usually occurs in floodplains and along rivers, and so should be protected by riparian and watershed S&Gs
Subacid forest seep	• Seeps are often hard to find and identify, so requiring Forest-wide protection would be difficult; where an occurrence is known, seeps should be protected through project-level mitigation measures
Subalpine cold-air talus barren	• Both known exemplary occurrences are outside MA 2.1, so harvest not a concern; recreation less likely on cold talus than most other communities
Subalpine heath – krummholz/ rocky bald system	• Alpine and subalpine habitats are protected by MA 8.1 S&Gs, including small patches outside MA 8.1
Subalpine rocky bald	• Alpine and subalpine habitats are protected by MA 8.1 S&Gs, including small patches outside MA 8.1

Table 3-60. Communities Considered but not Identified as Needing Additional Protection (continued).

Community	Reason not Addressed in Detail
Sugar maple – beech – yellow birch forest	• Relatively abundant on Forest; roughly 40% of NHNHB exemplary occurrences are identified as unsuitable for timber harvest, while others have been salvaged or otherwise harvested in recent decades
Sugar maple – ironwood – short husk floodplain forest	• Occurs in floodplains and along rivers, and so should be protected by riparian and watershed S&Gs

Affected Environment

Old Growth Enriched Upland Forest

These are 200 year old, or older, hardwood forests dominated by sugar maple and white ash, where seeps are common and the ground flora is an assemblage of species such as sweet cicely, Goldie's fern, ginseng, and nettle and zig-zag goldenrod. Representative examples are usually small, less than one acre in size, and isolated. While the soil is not calcareous, it is enriched in calcium, either from on-site weathering of bedrock where the soil is shallow to ledge, or the soil is transported from locations where the bedrock mineralogy is also rich in calcium. Surface soil layers are usually enriched with organic matter from the surrounding area. Enriched hardwood forests occur in New Hampshire in the White Mountain, Connecticut River, Mahoosuc-Rangely Lakes, and Vermont Upland subsections (Sperduto and Nichols, 2004), and likely occur in the Western Maine Foothills subsection. Occurrences that are more than 200 years old are undoubtedly quite limited in all subsections, given past and current management and development.

The old growth component of this community, rather than the entire community, was chosen because it is believed to be the rarest element and may contribute the most to biodiversity. In addition, the White Mountain National Forest may manage some of the only examples of enriched upland old growth forest in the state.

The analysis area for this outstanding natural community includes the ecological subsections in which the White Mountain National Forest exists (M212Ad, M212Ae, M212Ba, and M212Bc) and the subsection that covers the Connecticut River Valley (M212Bb, Map 3-02, Vegetation section), because these subsections contain the majority of occurrences of this community in New Hampshire (Sperduto and Nichols, 2004).

Montane Circumneutral Cliffs and Associated Talus

Cliffs, and possibly the talus slope beneath them, are sometimes calcium rich, circumneutral habitats that appear to support calcium-demanding or calciphilic plants. Seepage water emanating from rock fractures has a pH ranging from 6.5 to 8.2, and calcium concentrations in the range of five to ten milligrams per liter. This community is not well known or understood, but existing information suggests it may be uncommon. Surface water seepage that is notably rich in calcium may prove to be important to the composition of mosses and lichens in these communities. These cliffs and

associated talus slopes are scattered throughout the White Mountains. They range from very small, isolated ledge faces to relatively tall escarpments potentially suitable for rock climbing. Lichens and bryophytes may be the best indicators of this community (Sperduto and Nichols, 2004). Initial characterization of cliff communities on the Forest began three years ago to devise a useful inventory protocol, and begin understanding the range of physical, chemical, and biological features (Bailey et al., 2003).

The cumulative effects analysis area is land within the White Mountain National Forest proclamation boundary, plus adjacent state parks and the Appalachian National Scenic Trail corridor that is managed by the Forest. Cliffs and large rock outcrops are distinct habitats that are usually relatively isolated, so the management of one does not usually alter the community condition at a different site.

Northern White Cedar Communities

Two natural communities, northern white cedar – hemlock swamp and northern white cedar seepage forest, are dominated by northern white cedar, which is an uncommon species at the southeastern edge of its range in central New Hampshire (Sperduto and Nichols, 2004). On the Forest there are two known northern white cedar – hemlock swamps and one northern white cedar seepage forest. Given the rarity of these communities and the potential for timber harvest to alter local hydrology, it was determined that identifying these communities as outstanding natural communities was important to ensure their long-term conservation. Of the subsections in which the WMNF occurs, the northern white cedar seepage forest is known to from the Vermont Upland and Mahoosuc-Rangeley Lakes subsections in New Hampshire. The northern white cedar- hemlock swamp community is known from the White Mountains subsection (Sperduto and Nichols, 2004).

The cumulative effects analysis area for these communities is the White Mountains, Mahoosuc-Rangely Lakes, Western Maine Foothills, and Vermont Uplands subsections (Map 3-02, Vegetation section). These communities encompass all the known occurrences of these communities that may affect or be affected by occurrences on the WMNF.

Pitch Pine – Scrub Oak Woodland

The WMNF contains the northernmost New Hampshire occurrence of this fire-dependent community. These woodlands can be quite varied, with a patchy canopy of pitch pine, under which scrub oak and low heaths may be thick or sporadic. A 50-100 year fire return interval is important to maintaining the vegetative composition (Sperduto and Nichols, 2004). Classifying this community as an outstanding natural community ensures that any management in or adjacent to the single known occurrence on the Forest emphasizes conservation of this rare woodland system.

Almost all known occurrences of this community in New Hampshire are located south of the WMNF, in the Sebago-Ossipee and Coastal Plain subsections (Sperduto and Nichols, 2004). The Forest's single known occurrence is on the southeast edge of the WMNF. Therefore the cumulative effects analysis area for this community is the Sebago-Ossipee subsection,

in which the WMNF manages only a few stands, but which contains all the known occurrences of this community in proximity to the Forest.

Environmental Effects

Common to All Alternatives

Direct and Indirect Effects

No direct impacts are expected on the old growth enriched hardwood communities, as defined. Most, if not all, of these already occur in Research Natural Areas or Candidate Research Natural Areas in all alternatives. More examples may be found, but given the history of intense harvesting and fire at the turn of the century on the White Mountain National Forest, this appears unlikely. The most recently located good examples of old enriched hardwood forest are the CRNAs at Mountain Pond and possible inclusions at Shingle Pond.

Montane circumneutral cliffs may experience some direct impacts from recreational use, especially rock climbing. Revised standards and guidelines in all alternatives will prohibit clearing of vegetation at cliff edges and bases and limit group size for rock-climbing special use permits. They also allow for area-specific climbing plans, use limitations, and closure of climbing sites when these restrictions are needed to protect resources. However, cleaning of climbing routes and establishment of new routes would still be allowed on all cliff habitats unless an area is specifically closed, with no requirement for prior surveys. Talus slopes below these cliffs may have some hiking use, but this is arduous terrain where most hikers stay on the trail, so direct impacts are less likely. Cliff communities are in the earliest stages of examination on the Forest, and methods are being worked out for their inventory to locate these uncommon circumneutral sites. The protection afforded to these cliffs and associated talus areas by classification as an outstanding natural community only applies once they have been identified as calcareous, so impacts may occur until inventories are completed.

Forested wetlands of all types are partially protected by Forest-wide Water Resources standards and guidelines. Direction to conserve the northern white cedar outstanding natural communities would further ensure that management actions do not adversely alter local hydrology or other aspects of these important communities.

The only known occurrence of pitch pine – scrub oak woodland on the Forest is in MA 2.1, which allows prescribed fire and prohibits the use of wildland fire in all alternatives. Therefore the potential for management to maintain the fire regime needed by this community is the same in all alternatives. Timber harvest has been used elsewhere to help restore this community (TNC 2005), but harvest must be done carefully to preserve the critical components of these woodlands. Identification as an outstanding natural community would ensure management in this community under all alternatives is well thought out and designed to maintain it for the long-term.

Cumulative Effects

Over time, both on and off the National Forest, old enriched hardwood stands have probably been harvested; hiking trails were built across talus slopes and organic layers supporting plant communities were dislodged; vegetation has been removed along rock climbing routes on cliff faces; and wetlands and pitch pine – scrub oak woodlands were lost as development altered local hydrology and paved new ground. The magnitude of impact at cliffs and associated talus slopes communities has probably been minimized because of the narrow footprint of impact. The magnitude of impact for other communities may have been fairly great, because at one time these sites were unharvested.

Current actions within each of the identified analysis areas that might affect these communities include rural and urban development, road construction, timber harvest, and hiking in all but the cliff habitats, and rock climbing in montane circumneutral cliff communities. Future actions that might affect these sites include the current activities, plus potential access to cell tower and wind turbine sites or mineral prospecting. Although the White Mountain National Forest has few occurrences, the protection of these communities on the Forest is important in contributing to a network of sites that will exist and evolve over the long-term. Cumulative effects are expected to be minimal or nonexistent because direct and indirect effects would be minimized or eliminated through protections for outstanding natural communities and other management direction.

Effects on Non-priced Benefits

See page 3-70.

Puncheons elevate trail through marsh along the west side of Lonesome Lake (WMNF photo by Forrest Seavey)

Biodiversity Summary

As stated in the Biodiversity introduction, the White Mountain National Forest will maintain biological diversity using a combined coarse filter- fine filter approach. Based on the Soil, Water Resources, Riparian and Aquatic Habitats, Vegetation, and Wildlife sections, the coarse filter would maintain the variety of terrestrial and aquatic habitats throughout the planning area. Common communities and species would continue to be distributed across the Forest. The Rare and Unique Features section, which details the fine filter, indicates that rare communities and most rare species also would be maintained on the Forest into the foreseeable future.

This summary describes the expected basic ecological condition of the Forest under all alternatives. The details that change among the alternatives are described in the effects analyses of the preceding sections.

Ecological Condition

The Forest provides extensive areas of mature to old deciduous, coniferous, and mixed forest, small patches of young forest and herbaceous openings, hundreds of miles of streams and riparian habitat, large and small areas of alpine habitat, and scattered wetlands and ponds. Based on the proposed approach to conserving biodiversity, the Forest will continue to provide all of these habitats and maintain the diversity of natural communities that comprise them.

In the long-term, quantity and distribution of hardwood, mixedwood, and softwood forest habitats will be determined primarily based on potential natural vegetation, as indicated by ecological land types (ELTs). All three broad habitat types will be scattered across the Forest. Using land capability to determine the appropriate levels and distribution of ecosystems on the landscape increases the likelihood that biological diversity will be maintained over time (Aplet and Keeton, 1999). Oak, pine, hemlock, aspen, and birch dominated habitats will naturally be limited in quantity and distribution, but will remain available on the landscape. Within every forest habitat, there are species that occur in the canopy and understory in limited amounts, such as black cherry, yellow birch, oak, and hemlock. Management will retain minority species where they occur, and enhance their presence where feasible and appropriate.

Non-forested habitats (upland openings, streams, wetlands, lakes, cliffs, etc.) will primarily occur where they form naturally. Wildlife openings may be created on a limited basis where an opportunity for high quality habitat is present. Particular attention is given to ecosystems that are uncommon or rare off-Forest in northern New England, such as alpine communities.

All natural communities, aquatic, riparian, and terrestrial, will be maintained. Most occurrences of rare natural communities and some high quality examples of common natural communities will be protected from extensive changes by Forest management.

Non-forested habitats (upland openings, streams, wetlands, lakes, cliffs, etc.) will primarily occur where they form naturally. Wildlife openings may be created on a limited basis where an opportunity for high quality habitat is present. Particular attention is given to ecosystems that are uncommon or rare off-Forest in northern New England, such as alpine communities.

A majority of the White Mountain National Forest will provide mature and old forest habitat for the long-term. Regeneration age (0-9 years old) forest habitat will continue to result from natural disturbance, even-aged management, and group selection harvest. Even-aged regeneration harvest will occur primarily in northern hardwood and aspen-birch habitats. How much regeneration age forest would be created varies by alternative to address the timber and wildlife issue, but all alternatives propose even-aged regeneration harvest on two percent or less of the Forest per decade.

Most ecological processes on the Forest were affected by intensive harvest in the late 1800s and early 1900s. Some, such as wind disturbance, are now likely functioning as would be expected naturally. Others, such as accumulation of large woody debris in streams, are still recovering. Forest management will encourage this recovery and move hydrologic and terrestrial processes toward proper functioning condition where feasible.

Hundreds of animal and plant species are found on the Forest, and a few are found almost nowhere else. Maintaining aspen-birch and regeneration age forest habitats will provide more habitat for some species that the public likes to view or hunt (e.g., moose, grouse). Meanwhile, viable populations of all species will continue to be provided to the degree that is ecologically possible. For some species, factors outside Forest Service control, such as disease, may limit populations. For these taxa, the Forest Service will contribute to viability as much as feasible.

Summer fun at Franconia Falls (WMNF photo by Forrest Seavey)

Recreation

This section includes four sub-sections:

- Introduction
- General Recreation
- Recreation Activities
- Alpine Skiing

Introduction

Analysis Area

The analysis area is defined by the federal land managed on the White Mountain National Forest. The analysis area for individual recreation activities varies in scale, however. As explained below, some activities are suitable across the entire Forest, and others take place only in specific areas. The following rationales determined the analysis area for individual recreation activities in WMNF Plan revision, and was subsequently used to determine the analysis area for recreation as a whole.

Recreation activities connected to certain described areas can be considered distinct, and thus constitute an analysis area in themselves. They include:

- Spring skiing and ice climbing in Cutler River drainage.
- Recreation use in Congressionally-designated Wilderness.
- Recreation use in the Alpine Zone.
- Recreation use of the Appalachian Trail.

The Forest provides a unique setting to enjoy some recreation activities not similar to other areas in New England (see Forest Recreation Niche). In these cases the Forest itself is considered the analysis area. Only on the Forest would these activities receive impacts from other management activities or impact other ecological or social values. These include:

- Non-motorized activities –hiking, cross-country skiing on ungroomed or packed trails, mountain biking, snowshoeing, etc.
- Back country camping (backcountry facilities [huts, cabins, shelters, tent platforms] and dispersed campsites).
- Outfitter/guide use.
- Rock and ice climbing.

Some recreation activities are not unique to the Forest. Any decisions made about these activities on the Forest would not be enough to affect similar opportunities elsewhere. The analysis area for these activities is the WMNF land base. Only in these areas would these activities receive impacts from other management activities or impact other ecological or social values. These include:

- Hunting.
- Fishing.
- Developed recreation, including picnic areas, overlooks, water play sites (e.g., Lower Falls, South Pond), visitor centers, family and group

campgrounds, roadside camping areas (e.g., Gale River, Little Lary Roads), and roadside overnight sites (e.g., Tripoli, Gale River).

- Driving for pleasure (viewing scenery from roads only).
- Summer motorized trails.

Some recreation activities may or may not be substantially present on the Forest but are linked to similar activities elsewhere. There is no expectation that Forest Plan revision decisions would be noteworthy enough to substantially affect these activities. Conversely there is no expectation that whatever decisions are made on these opportunities elsewhere would affect this activity on the WMNF. The analysis area for these activities is the WMNF land base. But there are some contextual points that have to be made. These include:

- Snowmobiling is important to the corridor trail system of New Hampshire because of its location covering almost the full breadth of the state.
- Alpine Skiing — Forest Plan revision keeps the current ski areas and the current potential expansion areas. There is no site-specific proposal in Forest Plan revision that would affect other ski areas. Any proposal for expansion would trigger the NEPA process, which is when an analysis area would include other ski areas.

The Forest Recreation Niche

Recreation on the White Mountain National Forest covers many activities, settings, and opportunities and is enjoyed by a wide range of visitors. The niche described here doesn't begin to address all of the ways in which people enjoy their National Forest. It does try to cover the essence of what makes the White Mountain National Forest unique.

An "Urban Forest," the White Mountain National Forest provides a place of both wildness and naturalness within a day's drive of 70 million people. The majority of visitors come from New England, particularly Massachusetts and southern New Hampshire. There are also significant numbers of French-speaking Canadians and international visitors. Recreation use is high, with intense public pressure. There are many repeat visitors and families that have been coming to the White Mountains for generations. These people are part of a tradition of mountain-based tourism and recreation that began in the early 1800s and lives on today in numerous and very active hiking and mountain clubs. While the exact make-up of these and other groups has changed over the past 150 years—and will no doubt continue to change over time in ways that cannot yet be imagined, the National Forest will continue to draw immense numbers of people to its mountains. A big forest in a small state, it is one of the largest pieces of public land in the Northeast. The New Hampshire state tourism industry heavily promotes the National Forest, locally, regionally, and internationally. In turn, the Forest provides large economic benefits related to tourism for local and regional economies.

Recreation on the White Mountain National Forest is about mountains. Some of the most spectacular mountain terrain and scenery in the eastern US is

contained within its boundaries, including Mt. Washington, the highest peak in the Northeast. Terrain and weather combine to create one of the lowest elevation treelines anywhere in the world at this latitude. With 12.1 square kilometers of true alpine vegetation, the White Mountain National Forest has the largest alpine area in the eastern US and south of Labrador. The alpine area is significant both as an ecological community and as a draw for hikers and backpackers.

The Forest is home not only to the famed Presidential and Franconia ridges, but also to quiet woods and smaller mountains with equally grand views. The mountains provide the background for driving for pleasure, multi-day backpacking trips, gentle walks, and 160 miles of the Appalachian National Scenic Trail (AT) as it makes its way between Georgia and Maine.

The Forest draws millions of people to

Be in the mountains:

- Hike, snowmobile, ski, and walk in a rugged and relatively unspoiled mountain environment.
- Take advantage of about 1,200 miles of non-motorized trails on which to explore the upper — or lower and less difficult — reaches of the mountains.
- Seek out the largest alpine area in the eastern US and southern Canada.
- Enjoy a quality alpine and cross-county skiing experience on some of the most diverse ski areas in the eastern US.
- Explore the largest expanse of federally-designated Wilderness in the eastern US.
- Enjoy a unique mountain hut system, managed by the Appalachian Mountain Club under special use permit.

Look at the mountains:

- Drive along scenic byways with spectacular settings.
- Take advantage of high quality interpretation and recreation opportunities along the Kancamagus Scenic Byway.
- Camp in one of 20 family or 3 group campgrounds. The “full” signs posted most summer weekends attest to their popularity.
- Take advantage of roadside day use areas for relaxing by waterfalls, rivers, or ponds.

Be challenged by the mountains:

- Find opportunities for challenge at all ability levels.
- Seek a challenge in some of the harshest weather conditions on earth (including the highest recorded land wind speed of 231 MPH). Many renowned mountaineers have used the White Mountains as a training ground for international expeditions — with the same cold, extreme temperatures and wind as the more famous big mountains — everything but the elevation.
- Experience backcountry skiing and mountaineering in remote backcountry bowls, including the famous Tuckerman and Huntington

> ravines. Huntington was an early mecca for ice climbers, and along with other areas on the forest continues to provide remote climbs. Tuckerman Ravine is most famous for extreme spring skiing. Both ravines serve as home to the oldest Forest Service avalanche forecasting program in the country, a reminder that even in the East avalanches can and do kill people.

This mountain environment, where one can feel remote even close to roads, helps provide a sense of both wildness and naturalness not often found in the eastern US. In the hectic world of New England, being in the White Mountains gives people a chance to breathe, reflect, and find their own way.

The current approach to recreation management focuses on 1) general direction to provide a range of quality recreation opportunities, and 2) concentrating use at specific locations. The current Forest Plan has little direction or guidance for managing or limiting use levels to help avoid problems before they occur, and may not adequately respond to increasing recreation use.

The presence, type, and location of trails and facilities, the Forest's recreation history, and personal preference are all factors determining use levels and use patterns on the Forest. Generally, however, visitors coming to the White Mountains are expected to increase because of external forces (e.g., increasing development and continuing population growth) generally unrelated to changes in trail miles or backcountry facilities.

Winter in Tuckerman Ravine (WMNF photo by Forrest Seavey)

General Recreation

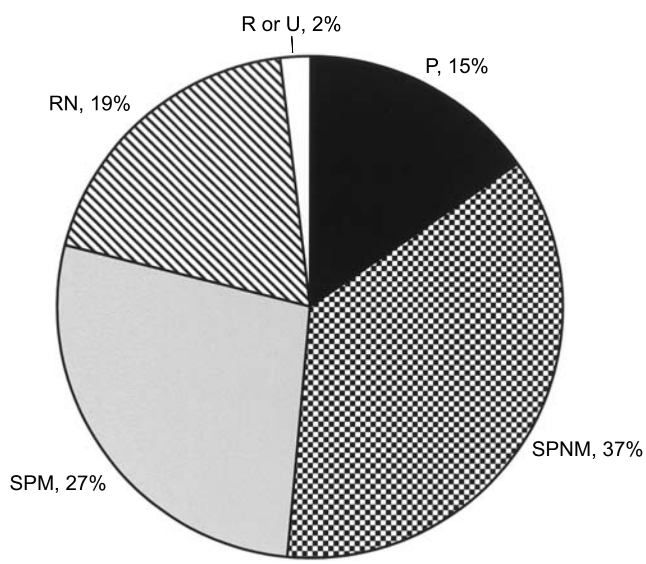
Affected Environment

Recreation Opportunity Spectrum (ROS)

The Forest Service uses the Recreation Opportunity Spectrum (ROS), a national recreation planning framework, to inform management for a range of recreation activities and opportunities. ROS combines physical, social, and managerial settings to help define a range of outdoor recreation conditions, activities, and opportunities (USDA, undated). The *physical setting* attributes include remoteness, size, and evidence of humans (modification of the natural environment, evidence and kind of trails, and presence of structures). The *social setting* is the level of contact with others. The *managerial setting* is the presence and amount of regimentation and controls (signage, presence of backcountry patrols, etc.). These combinations are grouped into five ROS Classes: Urban (U), Rural (R), Roaded Natural (RN), Semi-Primitive Motorized (SPM), Semi-Primitive Non-motorized (SPNM), and Primitive (P). Appendix H provides a detailed description of each of the ROS Classes. In general, however, the experience opportunities range from areas with more modified settings accommodating greater numbers of visitors (U, R, RN) to those offering a choice of solitude and challenge (SPM, SPNM, P).

Fifteen percent of the Forest is identified as Primitive, 37 percent as SPNM, 27 percent as SPM, 19 percent as Roaded Natural, and the remaining 2 percent is classified as Rural or Urban. Through public involvement, the Forest Service has concluded that there is neither a pressing need to reallocate zones nor to significantly alter the spatial makeup of recreation opportunities (Figure 3-07).

Figure 3-07. ROS Objectives as a Percentage of the Forest.



Management areas may have more than one ROS objective (Table 3-61). For example, MA 2.1 (General Forest Management) will generally have an ROS objective of RN within a half-mile of a road, and an ROS objective of SPM beyond that, where scheduled timber harvests are accomplished with temporary roads.

Table 3-61. ROS Objectives Within Management Areas

Management Area	ROS Objectives Within MAs					
	P	SPNM	SPM	RN	R	U
5.1 and 9.1 Designated Wilderness and Recommended Wilderness	X	X				
6.2 Nonmotorized recreation emphasis	X	X				
8.1 Special Areas — Alpine Zone (only in Alts 2, 3, and 4), Appalachian Trail (8.3 in Alts 2, 3, and 4), and Scenic Areas (8.5 in Alts 2, 3, and 4) all Scenic Areas except Rocky Branch and Pinkham Notch	X	X				
6.1 non-motorized rec. emphasis but allowing snowmobile trails and 6.3 allowing snowmobile trails in winter but managed for non-motorized activities in the summer		X	X			
8.1 (8.5 in Alts 2, 3, and 4) Scenic Area Rocky Gorge				X		
7.1 and 9.2 (Ski Area Permits and potential Ski Areas)					X	X
9.4 and 2.1 a Holding Area (not present in Alts 2, 3, and 4)		X	X			
8.1 (8.5 in Alts 2, 3, and 4) Scenic Area Pinkham Notch		X	X	X		
2.1 General Forest Management			X	X	X	X
8.1 (8.2 in Alts 2, 3, and 4) Experimental Forests			X	X		
8.1 (8.4 in Alts 2, 3, and 4) RNAs	SPNM but Recreation use incidental and not encouraged					
9.3 Candidate RNAs	SPNM but Recreation use incidental and not encouraged					

Within any ROS objective area there are sometimes aspects of the setting attributes that do not match the overall ROS objective of the area. These are termed "inconsistencies." Options for addressing inconsistencies vary from accepting it, mitigating its effects, or removing it. For example, the AMC Huts are recognized inconsistencies within the SPNM ROS objective of their location, and there are constraints on their operation (reduced helicopter

flights, limiting radio transmissions when possible, etc.) to mitigate their effect. In some cases, cumulative inconsistencies may be substantial enough to require changing the ROS objective.

Forest Plan direction, requiring management actions to be compatible with the ROS objective, should prevent additional inconsistencies. ROS objectives influence monitoring methods. For example, visitor satisfaction monitoring in a Roaded Natural ROS Class will be structured differently than that done in an area with a Primitive ROS objective.

Recreation Activities

Some recreation activities allowed by the ROS Objective may not be permitted for other reasons. For example, Wilderness may have a P or SPNM objective, but mountain bike use is prohibited (Table 3-62).

Table 3-62. Recreation Activities Currently Allowed, by Percent of the Forest.

MA	ROS Objective	Recreation Activities	% Forest
5.1, 9.1 (no 9.1 in Alt. 1)	P, SPNM	Non-motorized but prohibits mountain biking and de-emphasizes back-country facility camping.	14
8.3	SPNM	Non-motorized but prohibits mountain biking.	1
6.2, 8.1, 8.5	SPNM	All non-motorized dispersed recreation activities.	21
6.1, 6.3	SPNM with SPM (snowmobile trails) allowed in winter	Motorized (winter) and non-motorized dispersed recreation activities	16
2.1 (and 3.1 in Alt. 1), 8.2	SPM, RN, R, U	Complete mix of all motorized and non-motorized dispersed and developed recreation activities.	46
8.4, 9.3 RNAs and CRNAs	SPNM but Recreation use incidental and not encouraged	Only incidental non-motorized	1
7.1, 9.2	R or U	Alpine skiing and releated summer uses (lift rides, mountain bikes, etc.)	1

Environmental Effects

Effects on the Forest Recreation Niche

The Forest Recreation Niche provides an overall view of the setting, type, and quality of the experience a person can expect when visiting the White Mountain National Forest. The effect of projected growth and expansion in recreation activities on this niche is a major issue in Forest Plan revision. The consequences of the different recreation management approaches used in each of the four alternatives, and how they respond to recreation growth, are examined here. The management approaches outlined in the alternatives address changes anticipated over the next ten to fifteen years that could affect, to some extent, the Forest's recreation niche.

All alternatives continue to recognize that "This mountain environment, where one can feel remote even close to roads, helps provide a sense of both wildness and naturalness not often found in the eastern United States. In the hectic world of New England, being in the White Mountains gives people a chance to breathe, reflect and find their own way." They also incorporate a range of opportunities that include developed and dispersed camping, driving for pleasure, snowmobile trail riding, hobby mineral collecting, and natural and cultural resource interpretation, etc., at levels compatible with other resource objectives.

Cumulative effects focus on how foreseeable future actions may impact the long term consequences of projected growth in recreation demand. These include:

- Increasing regional development.
- Increasing population.
- Increasing acquisition of "conservation lands."
- Conversion of timber company lands historically open to recreation.

Effects Common to All Alternatives

Direct and Indirect Effects

Minerals

The mineral potential of the Forest is low (see Geologic Resources section). Mineral activities could effect recreation; however, NEPA analysis would be required for any proposed project.

Table 3-63 shows the relationship between MAs and direction for the extraction of leasable minerals, as well as potential recreation impacts.

Recreational mineral collecting has potential effects on other recreation activities, and the effects vary by management area and whether recreational mineral collecting is allowed or prohibited. MA direction allows recreational mineral collecting only in MAs 2.1, 6.1, 6.2, and 6.3, but within these, only some specific areas are potential sources of desirable minerals. Gold panning

Table 3-63. Potential impact of leasable minerals on recreation by MA.

MA	Leasable (Commercial) Mining	Potential recreation Impacts
2.1	Open to leasing	Potential visual, noise, and physical disruption impacts to recreation in defined areas where minerals or fissionable materials are leased but chances that this would actually occur are minimal. A higher chance that there may be leasing for specialty minerals which would also have visual, noise, or physical disruption impacts to recreation activities. No operations are currently being conducted.
5.1, 7.1, 8.6	Withdrawn via legislation	No effect on recreation activities in these management areas.
6.1, 6.3, 8.4, 8.5, 9.1, 9.2	No surface occupancy	Generally no effect on recreation activities in these management areas
6.2 8.1 8.3, 8.2	Administratively unavailable	No effect on recreation activities in these management areas
9.3	No mineral activities permitted which may alter the character or diminish the potential for a decision regarding designation is made.	Recreation use is incidental and not encouraged. — Minimal effects.

is popular on the west side of the Forest; smoky quartz collecting from bedrock is prevalent in the Moat Mountain Range, just west of Conway. Purple amethyst is collected by digging into glacial till on Deer Hill in Maine. When recreational mineral collecting occurs, there will be removal of vegetation and extensive digging done with hand tools, which could directly impact recreation visitors in these localities. The visual evidence of recreational mineral collecting will last beyond the actual collecting period.

Recreational mineral collectors continually search out new locations, and if more are identified, there will be similar localized direct and indirect effects on other recreation opportunities.

Communication Sites and Wind Towers

Special use permits for designated communication sites could be granted in Management Area 7.1 (permitted alpine ski areas) pending analysis under NEPA. These are consistent with the highly-developed character of the ski areas. To some skiers, the presence of communications sites would have little effect on their experience, while for others, they could have considerable impact. The visual impacts are not limited to the location itself: there are off-site visual effects to backcountry visitors and others. The intensity of the visual impact would vary, based on the design of the site, the location of the viewer, and the season.

Special use permits for the operation of wind towers could be granted in Management Areas 7.1, 9.2, and 2.1 (and 3.1 in Alternative 1) pending NEPA analysis. These could have strong visual impacts on Forest recreation visitors, especially if there are multiple towers. Although they are consistent with the highly-developed character of ski areas, their presence could still have a substantial visual effect on skiers and an even stronger visual effect on recreation visitors off-site. In MA 9.2 (potential ski areas) and 2.1, there would be visual impacts on backcountry hikers and campers on-site and off-site, as this level of development is currently not present in these management areas. There would be more roads, more noise, and more visual impacts. Scenery Management direction should mitigate some of the visual effects.

Roads and Vegetation Management

The impacts of roads and vegetation management on recreation visitors are typically clear. Trails that are temporarily or permanently relocated as a result of harvesting operations dislocate users of those trails. On the other hand, timber roads may be designed and located to improve hiking and snowmobile trails when operations have ended.

Specified roads, reconstructed for timber harvest access in areas designated Roaded Natural are consistent with the objective. The direct impact on the recreation visitor's experience should occur only during active logging, when equipment and workers are present.

There is a more indirect effect on the ROS objective. Specified roads reconstructed for access, skid trails, and the presence of equipment and workers resulting from timber harvest would create a temporary Roaded Natural appearance within the portions of MA 2.1 with an ROS objective of SPM. Although the span of activity is usually less than five years, the visual effect of the temporary roads on the SPM ROS objective setting could last several years longer. Eventually, however, the area will revert to ROS objective of SPM as revegetation occurs. The acres available and the intensity of timber harvest will determine the area impacted, but, generally, in any one year about one percent of the MA 2.1 land base will have active timber sales. Assuming that 20 years is necessary for signs of these operations to become essentially unnoticed by the casual user, about 20 percent of MA 2.1 will have a Roaded Natural appearance. Conversely, up to 80 percent of the area would continue to provide relatively remote, non-motorized recreation opportunities. The acres, the intensity, and the type of timber management changes by alternative, and will result in small differences in the extent of impacts to the SPM ROS objective. These areas would change location from year to year.

In MA 6.1, with an ROS objective of SPNM in summer (but allowing snowmobile use in winter), the occasional introduction of temporary roads (typically for logging activities) would have a transitory impact. A temporary Roaded Natural setting inconsistency would be created, and could last up to several years, depending on the size and intensity of the activity. In any case, the intent in this MA would be to obliterate the temporary road once it is not needed, and to allow it to return to a state consistent with the targeted ROS objective. The need for temporary roads is unpredictable; therefore

the presence, size, and intensity of their impacts are not known. Among the alternatives, there are only minor differences in acres allocated to this management area, and essentially no effect on temporary road needs.

Research Activities

Although recreation activities are permitted in Experimental Forests (MA 8.2), they are secondary to research. Temporary or permanent closing of roads to vehicles, mountain bikes, and snowmobiles may occur, as well as additional restrictions to protect research investments at specific locations.

In Research Natural Areas (MA 8.4), recreation is incidental and will not be encouraged. Existing recreation use in these areas may be limited or prohibited.

Research projects in other parts of the Forest should have little effect on recreation activity settings, as the research is constrained by the management area objectives.

Cumulative Effects

There was some commercial mineral activity in the White Mountain region at the beginning of the twentieth century, but there has been very little since. Currently, no commercial mineral activities are taking place on the Forest, although there has been an interest in leasing. Based on present knowledge, it is unlikely that minerals such as metals or fissionable materials, which have limited known potential on the Forest, would be extracted within the foreseeable future. Intensive research regarding the potential presence of significant mineral deposits has been focused at the experimental forests for decades, and should continue to be centered there. Little change is expected in the factors determining current Forest levels of mineral activity, vegetation management, and research activities. As a result, the direct and indirect effects of these activities should continue unchanged during the planning period.

Requests for designated communication sites have been a recent phenomenon. Although this demand could continue, technology has been constantly improving and there are some who believe that ground-based communications sites will not be necessary in the foreseeable future, but that is uncertain. The Forest Service allows for their consideration only in permitted ski areas. If the need for designated communication sites continues, there would be increased development on private lands in and around the Forest. Because of intermixed land ownership and the miles of private public boundaries, the visual effect would be evident to the Forest recreation visitor.

Projections for growth in wind energy are mixed. If development becomes more important, the Forest Service may experience more proposals for wind towers or wind energy sites. A sizeable portion of the Forest land base allows for their consideration. How much of this land is technically feasible for such use has not been determined. If demand is high, and there is little Forest land technically practicable, there would be increased growth on adjacent private lands, and the visual effect would be evident to Forest recreation visitors.

Alternative 1

Direct and Indirect Effects

Recreation Management Approaches

The current Forest Plan provides little direction for managing or limiting use to prevent problems. There are no stated levels or thresholds to help guide an overall approach or to identify specific desired outcomes. Over the last fifteen years, the Forest Service has responded to areas where recreation use or specific activities created particular resource or social concerns. Relocating trails away from threatened alpine plants or sensitive riparian areas have been successful, but in some cases this approach can appear haphazard, and a stated direction that ensures consistent Forest-wide implementation may be lacking.

Under this alternative, the recreation management approach will respond to important resource or social interaction problems when they become apparent or cause a significant public concern. However, continuing in this direction will make it difficult to manage the Forest's recreation opportunities as an interrelated system, and may not adequately address increases in use. Recreation use at the landscape level will continue to increase, due to increasing population in the surrounding area. Use at the Forest level will continue to be focused on trails or backcountry facilities. The development level of the backcountry may increase. Low use areas and facilities may move to higher use, and therefore the range of different recreation experience opportunities available to the Forest visitor may be narrowed.

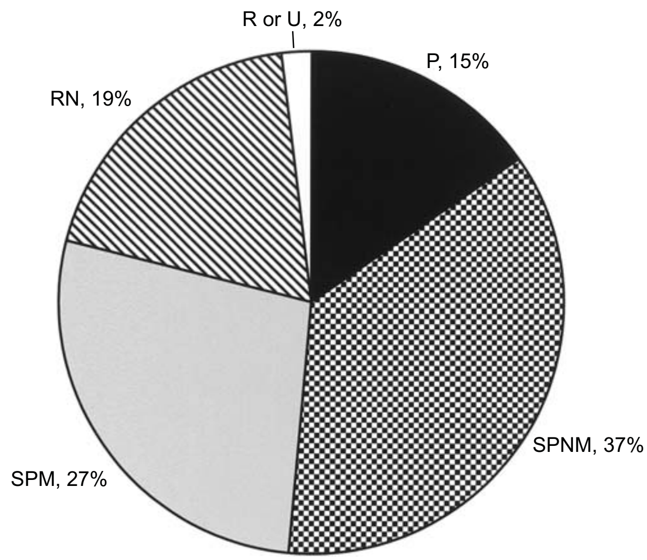
This alternative allows construction or designation of up to 60 miles of summer motorized trails on a trial basis in management areas 2.1 and 3.1. Proposals submitted by the public would be evaluated on a case-by-case basis, with use being limited to ATVs and trail bikes. Although no summer motorized trails are authorized at present, current levels of interest and growth of the activity on private and other non-federal public lands will very likely lead to multiple proposals. With potential approval and construction of up to two summer motorized trail areas, the current summer setting and recreation experience will change in particular locations. The exact location will not be known until a decision is made on a site-specific proposal using the NEPA process. ATV trail construction and management can be costly. In order to mitigate resource impacts, design requirements are nearly the equivalent of those for gravel roads. There is a risk of illegal use (and its potential resource impacts) off designated trails, as well as the potential of illegal use continuing at locations some distance from any designated trails. These factors contribute to the high cost of the program. Although, as with snowmobile trails, the states of Maine and New Hampshire would probably provide some support through local clubs, ATV trail maintenance and use management costs would still be considerable. Budget is generally not a factor in Forest planning, but the economics of this new activity are substantial enough to require consideration. There would be reallocation within the Forest recreation budget to address the costs, and their intensity would vary, depending on budget, state and local club support, and the extent of enforcement concerns. In addition, the

potential exists for summer visitors to be impacted by noise and other characteristics of motorized trail use at several locations within the 2.1 and 3.1 management areas. This alternative provides an opportunity on National Forest land for a recreation activity which some Forest stakeholders have requested. Because of the limited size of the potential trail system, off highway vehicle users would also need to use other places on public and private land that provide this type of recreation activity.

Recreation Opportunity Spectrum

This section shows the consequences of varying ROS objectives resulting from management area allocations (Figure 3-08).

Figure 3-08. ROS Percentages Under Alternative 1.



About 52 percent of the Forest is composed of ROS objectives P (15 percent) and SPNM (37 percent). There is no change from the current. About 20 percent is within a half-mile of permanent roads and therefore has an ROS objective of RN. Those areas with a SPM ROS objective constitute about 27 percent of the Forest land base, and are found mostly in MAs 2.1 and 3.1 (General Forest Management). This does not mean, however, that non-motorized opportunities do not exist in areas with a SPM ROS objective. Given that less than one percent of the Forest is harvested annually, and with revegetation making harvest activities essentially unnoticeable within a twenty year period, less than 20 percent of MAs 2.1 and 3.1 would show impacts from timber harvesting. Conversely, in any one year about 80 percent of the SPM area in MAs 2.1 and 3.1, amounting to about 180,000 acres, would offer relatively remote, non-motorized recreation opportunities. This amounts to 23 percent to the Forest, and, when added to the other areas managed for P or SPNM objectives, the total reaches 68 percent of the Forest land base that offer these types of opportunities. Rural (R) and Urban (U) ROS objectives areas include permitted Alpine Ski areas (MA 7.1), because of their high level of development, and areas of the Forest strongly influenced by adjacent development. These are often the result of the private/public land interface.

Recreation Activities

This section shows the consequences of the differences in recreation activities by alternative. Recreation activities, although defined by management area and then by ROS Objective, may also differ for other reasons. For example, Wilderness prohibits mountain bike use but would have either a P or SPNM ROS objective which allows mountain bikes.

In general, non-motorized recreation activities are allowed throughout the Forest but there are differences in acres of management areas where particular non-motorized activities are or are not allowed. Alternative 1 allows the full spectrum of non-motorized recreation activities on 83 percent of the Forest. One percent, the Appalachian Trail MA, prohibits mountain biking, and another 14 percent (Wilderness) prohibits mountain biking and de-emphasizes backcountry facilities (see alternatives comparison, Chapter 2).

The Caribou-Speckled area, recommended for Wilderness in the current Plan, has since been designated and no Recommended Wilderness is proposed in this alternative. This may mean increased use within existing Wilderness and the potential for additional management actions to ensure compliance with the Wilderness Act (see the Wilderness section). This alternative would not change the availability of mountain biking and backcountry facility camping.

Vegetation Management

In this alternative, Management Areas 2.1 and 3.1 constitute about 44 percent of the Forest (355,000 acres). An allowable sale quantity (ASQ) of 35 MMBF per year would involve 3,800 acres per year, or one percent of the MA 2.1/3.1 land base in any one year. The displacement of trail users, the effect on the ROS objective, and trail re-routing would be the highest under this alternative.

Cumulative Effects

There is expected to be increasing development in and around the Forest as well as increasing population in the surrounding region for Forest recreation visitors in the long term. This should give ever-greater importance to those activities and opportunities unique to the White Mountains. The Forest Recreation Niche will also grow in importance, to the extent it accurately expresses the unique activities and experiences of the Forest. Increasing growth over the long term would make it more difficult to maintain or improve the Forest recreation niche with the recreation management approaches in Alternative 1.

"Conservation" lands are being acquired throughout New England, but at the same time, many acres of timberland are being converted to other uses in response to increasing development. The eventual outcome of these counteracting trends and how it will affect the supply of land for dispersed recreation is uncertain. Those users seeking the trail and backcountry areas or opportunities with experiences similar to the Forest may be able to find them off the Forest if conservation acquisition keeps pace with recreation demand. Land development pressures south of the Forest will force people

to continue to rely heavily on both public and private land in the northern Forest area for dispersed recreation activities, particularly for non-motorized dispersed.

In the foreseeable future, with the same factors operating as stated in the direct and indirect effects, these recreation management approaches may not be sufficient to address demands linked to increasing population and the uncertainty of the outcome between acquiring conservation lands versus converting timberland to development. As a result, they may not be able to maintain the Forest recreation niche, the mix of Recreation Opportunity Spectrum objectives, or the range of quality recreation activities.

This alternative responds to increased demand for motorized trail recreation, albeit in a limited way. Off-highway vehicle users would increasingly need to use other places on private and non-federal public land that permit this type of recreation activity. The cumulative effect is generally the same as the direct and indirect effects. Including summer motorized trails could result in a change in the public's perception of the Forest's recreation niche.

There is expected to be increasing demand for Wilderness recreation. Because this alternative does not include Recommended Wilderness, it responds the least of all the alternatives to this demand.

Alternative 2

Direct and Indirect Effects

The additional recreation management approaches in this alternative provide Forest recreation managers a more complete framework to consider management actions (see Chapter 2). They evaluate how those actions fit within the overall goals of preventing increased development levels in the backcountry and protecting and managing both high and low use areas and facilities. The Forest's Wilderness Management Plan (Forest Plan, Appendix E) follows a similar process, and could serve as a model — recognizing that other management areas have different management objectives and would require different indicators, thresholds, and education or management actions. The overall effect of these approaches would be to guide and build public support for necessary agency actions in response to changing or increasing use. The anticipated consequences are that

- Use will continue to be focused on trails or at backcountry facilities.
- Current development levels in the backcountry will be maintained, or lowered where appropriate.
- Forest management actions will not disperse use from high to low use areas.
- Current low use areas and facilities will be managed to meet visitor needs and resource requirements through education and management controls, where necessary.
- High use areas and facilities will be managed for high use to meet visitor needs, while ensuring that they can be sustained over the long term.

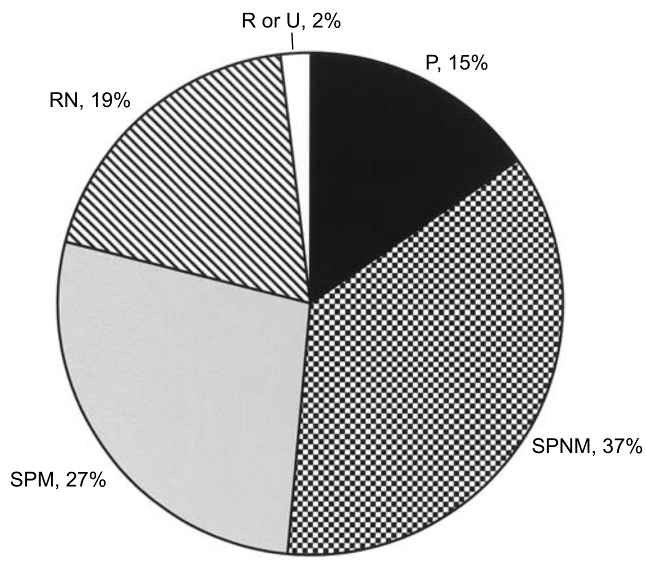
- The ROS objectives will not change and there should be no increase in the number of setting inconsistencies.

The majority of the Forest will continue to be managed for a semi-primitive or primitive non-motorized recreation experience. This alternative prohibits summer motorized trails. It maintains opportunities for motorized use on open roads by street legal vehicles. Winter motorized trails would provide the only other motorized trail opportunity available over the planning period. It would not respond to Forest stakeholders who have requested that ATV use be provided by the Forest. There would be no addition to the current mix of recreation activities on the Forest. Off-highway vehicle users would need to find other locations on private and non-federal public land that provide this type of recreation activity.

Recreation Opportunity Spectrum

The differences in ROS objective acres in this alternative are not substantial enough to result in differences by percent of the Forest compared to Alternative 1. (Figure 3-09).

Figure 3-09. ROS Percentages Under Alternative 2.



Recreation Activities and Management Areas

Alternative 2 allows the full spectrum of non-motorized dispersed recreation opportunities on 75 percent of the Forest. Another 5 percent generally prohibits mountain biking (most of the Appalachian Trail MA). A further 18 percent could eventually prohibit mountain biking (mountain biking is allowed in Recommended Wilderness areas on existing trails, but it would be prohibited if the area is designated Wilderness by Congress) and de-emphasize backcountry facilities (Wilderness and Recommended Wilderness). This alternative will have about 6 percent less of the Forest available to mountain bikers than Alternative 1, and 2 percent more area than Alternative 1 where backcountry camping facilities will be absent or minimal. On the other hand, it will have that many more acres than

Alternative 1 on which only non-mechanical, non-motorized use is allowed (see alternatives comparison, Chapter 2).

There are 34,500 acres of Recommended Wilderness in this alternative, in the Wild River and Sandwich Range areas. This provides additional Wilderness values in the Forest recreation mix, but a 4 percent change from current over two areas on the Forest would have limited effect. An increase in Wilderness is consistent with the Forest emphasis on non-motorized semi-primitive and primitive recreation, but it carries with it potential effects on mountain biking and backcountry facility opportunities. If these 34,500 acres are ultimately designated Wilderness by Congress, there would be 61 miles of system trails unavailable to mountain bikes (23 miles in the Sandwich Range and 38 miles in Wild River). All these trail miles are not necessarily used by or suitable for mountain bikes, but the figures give some indication of the potential effect (see alternatives comparison, Chapter 2).

Vegetation Management

In this alternative, Management Area 2.1 constitutes about 45 percent of the Forest (358,200 acres). With an allowable sale quantity (ASQ) of 24 MMBF annually, vegetation management would involve 3,400 acres per year, representing 0.9 percent of the MA 2.1 land base. Conceptually, the level of displacement of trail users, the effect on the ROS objective, and trail rerouting would be less than in Alternatives 1 and 4, but more than in Alternative 3.

Cumulative Effects

In the foreseeable future, with the same factors operating as in direct and indirect effects, the recreation management approaches may be sufficient to address demands linked to increasing population and development, and the uncertainty of the outcome between acquiring conservation lands versus conversion to development of previously accessible timberlands

The cumulative effects of continuing in this direction would intensify these direct and indirect effects over the long term, but would be countered by the recreation management approaches guiding Forest management actions in response to increasing use to balance the range of high quality recreation opportunities across the Forest. This should make it easier to manage the Forest's recreation opportunities as an interrelated system, and more likely to address increasing use levels adequately.

It is expected that demand for summer motorized trails will increase in the region. This alternative does not provide any of these opportunities on the Forest. The cumulative effect would be the same as the direct and indirect effects over the long term: off highway vehicle users would need to find other places on private and non-federal public land that provide this type of recreation activity. Not including summer motorized trails as part of the Forest recreation activity mix in the long term would maintain the current Forest recreation niche.

Additional Wilderness values of 4 percent Recommended Wilderness in this alternative would be coupled with the current 14 percent designated Wilderness to total 18 percent of the Forest land base potentially in designated Wilderness. This alternative places a moderate emphasis (more

than Alternatives 1 and 4 but less than Alternative 3) on Wilderness. Consequently, over time it would have a moderate effect on the balance of recreation opportunities. Conversely, the same number of acres would be closed to mountain bike use and would de-emphasize backcountry facility camping.

Alternative 3

Direct and Indirect Effects

Recreation Management Approaches

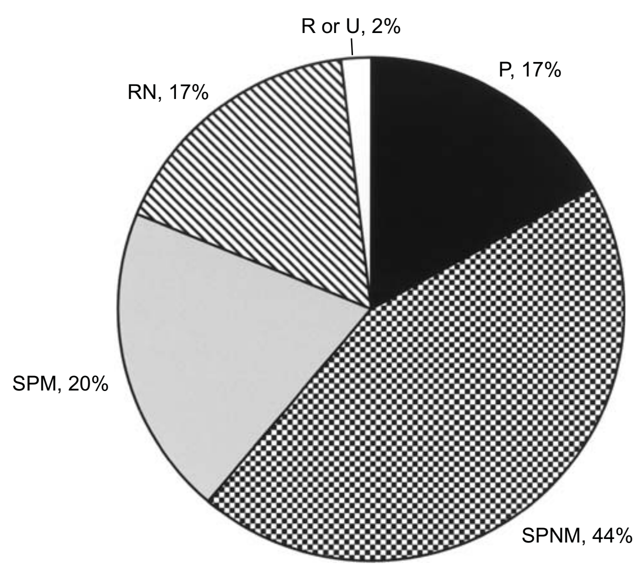
This alternative is the most restrictive in terms of allowed increases in campgrounds, backcountry facility capacity, snowmobile trails, and non-motorized trails. But generally, the effects of Alternative 3 in regards to recreation approaches are the same as for Alternative 2.

The direct and indirect effects of Alternative 3 are the same as for Alternative 2 in terms of prohibiting summer motorized trail opportunities and continuing winter motorized trail opportunities.

Recreation Opportunity Spectrum

Alternative 3 has the largest difference in ROS objectives of all the alternatives. It changes the mix of ROS objectives by increasing the primitive and semi-primitive non-motorized areas while reducing the semi-primitive motorized and roaded natural area. The almost 100,000 acres of recommended Wilderness drive this difference (Figure 3-10).

Figure 3-10. ROS Percentages Under Alternative 3.



Recreation Activities

Alternative 3 allows the full spectrum of non-motorized dispersed recreation opportunities on 67 percent of the Forest. Another 5 percent generally prohibits mountain biking. A further 26 percent could eventually restrict mountain biking (mountain biking is allowed in Recommended Wilderness on existing trails but would be prohibited if designated Wilderness by Congress) and de-emphasizes backcountry facilities. This alternative would

make approximately 16 percent less of the Forest available to mountain bikers than Alternative 1 and 12 percent more area than Alternative 1 where backcountry camping facilities will be absent or minimal. On the other hand, it will have that many more acres than Alternative 1 (Wilderness) where only non-mechanical, non-motorized use is allowed (see alternatives comparison, Chapter 2).

This alternative has 97,800 acres of Recommended Wilderness in the Wild River, Sandwich Range, Kilkenny, Dartmouth, and Pemigewasset areas. An increase in Wilderness is consistent with the Forest emphasis on non-motorized semi-primitive and primitive recreation, but carries with it potential effects on mountain biking and backcountry facilities. If these 97,800 acres are ultimately designated Wilderness by Congress, there would be 107 miles of System trails unavailable to mountain bikes (23 miles in the Sandwich Range, 26 miles in the Kilkenny, 20 miles in the Pemigewasset Extension, and 38 miles in Wild River). All these miles of trail are not necessarily used by, or suitable for, mountain bike use, but the figures give some indication of the potential effect (see management areas and how they determine the mix of recreation activities by alternative).

Vegetation Management

In this alternative, Management Area 2.1 constitutes about 37 percent of the Forest (296,100 acres). With an allowable sale quality of 18 MMBF annually, it would involve about 3,300 acres per year, representing 1.1 percent of the MA 2.1 land base. Conceptually, the level of displacement of trail users, the effect on the ROS objective, and trail reroutes would be less than Alternative 1 and 4, but slightly more than Alternative 2.

Cumulative Effects

Other than the effect of Recommended Wilderness, the cumulative effects are the same as Alternative 2.

There is an additional 97,800 acres of Recommended Wilderness areas in this alternative. An additional 12 percent Recommended Wilderness in this alternative would be coupled with the current 14 percent of designated Wilderness. This alternative places the highest emphasis on Wilderness, consequently it would have the most effect on providing increased Wilderness recreation.

Alternative 4

Direct and Indirect Effects

Recreation Management Approaches

The additional recreation management approaches in this alternative provide Forest recreation managers with a more complete framework to consider management actions. They evaluate how those actions fit within the overall goals of preventing increased development levels in the backcountry, and protecting and managing both high and low use areas and facilities. Countering this direction is the fact that this alternative also has the largest allowable increases in campgrounds, snowmobile trails, non-motorized trails, and backcountry facility capacity. This may result in use

continuing to be focused on trails or at backcountry facilities, but there will be additional trail miles and more backcountry facilities. In this alternative some of the increases in facilities and infrastructure may result in some high use areas having increased capacity, and eventually higher use, but not beyond sustainable levels. There may be cases where currently low use areas get additional backcountry facility capacity or more trail miles, which may bring them into a higher use category. There may be some differences in determination of thresholds to accept higher use level impacts. Even though these increases in facilities and infrastructure are greater than Alternative 1, the effects should be somewhat balanced by the provisions to respond to increasing and changing use patterns and to seek appropriate solutions within Forest-wide guidance. The additional recreation management approaches should, to some extent, mitigate the impact of increased infrastructure.

This alternative provides for a pilot (3 year test period) summer motorized trail proposal in either the Landaff area (7,500 acres, north of Route 112 and west of Route 116) or the Moat Mountain area (3,400 acres, west of West Side Road). Potential approval of a summer motorized trail proposal in one of these two areas, even though a pilot program, could result in up to 30 miles of summer motorized trails becoming a permanent recreation activity provided by the Forest. The specific location of the trail within the selected area would be based on site-specific NEPA analysis. The direct effects are generally comparable to those described in Alternative 1. Because this alternative represents only half the miles as Alternative 1, the effects would be similarly reduced. The consideration of two specific areas in this alternative allows for estimation of programmatic but more locality-specific effects. The Landaff area has a few hiking trails, but generally is not used in the summer; the effects on other recreationists would be slight. On the other hand, there are soil types there that would require considerable hardening to support ATV use. There are scattered homes outside the Forest boundary, and private tracts within the National Forest ownership that may create concerns. The Moat Mountain area is a popular area used by mountain bikers, hikers, and hobby mineral collectors. The potential for summer visitors to be affected by noise or other motorized trail characteristics would be higher than in Landaff. Trail construction could be more easily accomplished as soil types here are generally favorable to summer motorized trails. This area is relatively close to significant development and its associated concerns in the Conway/North Conway area (see also the Soils section).

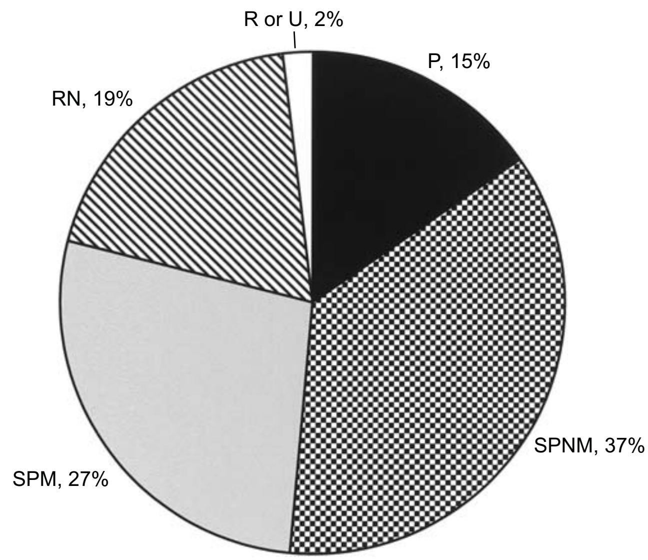
Recreation Opportunity Spectrum

Alternative 4 has a mix of ROS objectives similar to Alternatives 1 and 2. There are only minor differences in the P and RN classes. There should be no difference in effects (Figure 3-11).

Recreation Activities

In general, non-motorized recreation activities are allowed throughout the Forest, but there are differences in acres of management areas where particular non-motorized activities are not allowed (see alternatives comparison, Chapter 2).

Figure 3-11. ROS Percentages Under Alternative 4.



This alternative has 18,000 acres of Recommended Wilderness in the Wild River area. An increase in Wilderness is consistent with the Forest Service emphasis on non-motorized semi-primitive recreation, but carries with it potential effects on mountain biking and backcountry facilities. If these 18,000 acres are ultimately designated Wilderness by Congress, there would be 38 miles of System trails unavailable to mountain bikes in the Wild River area. All these trail miles are not necessarily used by, or suitable for, mountain bike use, but the figure gives some indication of the potential effect (see management areas and how they determine the mix of recreation activities by alternative).

Vegetation Management

In this alternative, Management Area 2.1 constitutes about 46 percent of the Forest (365,900 acres). With an allowable sale quantity of 30 MMBF annually, it would involve 4,470 acres per year, representing one percent of the MA 2.1 land base. Conceptually, the level of displacement of trail users, the effect on the ROS objective, and trail reroutes would be more than in all other alternatives.

Cumulative Effects

The effects for this alternative will be similar to those in Alternatives 2 and 3 in that the recreation management approaches will be applied. However, this alternative allows larger increases in recreation infrastructure than Alternatives 2 and 3, and small increases than Alternative 1. this alternative also responds to increased demand for motorized trail recreation, albeit in a limited way. Offl-highway vechicle users would increasingly need to use other places on private and non-federal public land that permit this type of recreation activity. The cumulative effect is generally the same as the direct and indirect effectsx. the additional infrastructure and inclusion of summer motorized trails could result in changed public perceptions of the Forest's recreation niche.

There is an additional 18,000 acres of Recommended Wilderness. Based on acres recommended, this alternative places a low emphasis on Wilderness,

Above: Greeley Ponds trailhead on the Kanc; Right:Forest Service employee Joan Hart helps a visitor at the Lincoln Woods Information Center; Below: Snowshoeing on the Tuckerman Ravine Trail (WMNF photos by Forrest Seavey)

higher only than Alternative 1. Consequently, over time it would shift the balance of recreation opportunities in this direction more than Alternative 1, but less than Alternatives 2 and 3. Conversely, the same number of acres would be closed to mountain bike use and would de-emphasize backcountry facility camping.

Recreation Activities

Affected Environment

Developed Sites

Developed sites include campgrounds (family and group), day use areas (picnic areas, overlooks), water recreation sites like Lower Falls and South Pond, visitor centers, roadside camping areas like Gale River and Little Lary roads, and trailheads. Permitted alpine ski areas are another feature, and are described in the Alpine Ski Area section. Developed recreation covers the fewest acres on the Forest, and usually has the most concentrated management of any recreation activity. Because these areas are managed for large numbers of people, higher levels of social interaction are more acceptable. From a resource standpoint, the area of impact is very focused. The Forest Service maintains and improves recreation facilities and enhances visitor services and wildlife habitat through fees collected under the Federal Lands Recreation Enhancement Act. About 90 percent of the receipts are retained on the Forest where the fees are collected. Under the former Fee Demo program upon which the act is based, these receipts have averaged about $650,000 annually from 1998 to 2003.

Campgrounds

The Forest Service oversees 20 family campgrounds and 3 group campgrounds, with a total capacity of 819 family campsites. The individual areas range in size from 7 to 176 campsites. The campgrounds offer a variety of development levels and amenities. Except for Crocker Pond and Franconia Brook campgrounds, which continue to be operated by the Forest Service, all other campgrounds have been operated under concessionaire permits since 1997. Concessionaire permits allow the private sector to operate Forest Service facilities on National Forest land, within Forest Service guidelines, for a portion of the campground fees.

Two New Hampshire State Park campgrounds are surrounded by the Forest: Lafayette Campground (97 sites) in Franconia Notch State Park and Dry River campground (48 sites) in Crawford Notch State Park. In addition, there are 29 campgrounds in Coos County (7 percent of the state total of 430), 56 in Grafton County (13 percent of the state total), and 81 in Carroll County (19 percent of the state total). Almost 40 percent of the campgrounds in New Hampshire are located in these three counties, including the Forest campgrounds (SCORP, New Hampshire, 2003).

The National Survey on Recreation and the Environment (NSRE, 2002) shows camping growing by one-half percent per year from 1960 to 1982, and about 4 percent per year from 1983 to 1994. On the Forest, campground use averages around 290,000 visits per year, and demand continues to exceed

supply at peak periods. Occupancy rates are near 100 percent during July and August at the larger, more highly developed campgrounds.

Day Use Areas

The Forest has 18 family picnic grounds with capacities ranging from 5 to 26 picnic tables (two of these, Lower Falls and Basin Pond, are also water recreation sites); 20 observation sites (and another 159 sites — roadside pullouts — without any designations); and 6 water recreation sites with capacities from 50 to 300.

Roadside Camping Areas

Camping along roads outside of developed campgrounds is called roadside camping and is allowed on the Forest except where closed by Forest Supervisor Order. Sites may or may not be identified, and where they are, use ranges from intense (on the Tripoli Road) to very low intensity along Gale River and Little Lary roads (which received about 1,900 visits for 2003).

Trailheads

There are 197 trailheads accessing the National Forest trail system, and many of these are on the private land that forms a ring around the Forest within its proclamation boundary. Trailheads for 39 trails, and almost 60 miles of trails, actually lie on private land.

Over the past years, the Forest Capital Investment programs been applied to help make White Mountain National Forest campgrounds and day use areas accessible. The Americans with Disabilities Act (ADA) transition plans are in place and are being implemented for all Forest facilities and special use areas.

Driving for Recreation Purposes

"Noted for their scenic vistas, the White Mountains offer outstanding opportunities to view spectacular gorges, streams, waterfalls, and pools. Along the lower slopes are luxuriant stands of hardwood trees providing extraordinary fall color. There are many opportunities for sightseeing along the scenic highways, rustic forest roads, in the 23 campgrounds and 16 picnic areas, and many day use areas. Other opportunities are available in the adjacent state parks and in-holdings such as the Mt. Washington Auto Road, Mt. Washington Cog Railroad, and Glen House" (Graefe, 2000).

Both New Hampshire and Maine promote the scenic beauty of the White Mountains region as a major tourist attraction. For example, New Hampshire states that it has "… a wealth of historic and cultural resources that help define our state. Covered bridges, stonewalls, historic buildings, old barns, and quintessential New England villages are part of New Hampshire's fabric. Our history and culture are also important tourist attractions and enhance some of the most popular outdoor recreation experiences including sightseeing and driving for pleasure" (New Hampshire, 2003).

The state of New Hampshire Office of Travel and Tourism Development lists highways in the White Mountains Region as scenic drives. Only some of these actually go through, or are adjacent to, the Forest, and several are

also part of the White Mountain National Scenic Byway, the "White Mountains Trail." Those in italics have substantial portions bounded by National Forest land, but all have scenic views of the White Mountain National Forest.

The White Mountain National Scenic Byway includes:

- Route 112 (the Kancamagus Highway) from Conway to North Woodstock.
- Route 3 from North Woodstock to Franconia Notch Parkway.
- Franconia Notch Parkway to I 93.
- I 93 exit 35 to Route 3 at Franconia Notch.
- Route 3 from Franconia Notch to Twin Mountain.
- Route 302 from Twin Mountain through Bartlett to Glen.
- Route 16 from Glen to Conway.
- The Bear Notch road connects the Kancamagus Highway to Bartlett, completing the figure 8.

Driving for recreation is available on all state, county, or township roads within the Forest. Those designated as Federal or State Scenic Byways receive special emphasis as tourist destinations. The number of miles and the specific Forest System roads open to the public vary over time, but about 35 percent of the Forest road system is not gated. Specific roads that are open or closed may change over time; some are closed every spring and winter and some roads may be opened during hunting season on a limited basis for retrieving game.

The fall foliage season in the Forest is one of the most popular times for participating in driving for pleasure, sightseeing, and viewing scenery. Both the New Hampshire Office of Travel & Tourism Development and Maine's Office of Tourism provide information on the fall foliage season, as does the White Mountain National Forest (Graefe, 2000).

Driving for pleasure has not been statistically sampled. Use can be estimated only roughly from yearly traffic counts by the New Hampshire Department of Transportation for key highways that traverse concentrated recreation areas on the Forest. The 2002 NHDOT Traffic Volume Reports for NH 16 at Jackson, US 302 in Bartlett, and NH 112 in Albany show a total use of 3,056,291 cars. The fact that the last nine years of these data (1994 through 2002) showed only a 1.19 percent average increase in volume indicates that this use is not growing rapidly. New Hampshire traffic count data for the Kanacamagus Highway at Conway shows the Annual Average Daily Traffic count (AADT) from 1995 to 2002 (Figure 3-12). Figure 3-13 shows traffic on I-93 through various exits that access the western part of the Forest. They show that about 66 percent leave the highway between the New Hampton and Lincoln exits.

The Socio-Economic Assessment determined visitor traffic rate growth as 2 percent per year (High et al., 2004).

Figure 3-12. Annual Average Daily Traffic Count (AADT), Kancamagus Highway, from 1995 to 2002 (NHDOT).

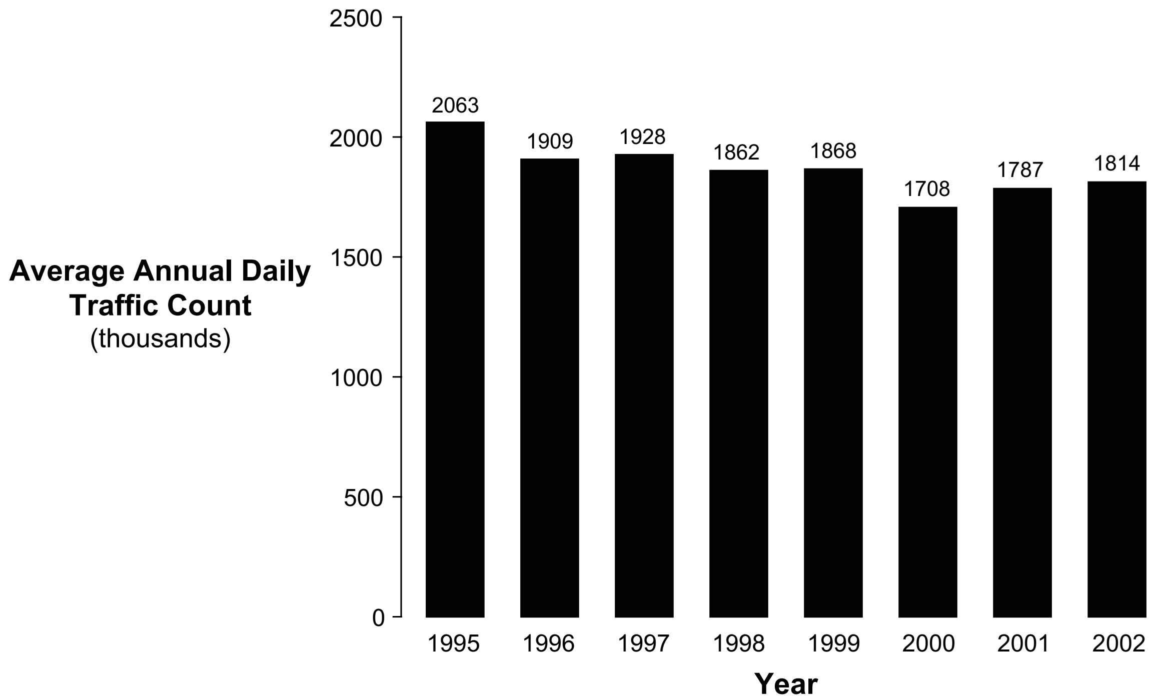
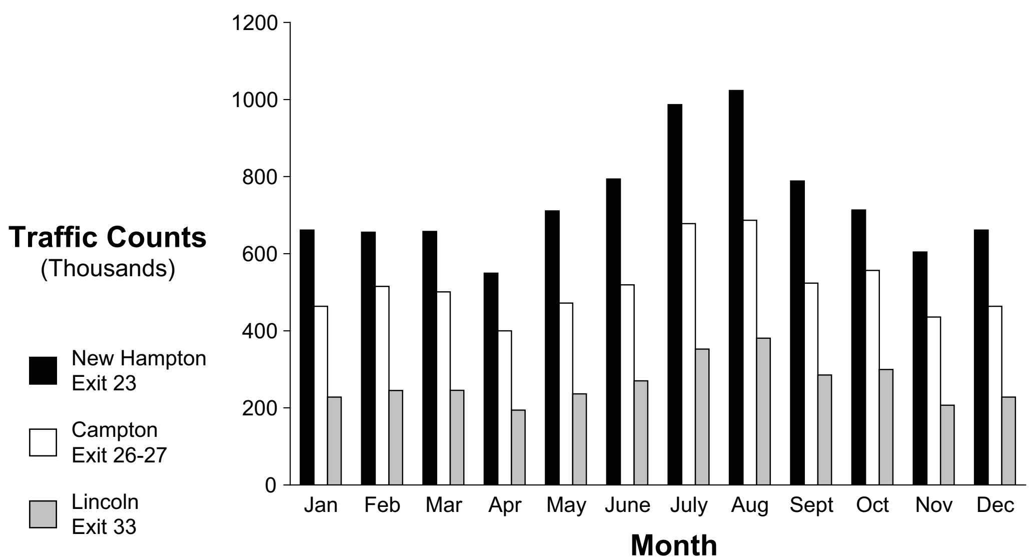


Figure 3-13. Monthly Traffic Counts at Exits 23, 26-27, and 33 (NHDOT).



Note: Use figures for August thru December at Campton are from 2001, because the station wasn't operating in 2002 for those months.

Motorized Trails

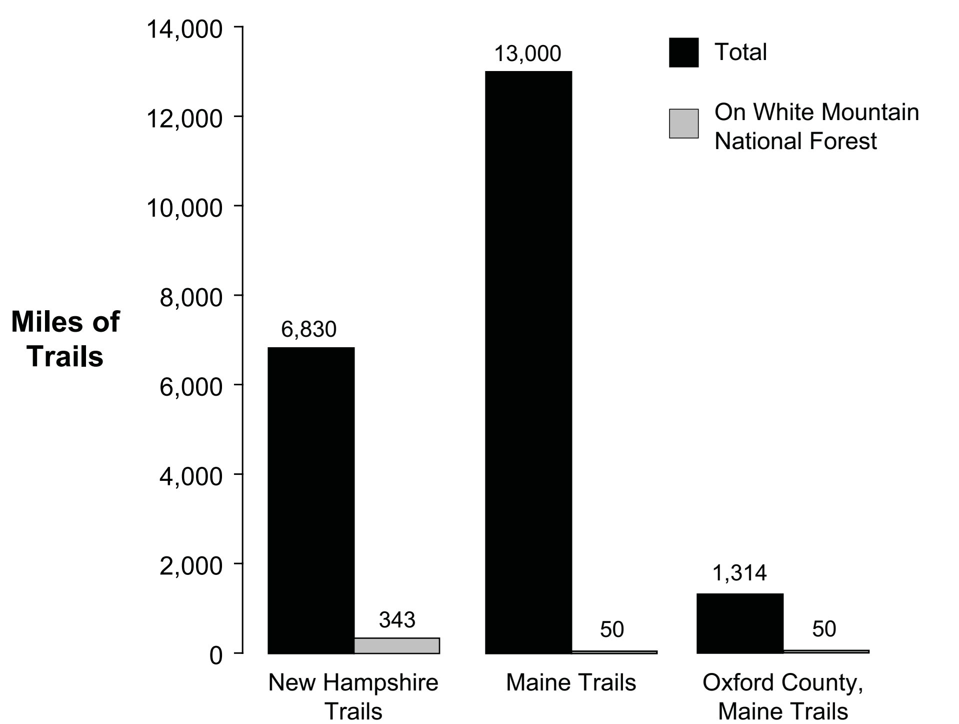
Snowmobile Trails

The 1986 Forest Plan closed the Forest to snowmobiles except where specifically opened. Currently, there are about 400 miles of authorized snowmobile trail on the White Mountain National Forest in Maine and New Hampshire, comprising a network of corridor and local trails that connect to the major corridor routes of the two states. Although the snowmobile trails on the National Forest are only a small part of the statewide and region-wide systems (New Hampshire has almost 7,000 miles of snowmobile trails; Maine has 13,000 miles), the location of the Forest, covering a large portion of central New Hampshire, makes its trails critical links in the larger network. Maine and New Hampshire are major partners in providing snowmobile opportunities on the Forest. Local snowmobile clubs maintain many of the trails with financial assistance from state grants-in-aid, as well as Forest Service cost share agreements. Figure 3-14 shows miles of snowmobile trails by state and the miles on the Forest.

Of the 343 miles of Forest snowmobile trail in New Hampshire, 59 miles (17 percent) are part of the NH Corridor System Trails. These include parts of Corridor Trail 11 (42 miles), Corridor Trail 12 (8 miles), Corridor Trail 19 (8 miles), and Corridor Trail 5 (1 mile).

Of the 50 miles of snowmobile trail in Maine, 24 miles (48 percent) are part of the Maine Integrated Trail System (ITS). All of these are part of Maine ITS80.

Figure 3-14. Miles of Snowmobile Trail by State and the Miles on the Forest (all jurisdictions).



The New Hampshire study on snowmobiling in New Hampshire (Robertson, 1996) and the Maine gasoline consumption study (Rubin, 2001) provide information regarding snowmobile use.

- 73 percent of the households in the Maine study have more than one snowmobile, with an average of 2.3 snowmobiles per household.
- 77 percent of New Hampshire's non-resident snowmobile registrations are from Massachusetts residents.
- There are 113 local snowmobile clubs in New Hampshire.
- 93 percent of snowmobilers ride on trails specifically designated and groomed for snowmobiles.
- 75 percent of the use occurs on weekends.
- Snowmobile riders travel an average of 73 miles per outing, with trips ranging from less than a mile to 700 miles. Half the trips are 50 miles long or more.
- 42 percent of snowmobilers like to ride near home; 44 percent like to travel. Distance did not matter to the remaining 14 percent.
- The average age of snowmobile riders is 34 years, and they have been riding snowmobiles for an average of 19 years.
- 85 percent of the snowmobilers trailer their snowmobiles at least sometimes to a place to ride them: 20 percent always do.

The National Survey on Recreation and the Environment (NSRE, 2002) shows a 67 percent increase in snowmobile use in New England from 1994 to 2001. This suggests an annual growth of 8 percent.

In Maine non-resident snowmobile registrations were about 14.5 percent during 1998, 1999, and 2000. Of the 2002 registrations in New Hampshire, 31 percent were from out-of-state.

In Maine, snowmobile trail miles increased by 21 percent from 1993 to 2002. Oxford County, Maine, (within which this part of the Forest lies) showed a 25 percent increase in trail miles, from 1,055 miles to 1,314 miles.

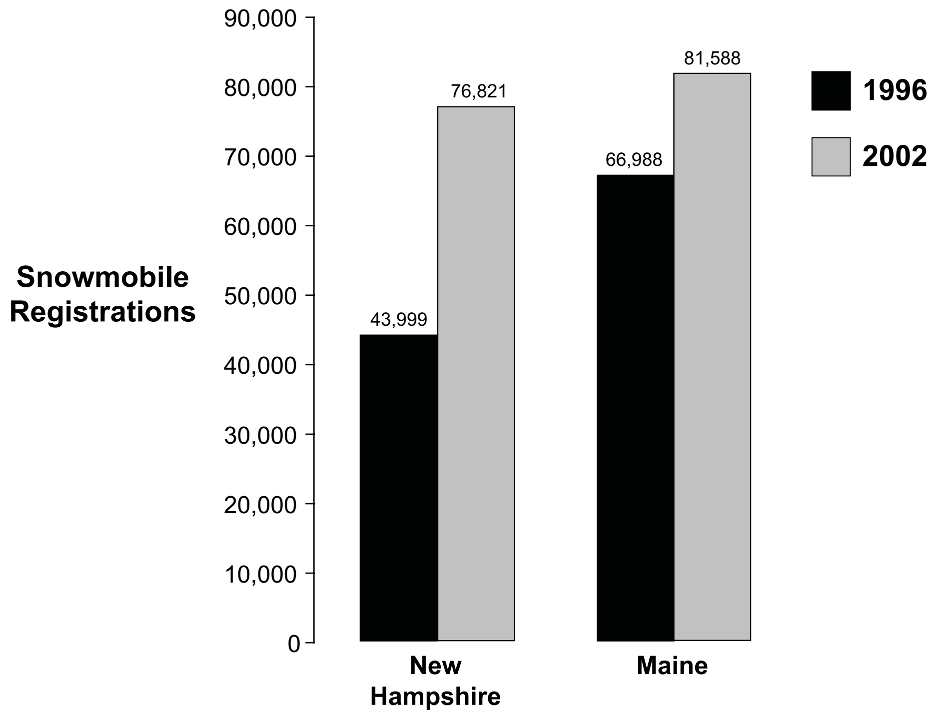
Snowmobile registrations in New Hampshire have grown by 75 percent from 1996 to 2000, and in Maine by 22 percent (see Figure 3-15).

Summer Motorized Trails

The Forest has no authorized summer motorized trails. There is some illegal summer motorized use in parts of the Forest, usually near boundaries where use on state and private land occurs.

Regionally, "Connecticut and Rhode Island have refused to open state lands to ATVs, while Massachusetts does allow limited use in eight state forests. New Hampshire and Maine are developing more ambitious ATV trail programs. In Vermont, where no state trails are open to ATVs, some towns have opened their back roads." (Matson, 2004) Maine has 2,200 miles of ATV trails; New Hampshire has about 300 miles of state-owned or monitored trails and 500 miles of trails on private lands. The State of New Hampshire is pursuing the purchase of 7,200 acres near Jericho Lake in Berlin for possible development of trails for ATVs. This tract is adjacent to the WMNF at the

Figure 3-15. Snowmobile Registrations in New Hampshire and Maine, 1996 and 2002.



southeastern end of the Kilkenny unit (NH Union Leader, January 13, 2005). New Hampshire is currently developing a State Trails Plan, with the focus on over 300 miles of state-owned abandoned railroads. Most are owned by the NH Department of Transportation (NHDOT) and were purchased for future rail use. Many of these are currently managed by the Department of Resources and Economic Development (DRED) and have been improved for snowmobile use.

Consistent with state law, OHRV or trail bikes registered for use on the highways of the state are allowed on Forest System roads that are open to public vehicular use (New Hampshire RSA 215-A:6, 35, and RSA 261, Maine Title 12 — Chapter 715 paragraph 13157 and 29-A).

OHRV registrations in New Hampshire showed a growth rate of 8.7 percent, increasing by 52 percent from 1996 to 2001.

Non-motorized Dispersed Recreation

Mountain Biking

Mountain biking is currently permitted anywhere on the Forest, on and off trail, except for the few areas closed to that use. Wilderness and the Appalachian Trail are permanently closed to mountain bikes. Some trails are specifically designed as mountain bike routes, but most are not. For example, the Pemigewasset Ranger District mountain biking map shows almost 410 miles of trail that can be used by mountain bikers, and a recreation opportunity guide for the Cherry Mountain bike loop has another 25 miles.

Only about 5 percent of these 435 miles of trail is constructed and maintained specifically for mountain biking.

In addition to the Forest Trail System, mountain bikers may travel cross-country using other travel corridors or devising their own route. These user-created trails are promoted by word-of-mouth, and soon become user-recognized mountain bike routes even though they are not officially part of the National Forest Trail System. There are instances where vegetation has been cleared and bridges built in places where no Forest System trail exists. There is some concern about impacts on rare and unique species from this use (see Rare and Unique Features section).

The alpine ski areas sometimes provide a mountain biking opportunity in the summer months, including lift-serviced mountain bike terrain, trails in the permit area, and linkages to National Forest lands and trails. These are usually full-service bike centers, offering bike rentals, repairs, and information on where to ride. Mountain biking opportunities in theses areas range from gentle, family-type rides to challenging downhill routes. The opportunities vary from year-to-year, based on market demand.

State Parks and private lands provide mountain biking opportunities throughout the region.

Backcountry Camping

Backcountry camping facilities are relatively small, distinctly defined locations in the backcountry where concentrated public use occurs and facilities are provided. These include huts, cabins, shelters, and tent platform sites. Huts are distinctive to the White Mountain National Forest, and an example is shown in Figure 3-16. At specific backcountry sites, managed overflow use historically has been accommodated. Even though this capacity is not represented in the capacity of the backcountry facility, it is added to reveal the existing situation.

Backcountry facilities have no motorized access except for limited administrative use. They are maintained and operated by the Forest Service, or by various partners under special use permit authority.

The Forest has 7 AMC huts, 8 cabins, 34 shelters, and 24 tent platform sites.

- 3 shelters and 1 tent platform site are located in Wilderness.
- 6 huts, 11 shelters, and 9 tent platform sites are located along the AT.
- 3 huts and 1 cabin are located in the alpine zone.
- 1 shelter complex (with a capacity of 78 people), 1 tent platform site (capacity of 18), and 1 cabin (winter use only, with a capacity of 16) are located in Tuckerman and Huntington ravines.
- Managed overlow use at 4 locations: Eliza Brook Campsite (managed overflow use of 20), Kinsman Pond Campsite (managed overflow use of 16), Guyot Campsite (managed overflow use of 8, and Nauman Tentsite (managed overflow of 8).

Figure 3-17 and Figure 3-18 show the capacities by type of backcountry facilities and backcountry facilities by areas of interest, respectively.

Figure 3-16. AMC's Greenleaf Hut.

Figure 3-17. Capacity of Backcountry Facilities, Summer and Winter.

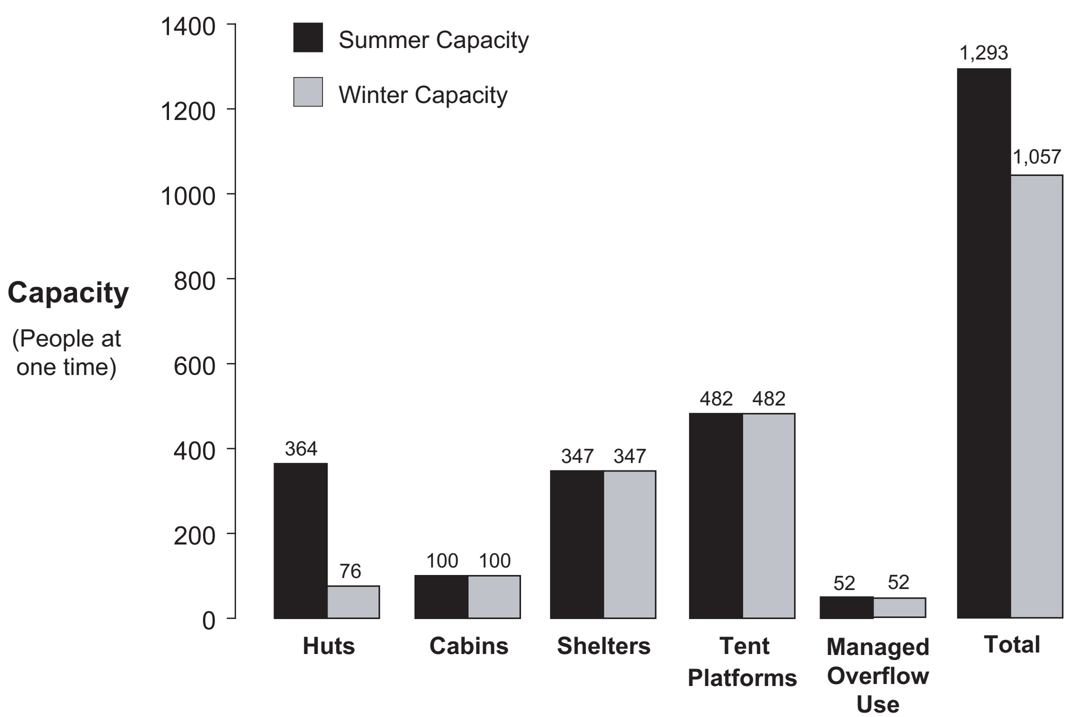
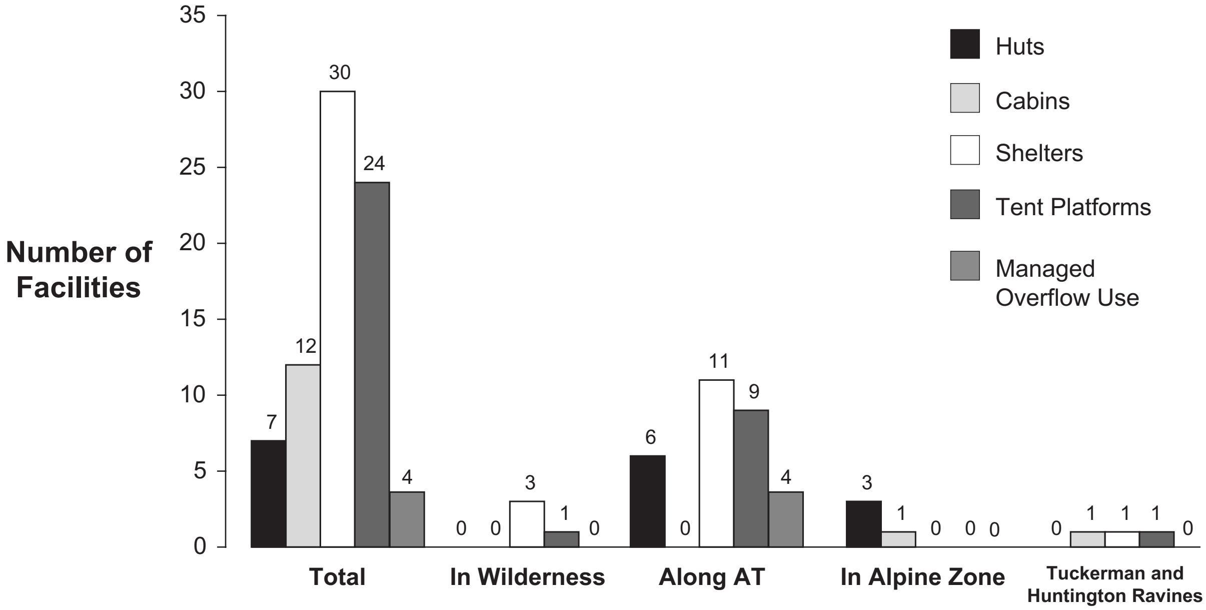


Figure 3-18. Number of Backcountry Facilities by Type in Various Areas.



Some facilities are included in both the "Alpine Zone" and the "AT" categories.

Use of Backcountry Facilities

Some staffed backcountry facilities, about 60 percent of the Forest's total capacity, have actual use counts. They are the most heavily used, and in 1998 (the only year that represents all the sites) they reported about 62,000 visits. From this figure it can be estimated that all the backcountry facilities receive about 100,000 visits annually for 100 percent of the backcountry facilities (WMNF, in-process). The 62,000 figure represents only when the facilities were staffed; there is additional use at most of the sites when they are not staffed. Managed overflow use at specifically identified backcountry sites are included in these counts.

Huts account for about 50 percent of the reported use (62,000 visits), and almost 30 percent of the estimated total use (100,000 visits) of backcountry facilities.

Figure 3-19 shows the growth in use of huts; Figure 3-20 illustrates use at those backcountry campsites where there is some continuity in use-count reporting. The annual growth in use of the huts since 1986 is about 2.5 percent. Increases in hut capacity are not allowed, so it can be expected that, as growth in use comes closer to capacity, it will slow until it levels off.

Other than huts, backcountry facilities that have continuous counts since 1986 show a growth of about 7 percent annually. All these sites are located along the Appalachian National Scenic Trail. Some new tent platforms have been constructed, but usually to accommodate overflow use at existing facilities. There have been no new cabins or shelters constructed since 1986. There are places where the Forest Service has allowed managed overflow use as an interim step in managing high use problems at specific locations.

Figure 3-19. Use of Huts, 1986-2003.

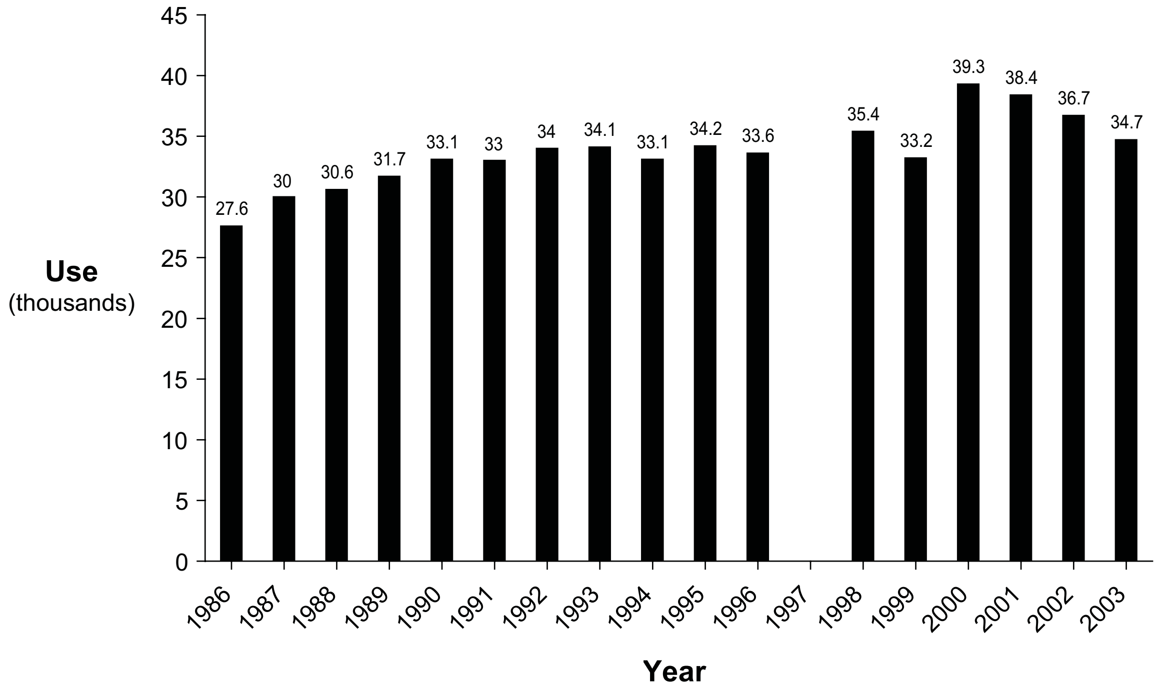
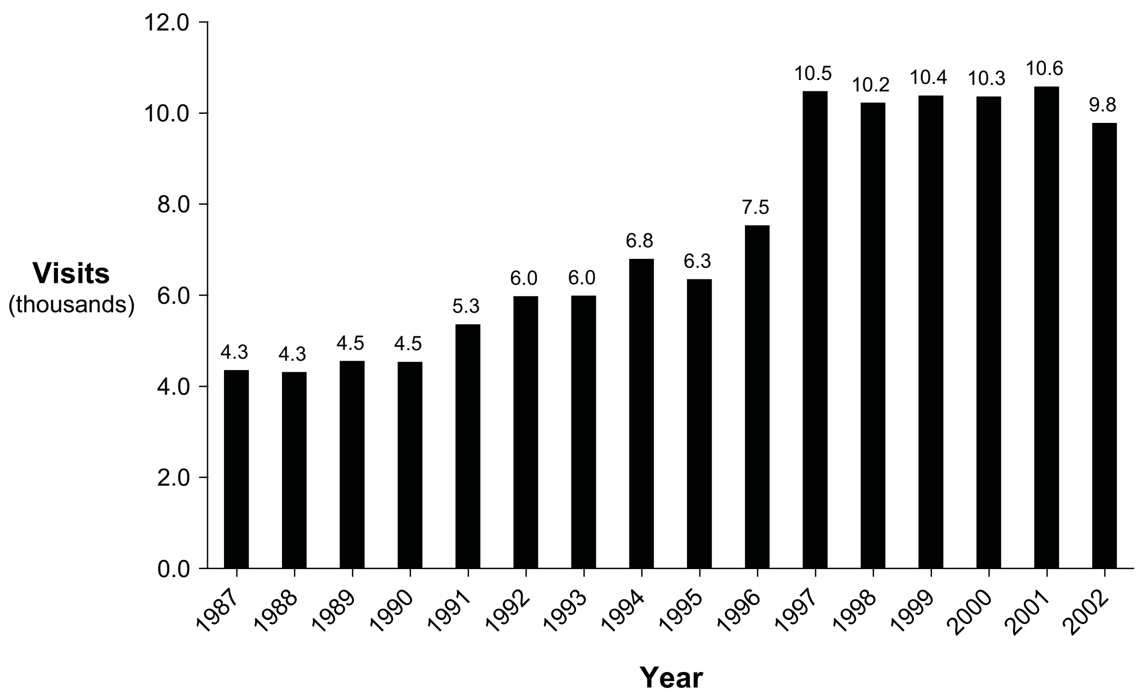


Figure 3-20. Use of Backcountry Facilities Other Than Huts, 1987-2002.



The National Survey on Recreation and the Environment shows a change from 1994 to 2001 in New England of 68 percent in overnight hiking (this equates with overnight use in the backcountry). This suggests a current trend of 8.5 percent per year increase in overnight use of the backcountry. Generally, local data and information take precedence over national data;

therefore, a 7 percent growth rate per year is used for Forest Plan revision purposes.

Dispersed Campsites

Over a three year period, the Forest Service has identified and mapped approximately 1,400 dispersed campsites, most user-developed (WMNF Campsite Survey, ongoing). This ongoing inventory represents a considerable investment of time and money, but will help the Forest Service understand the size and distribution of backcountry dispersed camping. Dispersed site camping, whether near to or distant from trails, is generally allowed except where closed. Use numbers are not collected at the 1,400 dispersed sites.

Trails

The Forest provides year–round hiking and walking opportunities, activities that have been a popular tradition for more than a century. The National Forest contains 389 hiking trails totaling 1,171 miles. These includes nearly 160 miles of the Appalachian National Scenic Trail and three federally-designated National Recreation Trails: the Crawford Path, Boulder Loop, and Sabbaday Falls Trail. Almost 208 miles of trail are in the five Wildernesses, and 55 miles of hiking trails cross the alpine zones of the Presidential Range and Franconia Ridge. Trail densities vary tremendously throughout the Forest. In some places, densities are as high as 10 miles of trail per square mile, while in others there are no trails at all. Trail use levels can also be extremely variable. The Forest Service has identified trail use by four categories: Very High, High, Moderate, and Low. Using trailhead registers, and estimating those hikers who did not sign the registers, Very High represents about 150 people per day (PPD) during the high use season; High about 50 PPD; Moderate about 20 PPD; and Low about 3 PPD.

Figure 3-21, illustrating trail use levels, shows that about 81 percent of Forest trails are in the Moderate to Low use categories. About 18 percent are High to Very High, and of these, only 6 percent show Very High use.

White Mountain National Forest trails comprise a significant portion of hiking opportunities in the region: 75 percent of all hiking trails in New Hampshire and 20 percent of those in New England (Trust for Public Lands draft, undated).

The White Mountain National Forest is responsible for all trail maintenance within its boundaries. In addition to Forest Service trail crews, the Forest relies heavily on cooperators, volunteers, and contracts.

Trail use varies by season, by weekend/weekday, weather, etc. Trail use throughout the Forest usually occurs in three general seasons:

- The summer season (July and August).
- The winter season (mid-October to April 1).
- The shoulder seasons (Fall, September to mid-October, and Spring, April, May, and June).

Use generally declines after the summer season through the shoulder seasons to the winter season. There are instances of high use or “spikes” in some

locations (e.g., fall foliage season, holidays, and spring skiing at Tuckerman Ravine). Almost all the use is daytime use; there is little hiking at night (Figure 3-22).

Figure 3-21. Number and Percentage of Trails by Use Category.

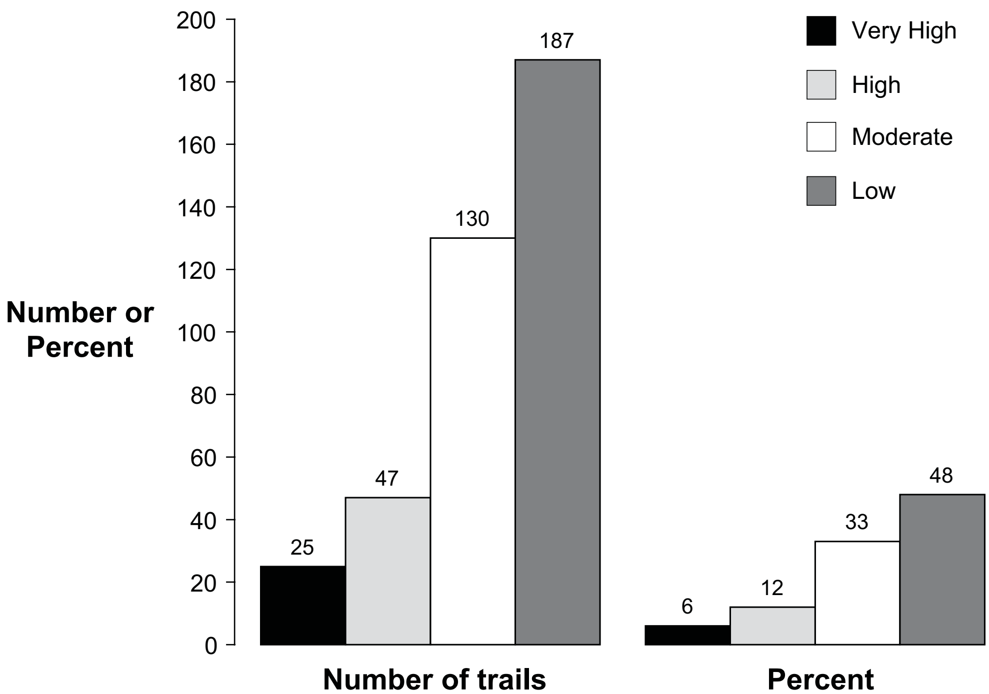
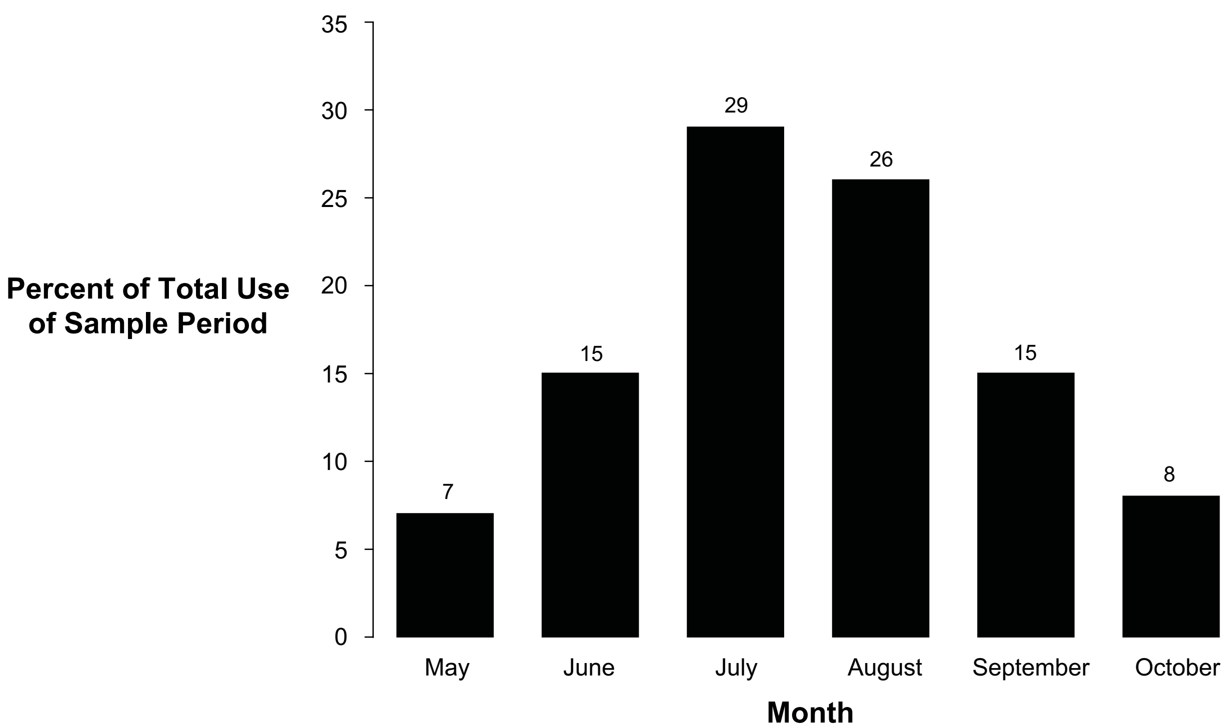


Figure 3-22. Trail Use by Season, 1998.



The ratio between day users and overnight users is generally about two to one but can vary by area of the Forest. In the Primitive ROS Class, it is about 1.2:1; in a combination Primitive and Semi-Primitive ROS class, it is 2.1:1, while in the Semi-Primitive ROS Class, it is about 3.2:1 (Dawson, 2001).

Geographic patterns of hiking use

For ease of description and analysis, the Forest can be divided into six different geographic areas, each bounded by state road systems (Map 3-04). Trail densities and trail use levels (Very High, High, Moderate, and Low) are described for each area.

Area 1

Routes 302, 2, and 16 delineate the first area, which has the most intensively used trail system on the Forest. Even here, however, use of the trail system varies from Very High to Low. This area includes the Presidential alpine zone, a segment of the Appalachian Trail, and an extensive portion of the Forest's backcountry facilities, including 3 AMC Huts, 4 shelters, and 3 tent platforms.

The Very High use trails access Mt. Washington and the alpine zone from the west, north, and east. These include:

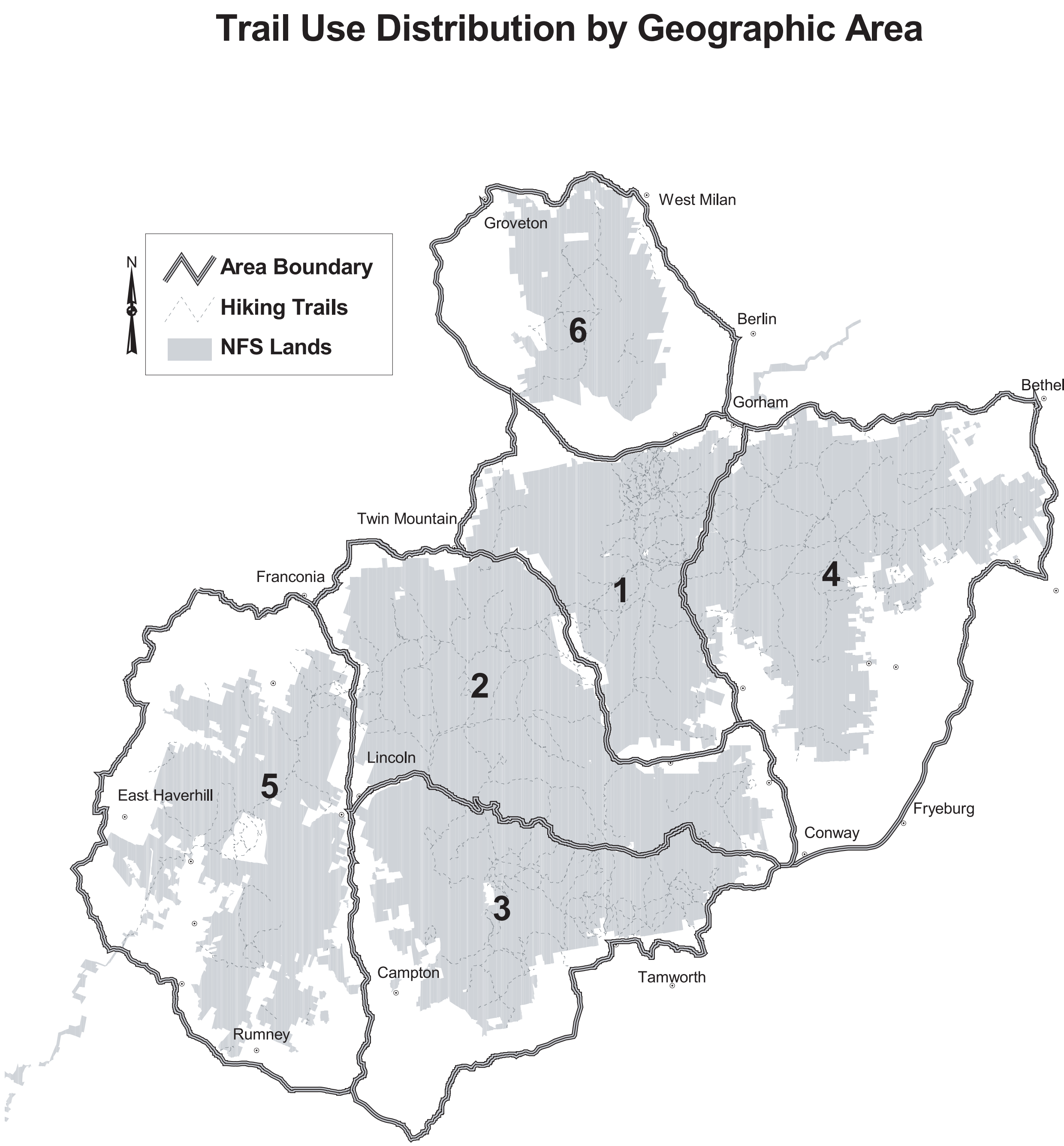
- Crawford Path from Rt.. 302 to Lakes of the Clouds Hut.
- Mizpah Cutoff, accessing Mizpah Hut from Crawford Path.
- Ammonoosuc Ravine Trail, accessing Lakes of the Clouds Hut from the Base Station Road to Gulfside Trail.
- Valley Way Trail, accessing Madison Hut from Rt. 2.
- Tuckerman Ravine Trail, accessing Tuckerman Ravine and Lakes of the Clouds Hut.

The High use trails generally interconnect with the Very High use trails. They include:

- Great Gulf Trail (in the Great Gulf Wilderness).
- Gulfside Trail.
- Alpine Garden Trail.
- Lion Head Trail.
- Tuckerman Crossover.
- Old Jackson Road.
- Madison Gulf Trail.
- Brookside and Airline Trails, paralleling the Very High use Valley Way Trail.
- The several High use trails accessing Randolph Mountain Club facilities.

To the south and the northeast of this High use trail system there is a well-dispersed trail system with an even mix of Moderate and Low use trails. Most of these are in the Presidential Range/Dry River Wilderness, and include Dry River Trail, Davis Path, Rocky Branch Trail, and the Mt. Stanton Trail.

Map 3-04. Trail Use Levels Areas.



To the west of this Very High/High use trail system (west of Jefferson Notch Road) is the Dartmouth Range, which is essentially without trails although there are some roads in the area.

Area 2

Routes. 112, 3, 302 and 16 encompass a second area, the second most heavily used backcountry portion of the Forest. In general the trail system here is widely and evenly distributed.

The Very High use trails are the Old Bridle Path, accessing Greenleaf Hut; the Falling Waters Trail, accessing Franconia Ridge; and the Franconia Ridge Trail itself. The Zealand Trail, accessing Zealand Falls Hut, and the Lincoln Woods Trail through the Pemigewasset Wilderness from Route 112 are also categorized as Very High use trails.

The High use trails include the Garfield Ridge Trail; the Twinway Trail, which follows the northern boundary of the Pemigewasset Wilderness; the Garfield Trail, accessing the ridge from the north; the Gale River Trail, accessing the ridge and Galehead Hut; the Sawyer Pond Trail, accessing Sawyer Pond from Rt 112; and Sugarloaf Trail, a short trail serving campground users.

The Moderate and Low use trails in this area outside the Pemigewasset Wilderness are widely and evenly distributed throughout the area.

Area 3

The area bounded by the Forest to the south, Routes 3, 112, and Route 16 back to the Forest boundary, is covered in large part by the Sandwich Range Wilderness, probably the third most heavily used backcountry area on the Forest, and with most of the intensely used trail system in the Mt. Chocorua Scenic Area.

Piper Trail, accessing Mt. Chocorua from Route 16, and Champney Falls Trail accessing Mt. Chocorua from Route 112, are the two Very High use trails here. High use trails are generally scattered throughout this area. Others include Guinea Pond Trail in the southwestern part of the area, the Tripyramid Loop Trail off Livermore Road (within the Sandwich Range Wilderness), and the Greeley Ponds Trail, accessing Greeley Ponds from both the Livermore Road and Route 112.

The Moderate and Low use trails in this area include parts of the trail access system to Mt. Chocorua and a well dispersed system accessing various parts of the Sandwich Range Wilderness. There is a predominance of low use trails in the eastern part of the Wilderness.

There are two Moderate use trails (Mt. Osceola Trail and the East Pond Trail System) in the area south of Rt 112, north of Tripoli Road, and west of Livermore Road.

To the west of Rt 49 and Tripoli Road there are only two widely separated trails, the Mt. Tecumseh Trail (Moderate use) on the north and the Very High use Welch-Dickey Loop on the south. The remainder of this area is without trails.

Area 4

The fourth area is that area of the Forest east of Route 16 and south of Route 2 including a section in Maine. The Caribou-Speckled Wilderness covers a small part of this area. Many of the trails in this location are classified as Low use.

The two Very High use trails are associated with 1) access to Wildcat Ridge and Carter Notch Hut, and 2) the Baldface Circle Loop Trail near Cold River Camp on Route 113. The High use trails in this vicinity are scattered around the edge of the delineated area. They include:

- The Imp Trail system, including the North Carter Trail to Carter Ridge.
- Rattle River Trail, a part of the Appalachian Trail leaving Route 2.
- The Caribou Trail, accessing the Caribou-Speckled Wilderness from both the Bog Brook Road and Route 113.
- Basin Trail at Basin Campground.
- Kearsarge North Trail, going to Mt. Kearsarge.

Moderate use trails in this vicinity include those that are part of the Very High use trail systems. These include:

- Wildcat Ridge Trail.
- Stony Brook Trail.
- Kenduskeag Trail.
- Mud Brook Trail.

Others, separate from the Very High use trails, include:

- Black Angel Trail.
- Wild River Trail.
- Black Mtn. Cabin Trail.
- Mountain Pond Trail.

Low use trails represent a considerable part of the remaining trail system in this area. They are widely scattered.

Area 5

A fifth area is delineated by that part of the Forest west of I-93/Route 3. It includes significant state and Forest System roads. The Appalachian Trail, running southwest to northeast, and associated trails represent the major trail system in this location. Other trails generally provide connections between the various roads. There are no trails in this location categorized as Very High use. The majority of trails are categorized as Low use.

There are two High use trails in this location, the Beaver Brook Trail and the Moosilauke Carriage Road, accessing Mt. Moosilauke.

Area 6

The Kilkenny area of the Forest, north of Route 2, has a limited trail system that generally has Low use trails, a few Moderate use, and no High or Very High use trails. It is a large, contiguous block of National Forest land, with

a road system generally limited to the southeastern part of the area. This is the lowest use backcountry area of the White Mountain National Forest. The Unknown Pond Trail is the only trail identified as Moderate use in this area. The northwestern part of the area has no trails and no significant road system.

Hiking Trends

The majority of hikers to the White Mountain National Forest come from the New England states, with some studies indicating almost 60 percent coming from New Hampshire and Massachusetts. States of origin from 1999 trail registry data (self recorded) for selected Forest trails are shown in Figure 3-23.

Figure 3-23. FY 1999 WMNF Selected Hiking Trail Registry by State of Residence.

Since establishing accurate use figures is difficult and the numbers cited are estimates based on modeling, not actual counts, they have a high margin of error. Therefore, they should be used as a guide not as an absolute tally.

Hiking use in 1998 and 1999 is estimated by applying an average number of visits to each use level category. Use is estimated by applying an average number of visits to each use level category. In 1998 and 1999, trails were randomly selected and sampled with trailhead registers in each of these categories to come up with an average people per day (PPD) visits, an average unregistered rate, and a verification of their use category. The noncompliance rate provides the basis for estimating the number of hikers who didn't register at the trailheads. Combining the registered and estimated unregistered use gives a total use by category of trail. Multiplying this total use by category times number of trails in each category, and then by an estimated season of use of 148 days sampled (mid May through mid October, which includes the "Summer" season, most of the "Fall shoulder" season, and part of the "Spring shoulder" season) gives an estimate of total hiking trail use for the primary hiking season. Hiking use for 1998 was estimated as 1,379,064 visits and for 1999 1,438,826 visits.

Rock and Ice Climbing

National trends identify a change from 1994 to 2001 in New England of 60 percent in day hiking and 68 percent in backpacking (NSRE, 2002), which suggests an annual increase in day hiking of 7.5 percent, and in backpacking 8 percent. The 8 percent figure has been used for Forest Plan revision purposes.

The Forest is open to rock, ice, and mixed climbing, within specific standards and guidelines, unless closed. There are 59 identified rock-climbing areas on the Forest, many with multiple climbs. Seven of the climbing areas are in Wilderness.

Rock climbing

Generally involves ascents made on rock cliffs, often divided into the following categories:

> Traditional climbing: usually involves ground-up ascents of features where removable protection is placed by a leader and retrieved by a second, following, climber. Generally offers a higher degree of uncertainty and a greater sense of exploration than sport climbing. Risk of injury is often greater, as skill in placing and evaluating protection quality is required.
>
> Sport climbing: involves ascents of routes established with fixed protection, usually bolts and hangers. It is designed to provide an increased level of safety and the opportunity to focus on gymnastic difficulty with lower risk of injury.
>
> Bouldering: usually involves ropeless free ascents or traverses of small formations or boulders. This category of use has not generally been reported.

Ice climbing

An offshoot of winter mountaineering, ice climbing generally involves ascending flows of alpine or waterfall ice using crampons and two technical ice axes. Ropes and ice, snow, or rock protection may be used. The goal or destination is usually the top of the ice flow, or where the technical difficulties end.

Mixed climbing

Considered an offshoot of ice climbing, it involves climbing on both rock surfaces and ice flows on the same pitch or rope length. Crampons and ice axes are used to hook rock edges and cracks, and also to climb ice in the conventional sense.

Most rock climbing on the Forest is done independently, rather than with guides under the authority of a special use permit. There are probably more guides in the winter months because of greater challenges. It is doubtful if any unclimbed sites exist on the Forest, but there are some remote sites that have low use.

Most White Mountain National Forest sites attract climbers from the region, but Rumney Rocks is now considered a national destination for rock climbing, as is Huntington Ravine for ice climbing.

The impression among both land managers and local climbers is that use levels in all forms of mountaineering have grown in the last few decades. Comparing 1987 and 1998 climbing guides for sites on the eastern side of the Forest shows the growth in rock climbing sites (Figure 3-24) and in rock climbs at those sites (Figure 3-25). This does not include growth in areas around Rumney (7 sites, 50 climbs in 1987), in Franconia Notch (1 site, 3 climbs on NF land in 1987), or the Zealand area (2 sites, 18 climbs in 1987), since data for the western part of the Forest was unavailable at the time of the study.

Figures such as these must be considered a relative indication. Hard numbers of this type may be misleading for several reasons. First, there is no strict definition of what constitutes an individual climb. For example, on a shorter section of cliff, a climb may involve only 60 feet of actual climbing. A climb on another, larger, part of the same cliff may involve several rope lengths — yet each would be represented as one "route" in a guidebook. Additionally, there are differences of opinion on whether to represent routes by the line of the original first ascent or by the common route description. One author may adhere strictly to history while another represents the current use patterns. Nonetheless, the above comparison bolsters the general belief that use is increasing.

Some indication of use can be gleaned from parking pass data at Rumney Rocks, by far the highest use rock climbing area on the Forest, showing about 75,000 visits. The outfitter/guide data base shows 205 permitted rock climbing trips (there are multiple trips on one permit) in 2002 and 282 in 2003.

Figure 3-24. Comparison of the Number of Climbing Sites on the WMNF, 1987 and 1998.

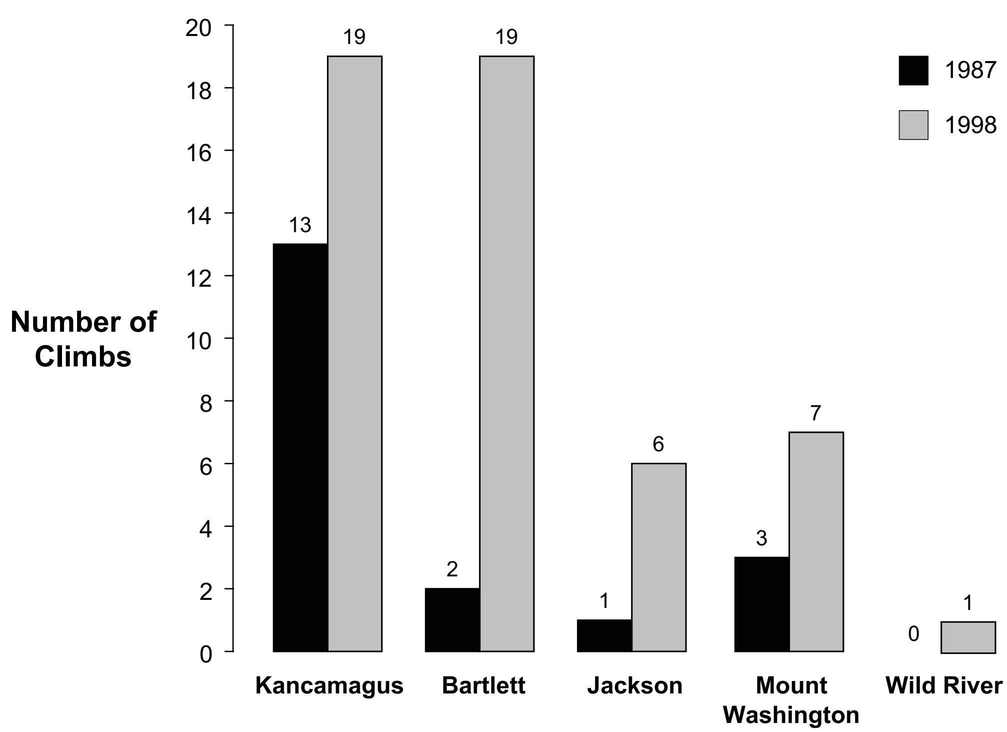
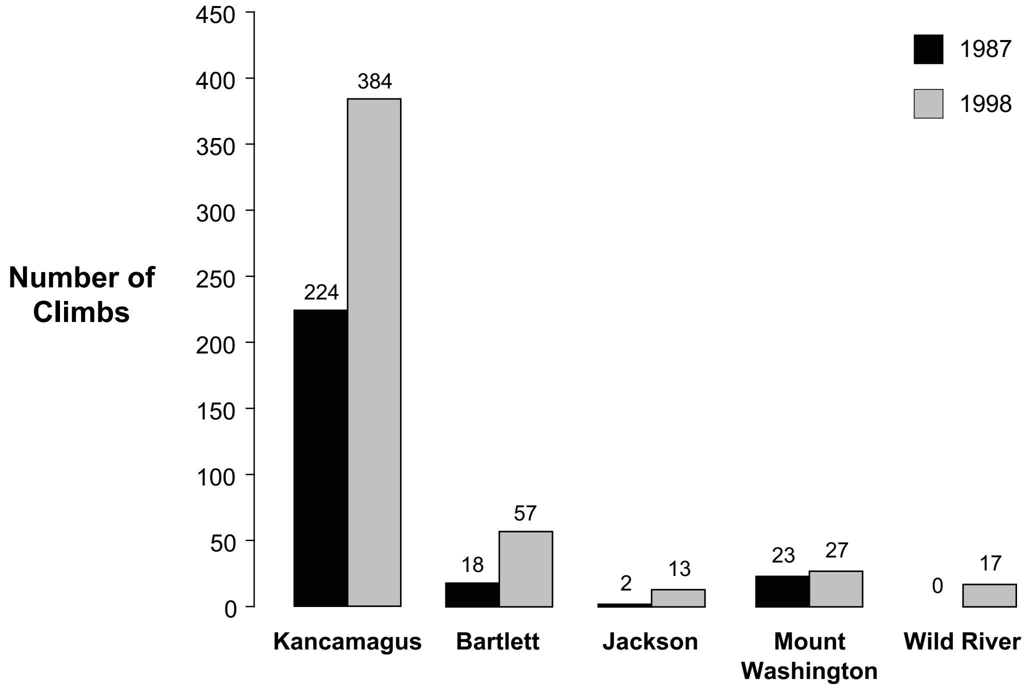


Figure 3-25. Comparison of the Number of Climbs on the WMNF, 1987 and 1998.



Local climbing enthusiasts generally believe that rock climbing enjoys the greatest popularity, and within that grouping the discipline of sport climbing has grown significantly since the mid-1980s. Judging from anecdotal evidence and observation, bouldering has increased in popularity nationally, but no significant concurrent growth in bouldering opportunities has occurred on the Forest. (Johnston, 2002)

There is some indication that ice and mixed climbing has grown at a more rapid rate, over a shorter timeframe, than rock climbing. Ice climbing has grown dramatically — especially in the 1990s — as technology has improved tools and equipment. In the last five years especially, mixed climbing has gained popularity. Formerly, any route requiring the use of ice tools on rock was considered exceptionally challenging, and few climbers attempted these lines. Today, winter climbs involving mixed terrain are regularly ascended. This use is growing rapidly, with almost all the sites being user developed. Mixed climbing has received a significant level of coverage in the national climbing media as standards of difficulty have skyrocketed. Local climbers have expanded their concepts of what is possible, opening new areas and climbing routes previously considered unclimbable. (Johnston, 2002)

The National Survey on Recreation and the Environment (NSRE) shows rock climbing growing at a rate of 27 percent between 1994 and 2001, implying an annual growth rate of 3 percent.

Outfitter/Guide and Group Use (Recreation Specific)

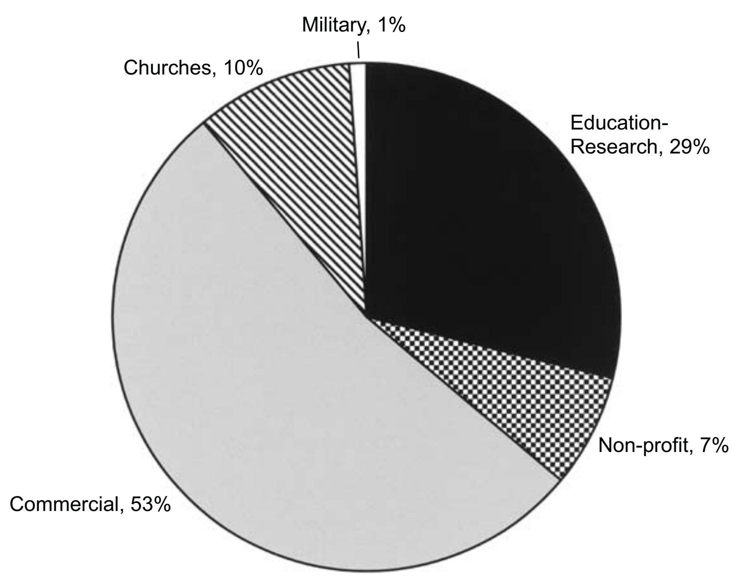
Outfitter/guide permits may be required of groups such as summer camps, snowmobile outfitters, outdoor leadership schools, and non-profit organizations leading trips to the National Forest. Almost all the Forest outfitter/guide permits are given to organizations that charge money to provide services or assistance (e.g., supervision, protection, education) to individuals or groups in their pursuit of a natural resource-based outdoor activity on the Forest (USDA FS O/G Administration Guidebook). The Forest Service also tries to track significant group use beyond those groups requiring permits, such as AMC Chapter or Boy Scout trips. Although the Forest Service has had authority to issue outfitter/guide special use permits for many years, it was only after the mid-1980s that the current policy was emphasized. There is still not a complete understanding among all groups that permits are required for their activities on the Forest.

The New England region is home to some of the country's oldest and most respected summer camps (ACANE, 2004). The New Hampshire Camp Directors Association lists 80 organized camps on its membership rolls, and many of these have been using the White Mountains for decades.

The White Mountain National Forest is a major attraction for summer camps and organizations in the region seeking a mountain outdoor experience for their clients or members. These are usually annual permits, that are reissued each year. Over the past three years, the Forest has averaged 165 organizations holding permits annually. Some permit holders make multiple trips under one permit.

The general categories of groups to which permits are issued (average 2001-2003) are shown in Figure 3-26. A different breakdown of categories (for 2001) is shown in Table 3-64.

Figure 3-26. Types of Groups Receiving Outfitter/Guide Permits, 2001-2003.



Source: Special Uses Database (SUDS)

Table 3-64. Groups Receiving Outfitter/Guide Permits, 2001.

Type of Outfitter/guide permit	Number	Percent
Summer camps	67	49%
Colleges, universities, and private schools	25	18%
Commercial (including hunting and fishing)	20	15%
Youth educational groups (e.g., Outward Bound)	17	12%
Commercial snowmobile	8	6%
Total	137	100%

A summary of all O/G database entries (O/G Permits and non-permitted groups) shows that about 61 percent are day trips and about 39 percent are overnight trips. O/G Permits show about a 53 percent to 47 percent (1.1:1) ratio of day trips to overnight trips, whereas groups not needing permits show about a 79 percent to 21 percent (3.8:1) ratio of day trips to overnight trips.

In FY 2003, there were 1,275 different outfitter/guide permitted trips, totaling 10,065 visits to the Forest. Tracked groups not needing permits accounted for an additional 562 trips, with a total of 4,086 visits. The 14,100 visits represent about 1 percent of the total estimated hiking use on the Forest. If 61 percent of these (8,600 visits) are assumed to be overnight use (8,600 visits), that represents more than 8 percent of the estimated backcountry facility use.

There are no long-term outfitter/guide data available to determine trends in amount or kinds of use.

Alpine Zone Recreation

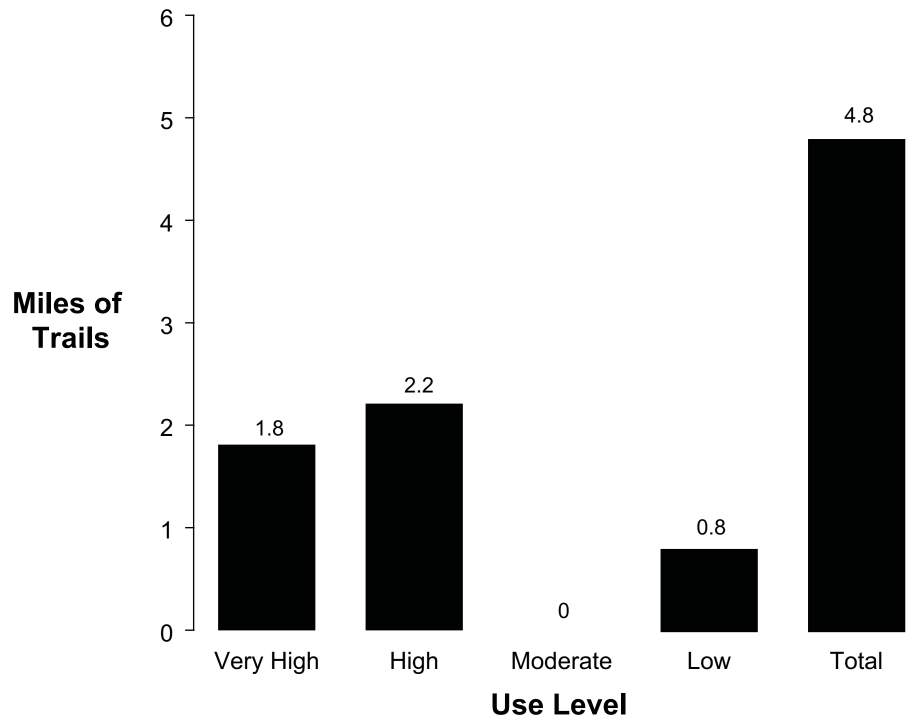
New Hampshire has the largest and most diverse alpine habitats east of the Rockies and south of the Canadian arctic. There are 8,300 acres of alpine zone in this region, the largest portion of which (7,600 acres), is in the White Mountains. The Presidentials (the largest and most varied) is about 6,800 acres; Franconia Ridge is 775 acres. The ecological resources of the alpine zone are unique and sensitive:

- 33 percent of the plants identified as species of concern are alpine species.
- two bird species and two insect species identified as species of concern are alpine species.

The alpine zone has been of long-standing interest to hikers, as well as botanists, geologists, and weather scientists. The unique environment and expansive views draw large numbers of people to the alpine zone each year. The Appalachian Trail, which was originally laid out in the White Mountains to take advantage of the existing trail system, traverses both the Franconia and Presidential Range alpine zones. While most of the recreation use takes place during the warmer months, many climbers and mountaineers also seek out the alpine zone in winter for a chance to face some of the harshest and most challenging weather conditions on earth.

The Franconia Ridge alpine zone has segments of 6 trails, totaling less than 5 miles; Greenleaf Hut is the only backcountry facility. Miles of trail by use level are shown in Figure 3-27.

Figure 3-27. Miles of Trail by Use Level, Franconia Ridge Alpine Zone.



In the Presidential Range alpine zone, there are segments of 60 trails, totaling about 50 miles. Facilities include Madison Hut, Lakes of the Clouds Hut, and Gray Knob Cabin. There is also the Mount Washington State Park, the privately owned Mount Washington Auto Road, the Cog Railway, and lands owned by Dartmouth College in this alpine zone. Figure 3-28 shows the miles of trail by use levels.

Dispersed campsites are prohibited in the alpine zone. Nevertheless scattered user-developed dispersed campsites appear intermittently in both these areas. Forest direction is to close and rehabilitate user-developed dispersed campsites in the alpine zone.

Recreation use in the alpine zone has been estimated to be about 453,000 visits per year (see the method of determining use described in Hiking Trends, above). The process used in developing these estimates is based on the full length of the trails, not just the segments within the alpine zone. Nevertheless, there is a relationship between use on the alpine zone trail segments and use on the full length of these trails. Use at the four identified backcountry facilities (Greenleaf, Lakes, Madison, and Gray Knob) in the alpine zone was about 20,000 visits in 2000. Establishing accurate use figures is difficult, and because the numbers cited are estimates based on modeling, not actual counts, they have a high margin of error and should be used as a guide only (Figure 3-29 and Figure 3-30).

Figure 3-28. Miles of Trail by Use Level, Presidential Range Alpine Zone.

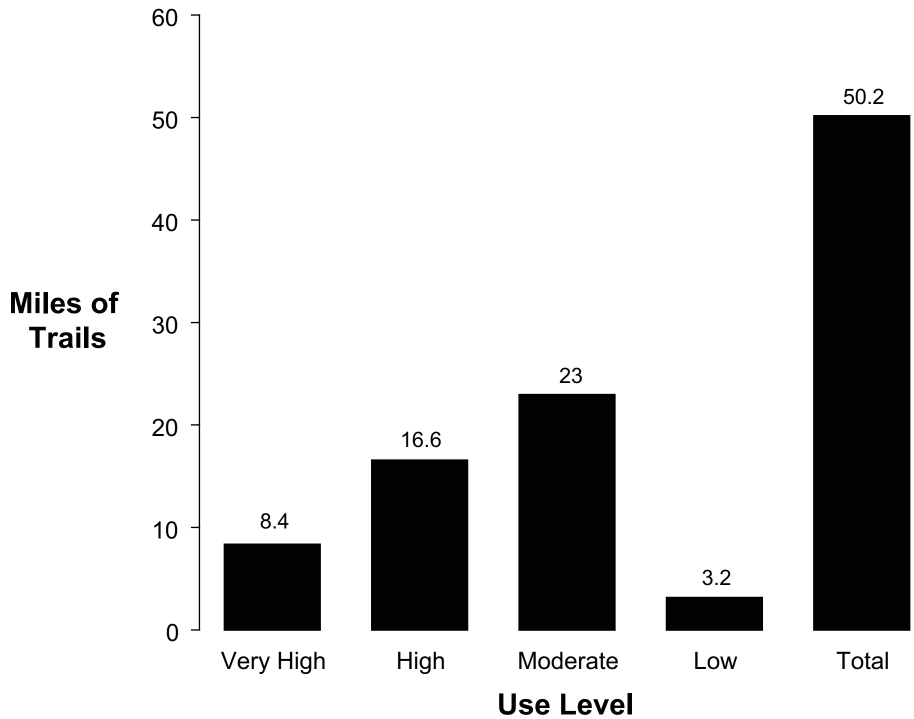
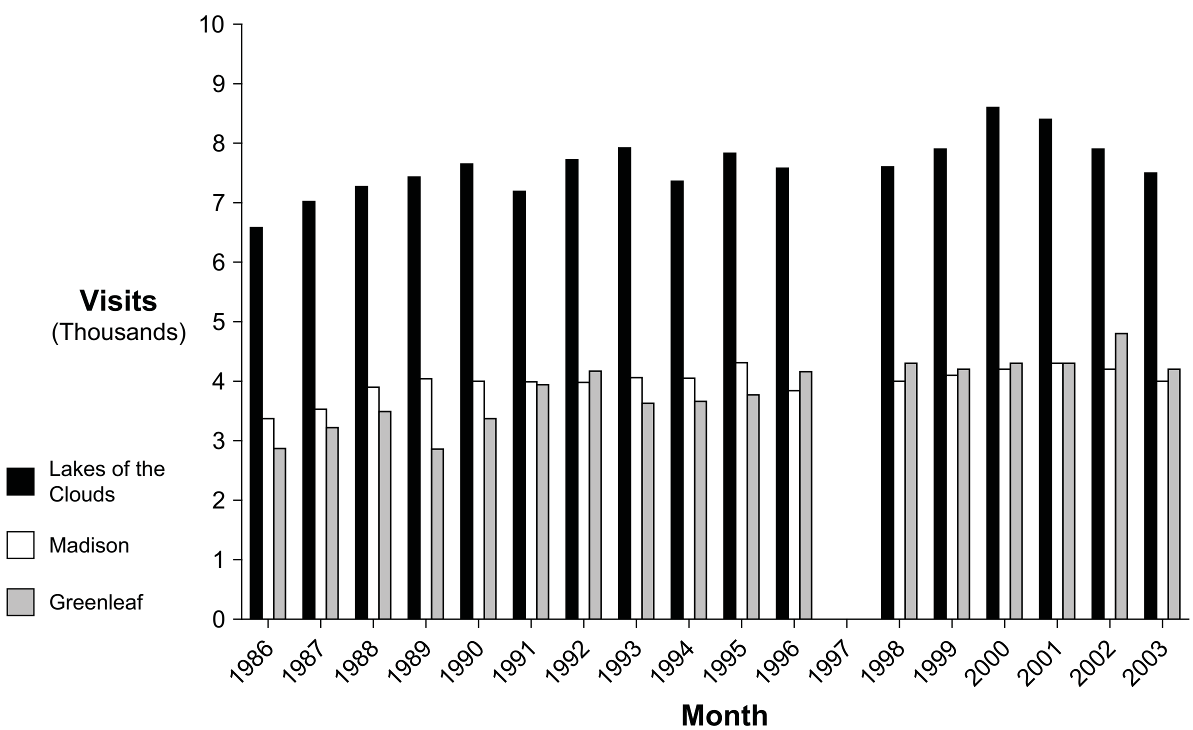


Figure 3-29. Presidential Range Alpine Zone Hut Use, 1986-2002.



The majority of alpine zone trail use is in the Presidential Range because of its size and the many trails in the area. About 20 percent (89,000 visits) of alpine zone trail use is in the Franconia Ridge area (Figure 3-31).

Figure 3-30. Presidential Range Alpine Zone, Gray Knob Cabin Use, 1991-2002.

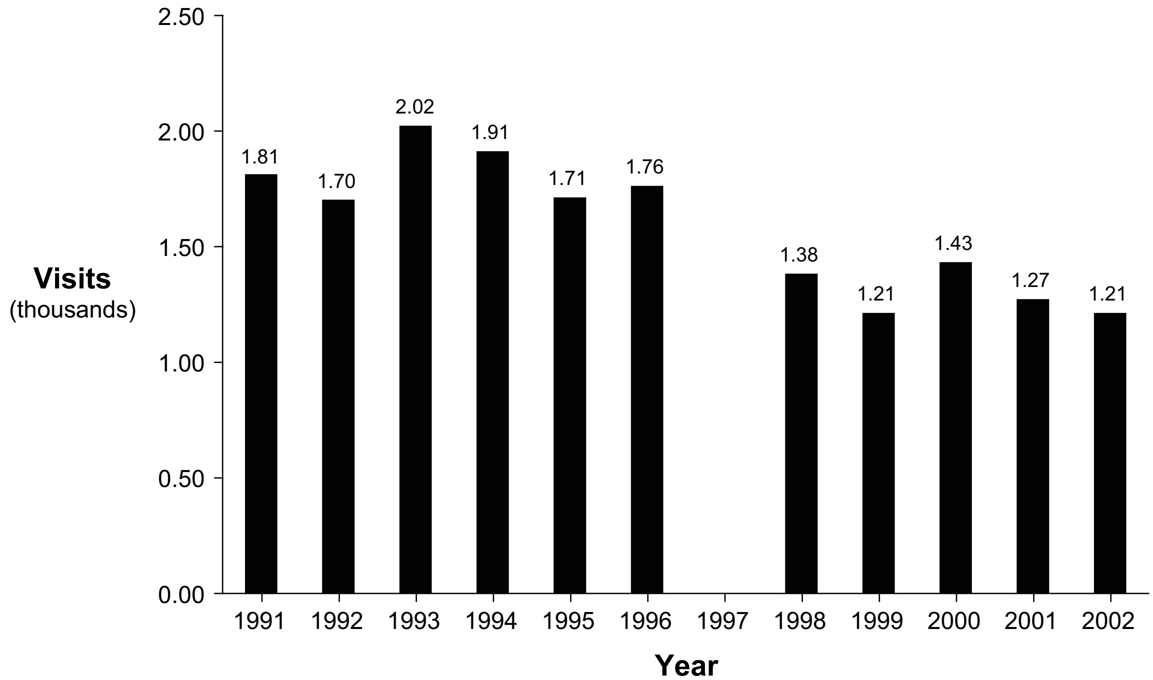
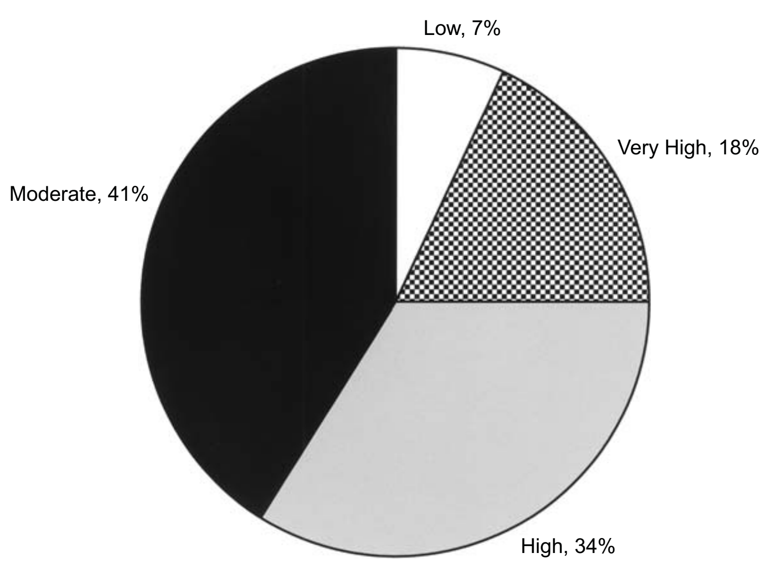


Figure 3-31. Percentage of trails in the Franconia Ridge and Presidential Range alpine zones by use category.



Efforts over the years to implement a strategy of concentrating and restricting use have successfully reduced the area of alpine zone vegetation impacted. Since 1980, alpine zone trail management standards have been standardized and skills among Forest Service and cooperator trail crews have greatly increased to include more effective techniques for keeping hikers on trails (Waterman and Waterman, 1989). One of these techniques is the use of scree walls to better define the trail. In 1989, the effectiveness of 1977 scree wall construction on the Franconia Ridge Trail was evaluated. It showed a significant decrease in hiker impact to the previously disturbed alpine vegetation adjacent to the treadway "... from a relatively barren condition of 6 percent vegetative cover in 1975 to 26 percent in 1989." (Doucette, 1989) Forest field personnel have informally monitored for scree wall effects. "While not a true alpine zone, there are the scree walls on Welch Mountain which have been effective in preserving the *Minuarta glabracolonies.* I've been monitoring the site for three years and have seen minimal human impact. Hikers are pretty good about avoiding the islands. ... There are scree walls on Franconia Ridge which have channeled hiker traffic and allowed for quite a bit of revegetation. I recall one trail section on Mt. Lincoln along the Franconia Ridge Trail that was 15-20 feet wide, which is now mostly recovered." (Williams, 2004) In order to help alpine vegetation get started, reseeding has also been done in several heavily impacted places where the scree walls have successfully constrained use to the trail tread (Figure 3-32a and Figure 3-32b).

Figure 3-32a. Left. Section of Franconia Ridge Trail in 1975. Figure 3-32b. Right. Same section in 1993, showing effects of scree wall construction to focus trail use (Cogbill, 1994).

A review of historical and present vegetation at Lakes of the Clouds and Madison Springs huts was done in conjunction with the AMC Hut re-permitting Environmental Impact Statement. That study showed:

"Other than the heavily trampled area around the Hut itself, there appears to have been little change in vegetation since construction, as the vicinity supports a relatively intact, wind exposed community. Sheltered areas near boulders and rocks, and near the Hut, sustain vigorous populations of alpine species. The clearing behind the Hut (Greenleaf) in the 1930s is now

revegetating the site indicating no tendency for its size to expand with human use in the vicinity." (Cogbill, 1996)

Appalachian National Scenic Trail

The Appalachian National Scenic Trail (AT) includes all trails designated by the National Trails System Act, as amended (P.L. 90-543), that occur on Federal lands managed by the Forest Service. This includes lands outside the Forest proclamation boundary acquired by the National Park Service (NPS) for the AT in the state of New Hampshire and administratively transferred to the USDA Forest Service under a Memorandum of Agreement. They are "... managed for the protection and enhancement of the Appalachian Trail and also in accordance with this agreement ..." as part of the White Mountain National Forest "... subject to the National Trails Systems Act and laws, rules and regulations pertaining to the National Forest System." (MOU, 1993) These NPS-acquired lands are commonly referred to as "corridor lands" or "transfer lands."

The Appalachian National Scenic Trail was designated a National Scenic Trail in 1968, and is administered by the Secretary of the Interior in consultation with the Secretary of Agriculture, and managed as a partnership between the National Park Service AT Park Office, USDA Forest Service, local Appalachian Trail Clubs, and the Appalachian Trail Conference (ATC).

Although the AT stretches some 2,100 miles, from Springer Mountain, Georgia, to Katahdin in Maine, only that portion within the management responsibility of the White Mountain National Forest is considered in this effects analysis.

In the 1986 Forest Plan, the Appalachian Trail has a management area designation where it passes through MAs 2.1 and 3.1. It is described as the "foreground zone" under the Visual Management System then in use. AT transfer lands have MA 8.1 (special area) designation. Segments of the trail that transect MAs 5.1, 6.1, 6.2, and 6.3 do not have the 8.1 MA designation. The Forest's AT management area configuration differs from other National Forests.

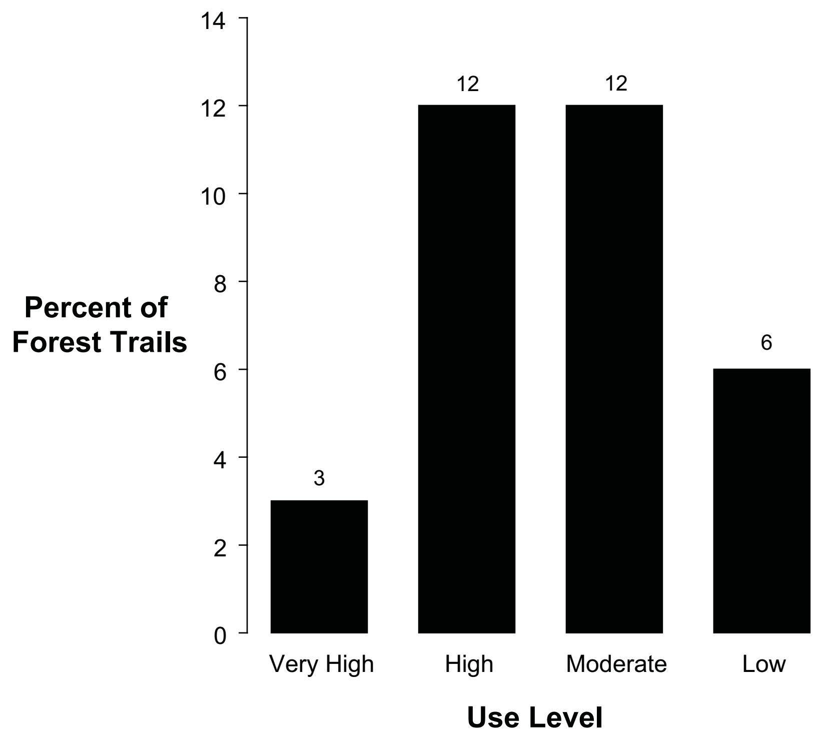
The AT accounts for about 160 miles of the 1,200-mile hiking trail network on the White Mountain National Forest. Its history and national designation give it a distinction that appeals to many of those hiking it, while for others, the fact that their hike may include portions of the Trail is incidental.

The AT traverses some of the most beautiful and popular areas of the White Mountain National Forest, including the alpine areas. It follows many long used, historical trails, some of which predate it by as much as 70 years. The portion of the AT through the White Mountains generally took advantage of an already-existing trail network (33 different trails), including trails to AMC Huts (Waterman and Waterman, 1989).

There are 24 backcountry facilities (some are combined shelters/tent platform sites) along the AT in the White Mountains. These include 6 AMC huts (Greenleaf Hut is near, but not on, the AT); 11 shelters, and 9 tent platforms.

The sites are operated by a variety of organizations, including the Forest Service, Appalachian Mountain Club, and the Dartmouth Outing Club. There are approximately 320 dispersed campsites within 500 feet of the AT (WMNF Campsite Survey, ongoing). There are some fairly long, exposed sections of the trail, all above treeline, with very limited overnight accommodations or options. An example is the segment in the alpine zone, where the AMC huts are the only overnight option and dispersed camping is prohibited. The use levels for the Forest trails comprising the AT are shown in Figure 3-33.

Figure 3-33. Use Levels for Forest Trails Comprising the AT.



Recreation use on the Appalachian Trail has been estimated by the Forest Service as about 198,000 visits annually. The process used in developing these estimates is based on the full length of the trails, not just the segments that are part of the AT. Nevertheless, there is a relationship between use on the AT trail segments and use on the full length of these trails. Since establishing accurate use figures is difficult, and the numbers cited are estimates based on modeling, not actual counts, they have a high margin of error and should be used only as a guide.

The Use and Users study of the AT indicates that about 36 percent of users along the entire length of the trail are day users, 32 percent are overnight users, with section and thru-hikers making up another 32.7 percent. In the New England section of the AT, those numbers are 30 percent, 48 percent, and 21 percent, respectively (Manning, 2000).

AT 2,000-milers (thru hikers, including section hikers) have increased from 116 in 1986 to 603 in 2001.

Environmental Effects

Table 3-65 summarizes the differences in recreation activities among the alternatives.

Effects Common to All Alternatives

Direct and Indirect Effects

Developed Sites

Developed sites are almost always located in MA 2.1 (and 3.1 in Alternative 1), the General Forest Management area. In spite of the wide range of activities that can take place in this MA, the specific management direction for developed sites means that they are generally unaffected by other actions.

The Forest would continue to provide a range of quality developed recreation opportunities not normally found in the private sector. Over time, there may be a more consistent architectural character (guided by the *Built Environment Image Guide*) among the campgrounds and day use areas. Developed recreation facilities may more closely match their designated Recreation Opportunity (ROS) objective (Urban, Rural, or Roaded Natural). A range of development levels would be considered for new construction, reconstruction, and rehabilitation projects. Forest-wide management direction would provide consistency in Forest-developed recreation experiences.

Although demand for day use areas will continue to grow, destination day use sites are tied to a specific attraction and their numbers and capacities are limited. There is some ability to respond to growth in use by increasing parking lot capacity, but the configuration of the attraction itself limits this. The Forest visitor should find little difference in day use opportunities over the planning period.

Picnicking use is projected to grow at a rate of 2 percent annually. Based on current use levels of about 416,000 visits, there would be a need to meet 557,000 visits annually by the end of the 15 year planning period. There is enough current capacity of Forest picnic grounds to meet projected increases in use.*

The Forest would continue to be open to roadside camping, unless closed under Forest Protection Area orders.

Snowmobile Trails

The Forest would continue to provide snowmobile opportunities under the "closed unless open" concept, meaning snowmobile use is allowed only on designated trails. Off-trail cross-country use is prohibited.

* The Forest currently has 1,744 picnic tables, therefore, 1,744 X 5 PAOT (people at one time) X 150 day season = 1,308,000 visits X .60 (% of maximum capacity to give typical optimal operating levels) = 789,500 at typical optimal operating levels.

Table 3-65. Differences in recreation activities by alternative.

Recreation Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Campground Sites	Up to 54 new sites Updated S&Gs	Up to 32 new sites Updated S&Gs	Up to 10 new sites Updated S&Gs	Up to 99 new sites Updated S&Gs
Snowmobile Trails	Up to 30 new miles	Up to 20 new miles	Up to 10 new miles	Up to 50 new miles
Summer Motorized Trails	Up to 60 miles in MA 2.1 (& 3.1, Alt 1)	None	None	Up to 30 miles in one of two identified areas
Backcountry Facilities	Increased capacity up to 45 people Updated S&Gs	Increased capacity up to 40 people Updated S&Gs	Increased capacity up to 35 people Updated S&Gs	Increased capacity up to 65 people Updated S&Gs
Non-Motorized Trails	Up to 40 new miles Updated S&Gs	Up to 25 new miles Updated S&Gs	Up to 10 new miles Updated S&Gs	Up to 100 new miles Updated S&Gs
Mountain Biking	Forest open unless closed. AT and Wilderness closed. Off trail travel authorized.	Forest Trail System open unless closed. AT and Wilderness closed. Off trail travel prohibited. Travel corridors open unless closed.	Forest Trail System open unless closed. AT and Wilderness closed. Off trail travel prohibited. Travel corridors closed unless open.	Forest Trail System open unless closed. AT and Wilderness closed. Off trail travel prohibited. Travel corridors open unless closed.
Rock and Ice Climbing	No restriction on permanent anchors in Wilderness. Updated S&Gs	Permanent anchors for new climbs in Wilderness prohibited. Updated S&Gs		
Outfitter/Guide and Group use	Updated standards and guidelines			
Alpine Zone	Updated recreation S&Gs			
	No MA	New Alpine Zone Management Area (MA 8.1)		
Appalachian National Scenic Trail	MA only where adjacent to MA 2.1 and 3.1.	AT Management Area (MA 8.3), generally 1/2 mile either side of trail.		
	Recreation S&Gs clarified.			

Snowmobile trails are allowed in Management Areas 2.1 (and 3.1 in Alternative 1), 6.1, 6.3, and Experimental Forests (MA 8.2). These management areas have ROS objectives (R, RN, or SPM) consistent with snowmobile use. In MAs 2.1 and 3.1, existing snowmobile trails could be temporarily closed or re-routed as a result of scheduled timber harvest operations or other management activities. Although there could be important impacts of this sort, efforts are made to minimize them by:

- Specific mitigation measures addressing "dual use" would be determined through the project-specific analysis at the time of the subsequent project's proposal and analysis. Accommodations could include widening the road to allow snowmobile use adjacent to the current road surface, bypassing the road with a trail parallel to the road, seasonal closures, scheduled daily closures, or a combination of these measures. It is likely that use of this road for vegetation management would be limited to one operating season or less; it is unlikely that timber sale activity would use the road for more than one year. In all cases, the appropriate time to determine the type and scheduling of mitigation measures would be during the analysis of a subsequent proposed vegetation management.
- Standard coordination between the timber, recreation, and engineering organizations and local groups to minimize impacts and, in some cases, improve the trail system through road standards, bridge placement and design, etc.
- In any one year less than 5 percent of the 2.1 and 3.1 land base could have potential impacts on the snowmobile trail system. In MA 6.1, the same is true when salvage or insect and disease control operations, using temporary roads, takes place. These occur only intermittently, and would have less impact on snowmobile trails.

Forest direction requires that segments of the New Hampshire Corridor and the Maine Interconnected Trail System (ITS) provide uninterrupted use. Corridor routes would be relocated if timber operations impacted them. MA 6.3 prohibits timber activities and temporary road construction. In Experimental Forest (MA 8.2), all recreation activities are secondary to research. There may be temporary or permanent closures to roads presently designated open for snowmobile trails.

Snowmobile use has become dependent on groomed trails, and this has limited illegal use other than on a few user-developed trails scattered around the Forest, often where National Forest and private lands abut. Intermittent illegal off-trail use does not have the same intensity of effect as illegally built trails.

Sound levels from motorized trails use can affect the recreation experience. Sound produced by the current snowmobile trail configuration and use levels would not differ by alternative, and this effect would be limited to winter months. Snowmobile use is restricted to designated trails, and those may only occur in specific management areas. Thus, snowmobile sounds are generally confined near designated trails within management areas 2.1, 6.1, 6.3, and 8.2. Because sound levels are complicated by factors such as

snowmobile volume, group size, speed, machine age and condition, ground cover, and slope, sound may or may not carry beyond the immediate activity, depending on the specific location. Ambient sound levels include those associated with existing vehicle traffic. Where snowmobile trails are located near or adjacent to roads (also a function of management area designation), the ambient sound from varying amounts of traffic could mask snowmobile sounds. State and federal standards for sound generated by snowmobiles apply on the Forest. It is illegal to modify a snowmobile exhaust system in any way that increases the sound level, and the National Snowmobile Safety and Certification Committee provide manufacturer specifications for sound levels. Snowmobiles produced since February 1, 1975, and certified by the Snowmobile Safety and Certification Committee's independent testing company emit no more than 78 dB(A) from a distance of 50 feet while traveling at full throttle when tested under the Society of Automotive Engineers (SAE) J192 procedures. To place decibels in context, the following estimates are provided:

Activity	Approximate sound levels in decibels (dBA)
Threshold of human hearing	0
Normal breathing	10
Rainfall	50
Normal Conversation	60-70
Vacuum Cleaner	60-85
Rural Highway Traffic	60-70
Snowmobiles at 20 miles per hour*	65-75
Flush Toilet	75-85
Power Lawnmower	65-95
Snowblower	105
Symphony, percussion section	130

*This may vary in relation to trail slope, direction of travel, engine and exhaust design, etc.

When considering any effects of sounds generated by snowmobiles, it is important to note that new EPA-mandated emissions standards will take effect on all new snowmobiles, beginning in 2006. It is anticipated that between 2006 and 2014 the pre-emission standard for snowmobiles will be replaced with the new models; it is expected that by 2014, most snowmobiles in the WMNF area will meet the new emission standards, and will transition to 4-cycle engines. The attrition of 2-cycle engines and transition to 4-cycle models may take as long as 10 years, over which time the effects of sound will continue to be reduced.

The standards and guidelines to protect lynx habitat must be considered in evaluating any new snowmobile trail proposal. As a result, there may be places where proposals will need to be relocated or reconsidered.

Summer Motorized Trails

The Forest Service maintains opportunities for motorized use on open roads by street legal vehicles. Permanent roads are allowed only in the General Forest Management area (MA 2.1 and 3.1 in Alternative 1), Alpine Ski Areas (MA 7.1), and Experimental forests (MA 8.2). Some illegal ATV and OHRV use occurs on the Forest. Though limited in area, potential resource impacts can be substantial. The same factors relating to sound from snowmobiling trails also apply to summer motorized trails, except that, of course, effects would occur in the summer months and use would be limited to Management Area 2.1 (and 3.1 in Alternative 1). Sound levels for ATVs must be 106 decibels or less, measured 20 inches from the exhaust pipe at a 45 degree angle with the engine operating at 2,800 revolutions per minute for 1- and 2-cylinder engines (New Hampshire Title XX1 Chapter 266.59a).

Backcountry Use

The Forest Service will continue to manage its trail system and backcountry camping facilities using updated Forest-wide standards and guidelines, generally clarifying the intent of existing direction. The Forest remains open to dispersed camping unless posted closed to that activity, (e.g., restricting camping within 200 feet of Ammonoosuc Ravine Trail). Forest visitors will continue to find evidence of trails, backcountry facilities, and dispersed campsites present throughout the Forest, and may find changes that have resulted from specific concerns and situations. Off-trail use by hikers incurs impacts on vegetation and wildlife (see Rare and Unique Features section).

Backcountry recreation activities prevail throughout the Forest. Recreation is a major objective in some management areas (7.1, 6.2, etc.). In some management areas, backcountry recreation activities exist in partnership with other Forest objectives and management actions. Backcountry recreation activities are prevalent throughout the General Forest Management areas (2.1, and 3.1 in Alternative 1), 6.1, and 6.3, and are present in Experimental Forests (MA 8.2). In MAs 2.1 and 3.1, existing hiking trails could be directly (but temporarily) affected by scheduled timber harvest operations. This should be minimal for the same reasons discussed under Snowmobile Trails, above.

Recreation use is incidental in Research Natural Areas (RNAs) and Candidate RNAs, and existing trails are subject to reconstruction and relocation under special conditions. Existing recreation use in these areas may be limited or prohibited.

The section on Vegetation Management under General Recreation (above) describes activities as they affect the Recreation Opportunity Spectrum (ROS) setting. In MA 6.1, the same effect on hiking trails could be true when salvage or insect and disease control operations occur. In Experimental Forests (MA 8.2), there may be temporary or permanent closures of trails presently designated open because recreation use is subordinate to research activities.

Mountain Biking

Wilderness and the Appalachian Trail Corridor will continue to be closed to mountain bike use. Mountain biking is allowed in all other management

areas. In MAs 2.1 and 3.1, mountain biking may be temporarily affected by scheduled timber harvest, as described in the Snowmobile Trails discussion above. There could be permanent changes to mountain biking opportunities in Recommended Wilderness (MA 9.1). Given that all recreation is subordinate to research activities in Experimental Forests (MA 8.2), both temporary and permanent changes could occur in this MA. Mountain biking would be prohibited if a Recommended Wilderness received Congressional Wilderness designation.

Rock and Ice Climbing

Generally, rock and ice climbing opportunities will continue to remain open for both sport climbing and traditional climbing. However, updated Forest-wide standards and guidelines designed to manage social and biological impacts may place some restrictions on climbing.

Some Forest-wide resource area standards and guidelines that have always affected climbing will continue; for example Threatened, Endangered, and Sensitive Species (TES) could restrict climbing on certain cliffs.

Updated direction for rock and ice climbing prohibits some techniques that could have adverse resource impacts (e.g., chipping to create foot and hand holds, gluing to stabilize features, and attaching artificial handholds). New direction describes acceptable equipment for cleaning the rock face, and may temporarily or permanently close specific areas if climbing creates unacceptable resource or social impacts. Some areas will have site-specific climbing plans when standards and guidelines themselves are not sufficient to address concerns. As use increases, climbers may find access limited at some locations, and additional requirements may change the general feeling of self-determination that many rock climbers seek.

A new Forest-wide guideline to conserve calcareous cliff natural communities may restrict climbing at certain locations.

Outfitter/Guide and Group Use

All alternatives have updated Forest-wide standards and guidelines addressing recreation special uses. These address the timeliness of permit applications and consider their effective administration. There will be fewer off-trail permits, although permits for water-based activities, activities on two or more feet of snow, and established climbing routes (see the rock and ice climbing standards and guidelines) are allowed. Recreation special uses may have more restrictions on number of permits and number of participants. Overall limits may be implemented for recreation special uses if monitoring and analysis determines that capacity (either social or resource) is being reached. The consequence is that outfitter/guide permit holders may have to meet more requirements, and may choose find locations off the Forest that can provide the opportunities they seek.

Alpine Zone Recreation

To address increasing growth and impacts in this distinctive resource, new trails and new backcountry facilities are prohibited. No expansion, in capacity or footprint, of existing overnight facilities in the alpine zone is allowed. This means that in all alternatives, any increase in use would result

in more crowding, and overnight users may not be accommodated. Dispersed camping is allowed in the alpine zone, but only on two or more feet of snow. These factors may push toward greater use in the alpine zone during the winter, e.g., more Presidential traverses or extended operating seasons for existing backcountry facilities.

Appalachian National Scenic Trail (AT)

Management of the Appalachian National Scenic Trail will continue to follow the provisions of the National Trails System Act, as amended (P.L. 90-543). The AT will continue to be managed as a partnership between the National Park Service AT Park Office, USDA Forest Service, local Appalachian Trail Clubs (Appalachian Mountain Club and Dartmouth Outing Club), and the Appalachian Trail Conservancy. The Trail traverses both of the Forest's alpine zones, and since there will be no increase in camping capacity in the alpine zone, the opportunities for overnight camping here will not change. There may be new camping facilities along the AT outside the alpine zone, consistent with Forest-wide direction. Development levels and levels of use will vary along the Trail, but standards and guidelines should make them consistent with AT requirements. As a result, the Appalachian National Scenic trail will continue to be managed and protected consistent with the purposes of its designation.

Cumulative Effects

Some of these recreation activities are also discussed under the alternatives where there are noteworthy differences by alternative.

White Mountain National Forest campgrounds have been operated by the private sector under a concession permit for seven years, and that is expected to continue. This arrangement benefits the Forest by making campground operating costs dependent on campground revenues and the visitor by providing flexibility in responding to user preferences. Conversely, concession operation is viewed by some as contrary to the role of public land, i.e., to provide opportunities not generally provided by the private sector.

The involvement of state-wide and local trail clubs in the Forest snowmobile trail system is expected to continue. There will be increasing demand for snowmobile trails in the region, if registrations continue to increase. Regional snowmobile trail networks are an important part of this activity. Although the Forest is only part of the network, the fact that it encompasses nearly the breadth of central New Hampshire makes it important. Although the current snowmobile network on the Forest is generally acceptable in terms of its linkages with the regional network, some Forest stakeholders feel it could be improved. Some proposed land allocation (e.g., Wilderness and MA 6.2) and the implementation of the lynx strategy that prohibits a net increase in packed over-the-snow trails in lynx habitat, would affect new snowmobile trail proposals. It is expected that, in the long term, the current snowmobile trail system will continue and may be refined, but that it will become gradually more challenging to implement sizeable additions.

Rock climbing in the White Mountains dates back to 1910 (Webster, 1987). By 1927, it had become a full-fledged activity, especially for the Boston

Appalachian Mountain Club (Waterman, 1993). During this decade, routes were established that remain classics today (e.g., the North East Ridge of Pinnacle Buttress in Huntington Ravine). From its origin, the local climbing community has fought hard to maintain a traditional set of ethics. Sport climbing is becoming increasingly important to the mainstream climber as shown at the well developed, and heavily used areas in Rumney, New Hampshire. The increasing demand, coupled with a discrete set of climbing locations, has prompted concern about impacts on resources such as calcareous cliff communities, and the impacts of large number of users. The increase in sport climbing has reduced traditional climbing opportunities. In the long term it is expected that climbers will encounter more site-specific restrictions to protect resources and to address high use. There will be a greater availability of sport climbing as opposed to traditional climbing opportunities (the prohibition of permanent anchors in Wilderness and Recommended Wilderness addresses this concern).

Activities at the summit of Mt. Washington and permitted backcountry facilities in the alpine zone may influence growth in visitation and therefore the quality and type of recreation experience in the backcountry. The Mt. Washington State Park, and portions of the privately-owned Mount Washington Auto Road and Cog Railway, will continue to bring increasing numbers of visitors to this portion of the alpine zone. Although much of this use will generally be limited to the summit area, over the long term, it may extend further into the alpine zone. There have also been efforts by the Auto Road and the Cog to extend their use beyond the current limited season. The AMC has, in the past, extended their season in some of the huts. The quiet times once available in the winter alpine zone are becoming increasingly effected. The alpine zone will continue to be a major visitor draw, and may see increasing use outside the traditional summer season.

When the AT was located in the White Mountains in the mid-1930s, it built on the hiking history of the region. It followed the popular ridges, including the alpine zone, and used the existing trails and backcountry facilities, including AMC Huts. Although these trails were already heavily used, the AT provided another attraction for White Mountain hikers. In 1993, the lands acquired by the Park Service for AT purposes outside the Forest were administratively transferred to the USDA Forest Service. Since then, the entire length of the AT in New Hampshire has been managed in the partnership arrangement discussed above. As a consequence of this partnership, the portion of the AT on the WMNF will continue to be managed and protected consistent with the purposes of its designation into the foreseeable future.

Alternative 1

Direct and Indirect Effects

Developed Sites

Visitation on the White Mountain National Forest will likely increase regardless of planning and management decisions; increasing area population and the increasing popularity of recreation will drive this growth. For developed recreation, there is a close tie between changes in capacity

and increased use. The National Survey on Recreation and the Environment (NSRE) projects campground use to grow at a rate of 1 percent annually. These are national projections; there may be variations because of local conditions and situations. Based on current use levels, this would project a need to meet 305,000 visits annually by the end of the 15 year planning period.

Because there is a marked difference in use at the larger, more highly developed campgrounds versus the smaller, less developed campgrounds, they are viewed as two separate entities in this analysis.

1. The larger and more highly developed campgrounds on the Forest currently accommodate the greatest proportion of campground use, often operating at full capacity on many summer weekends. They include, but are not limited to, the campgrounds near I-93, those along the Kancamagus Highway, and Dolly Copp.* It is expected that the majority of the projected increases in use will be focused on these facilities. They represent 70 percent of the Forest's family campground capacity.
2. The smaller and less developed campgrounds include Basin, Big Rock, Cold River, Crocker Pond, Sugarloaf I and II, Waterville, Wild River, Wildwood, and Zealand campgrounds. These generally do not operate at full capacity on busy weekends. The number of campground sites in this group does not change by alternative.

The additional sites could accommodate 24,300 visitors annually.** Adding these sites would bring the Forest's total capacity to 289,300 visitors per year. The increased capacity, however, would ultimately accommodate only 61 percent of projected increases in use over the 15 year planning period. Visitors not accommodated would either go to the smaller, less used campgrounds, return during lower use times (made easier with the campground reservation system), or go to other campgrounds off the Forest. The different experiences and equipment needs between the highly developed and less developed campgrounds would likely limit the number of people who would choose to go to smaller Forest campgrounds. In response, there would have to be increased management emphasis to maintain the status of the less developed campgrounds. Those who would choose to go to private, off-forest campground would likely find more campers present during their stay.

Snowmobile Trails

This alternative allows for up to 30 miles of additional snowmobile trails. Although some increases would be based on addressing problems with the current trails (relocations that add distance to a trail, alternate trails for corridor segments, etc.), there would also be an increase in total snowmobile trail miles.

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* Blackberry Crossing, Campton Family, Covered Bridge, Dolly Copp, Hancock, Jigger Johnson, Passaconaway, and Russell Pond campgrounds. Although Blackberry Crossing and Passaconaway do not fit the "larger more highly developed" definition, they are included because of their location on the Kancamagus Highway among other large, highly developed facilities.

** 54 campground sites X 5 PAOT X 150 days = maximum capacity X .60 of maximum capacity to give typical optimal operating levels (in this case an additional 24,300 visits).

The proposed increase may result in more secondary trail access to corridor trails, and perhaps more corridor linkages, depending on the specifics of individual proposals and the results of their analysis. The projected growth, based on a 9 percent annual increase in registrations, would result in increased use on the regional snowmobile trail network. Because Forest trails interconnect with the regional network, the Forest user would encounter increased traffic.

This section considers the *change* to the sound levels based on the implementation of Alternative 1. Though there may be up to an additional 30 miles of snowmobile trails constructed during the life of the Plan, there is no way to determine exactly where this would occur. In general, any new trails would be limited to designated routes in Management Areas 2.1, 6.1, 6.3 usually, and perhaps in MA 8.2. Sound levels would vary by snowmobile volume (tied to type of trail — a Corridor or ITS trail would be expected to have higher use than a secondary trail), and also by factors such as group size, speed, machine age and condition, ground cover, and slope. It could generally be expected that sound levels would be increased in these management areas. It would also be expected that, with management area and lynx restrictions, new trails would most likely be located near existing trail systems. Therefore, although there may be increased sound levels, there should be limited new areas with sound impacts from construction of additional snowmobile trails. Obviously this would occur only when there is snow cover.

Summer Motorized Trails

The Forest summer trail system remains closed unless specific trails are designated open to this use. This alternative allows construction of summer motorized trails (limited to ATVs and trail bikes) on a trial basis in MAs 2.1 and 3.1 (totaling 370,000 acres), based on a case-by-case analysis of specific proposals by the public. Although no summer motorized trails are authorized at present, current levels of interest and growth of the activity could lead to multiple proposals. The assumption is that by the end of the planning period, a series of proposals could result in up to two self-contained summer motorized trail systems, each around 20 to 30 miles long (current self-contained trail systems in the state average 20 to 30 miles). If an ATV trail is created, a monitoring program would be established. If use is found to create irreversible damage, summer motorized recreation on the Forest would end. If monitoring results indicate resource or social impacts can be mitigated, summer motorized use would continue. A second proposal for summer-motorized use on the Forest would be considered following the successful trial of the first area. The location of these possible trail systems would be dependent on specific proposals and the results of site-specific project NEPA analysis. New trails could create a draw, greatly increasing summer motorized use. Potential approval of a summer motorized trail proposal, even though on a trial basis, could consequently lead to summer motorized trails becoming a permanent recreation activity provided by the Forest.

There are currently no authorized summer motorized trails on the Forest, and sound emissions from ATVs would represent a new impact. Even so,

their use would be limited to designated trails in up to two locations anywhere in Management Area 2.1. This use would occur during the snow-free season.

Because any trail system on the Forest would be limited, off-highway vehicle users would also need to find other sites on private and non-federal public land that provide this type of recreation activity. With potential approval of summer motorized trail proposals, the current mix of recreation activities in the Forest recreation niche would change. Summer visitors could be impacted by characteristics of motorized trail use, such as sound. This alternative provides an opportunity for a use on National Forest land that some Forest stakeholders have requested.

As a new Forest recreation activity, there would be new costs not usually associated with ongoing activities. There would be additional work with the states, local clubs, and volunteers to develop new working relationships. Currently existing illegal use may not be resolved by new trails; they may actually contribute to illegal uses, such as mudding, if opportunities are visible from the trail. This could result in additional law enforcement involvement.

Backcountry Use

The National Survey on Recreation and the Environment (NSRE) projects an 8 percent annual growth in overnight hiking. These are national projections; there may be variations because of local conditions and situations. For example, data for Forest backcountry facilities that have continuous counts since 1986 suggest the growth is about 7 percent annually, while hut growth data show a 2.5 percent annual increase. Although this 8 percent growth rate is used to estimate programmatic effects, use monitoring would be needed to determine when management actions are actually applied to respond to effects of changes in use. For example, this rate of growth did not occur between 2002 and 2003.

This alternative allows for an increase of up to 45 people at one time at backcountry camping facilities, and up to an additional 40 miles of non-motorized trail. Although some increases and changes to trail miles and backcountry facility capacity would be based on addressing problems with the current situation (e.g., trail relocations that result in lengthened trails), there would also likely be an overall increase in miles of trail, increased capacity of existing backcountry camping facilities, and, perhaps, new backcountry facilities. These changes would most likely take place at or in the vicinity of the more highly used areas that have the greatest demand.

In this alternative, increases in backcountry facility capacity could provide up to 4,050* backcountry facility visitors annually. Increases in trail miles could, theoretically, provide for about 19,200** visitors annually. These changes in use will occur incrementally. There will be some dispersed

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* 45 PAOT X 150 days = maximum capacity X .60 of maximum capacity to give typical optimal operating levels of 4,050 visits.

** Since additional miles of trail are built to meet increasing demand it is assumed that the 10 miles of trail modeled in this alternative represent four different smaller self-contained trails. Therefore use is projected as, an average current use level of trails of 32 PPD (people per day) X 150 day season X 4 trail systems = 19,200. If the additional trail miles were expansions/changes to existing systems there might be no increase in use, just additional user dispersal.

campsites designated by the Forest, but the majority of dispersed sites are user-generated.

In general, there is little existing backcountry facility capacity to accommodate the overnight hiker component of the additional projected use. On average, the backcountry facilities on the Forest are currently operated at or above typical optimal operating levels, although use varies considerably by location and by season. The increased capacity allowed in this alternative would still not meet projected use increases because it provides for a maximum of only 4,500 additional visits at backcountry facilities. Those overnight hikers not accommodated by existing or additional backcountry facilities would probably dispersed camp in the vicinity of a particular location, especially near current high-use locations like the Appalachian Trail. It is uncertain whether increased use will necessarily mean more dispersed sites; it may mean that existing sites will be used more often. The need for more capacity, and the movement of people from backcountry facilities to dispersed campsites, will happen incrementally.

It can be theorized that the projected increase in hikers would mean continued use of the existing and new miles of trail, thus affecting the experience. As a result, some visitors would stay on the Forest, leading to more crowding in the backcountry; others would find the crowding unsatisfactory and would tend toward lesser-used areas, leading to higher use at previously low use areas; still others may seek similar opportunities off the Forest.

At some point, management actions would have to be initiated to address effects from increasing use. In this alternative, management actions are directed by recreation management approaches stated in the 1986 Forest Plan. They include providing a specific range of quality dispersed recreation activities and opportunities, and concentrating use at specific facilities. This does not provide sufficient direction or guidance for managing or limiting use to help avoid problems before they occur. There is no stated process for determining levels or thresholds to help guide an overall approach or to identify specific desired outcomes. The effect of using these management approaches to respond to increasing growth are described in the Recreation Management Approaches subsection.

Mountain Biking

Under this alternative, the entire Forest is open to mountain biking unless closed. Use of the Forest's trail system, and travel corridors, as well as cross-country (off-trail) travel is allowed. Off-trail use may be no more than a single trip through the forest, or it may result in an incidental trail, which may ultimately evolve into a user-developed mountain bike route. These would not be part of any Forest-authorized system even though legal, meaning a mountain bike system of unknown size and configuration could exist outside of the recognized Forest Trail System and thus bypass the normal Forest Service site-specific environmental analysis process.

Although this alternative provides the most opportunities for mountain bike use, it could result in unmanaged use with its associated impacts. As mountain bike use increases, the risk of impacts to natural resources would

also increase. On the other hand, this alternative has the potential to provide the least impact to hiking trail users by giving mountain bikers the most opportunities outside the designated Forest trail system.

See the discussion in Recreation Activities section, and how Wilderness allocation affects mountain bike opportunities.

Rock and Ice Climbing

In this alternative there is no difference between Wilderness and the rest of the Forest regarding rock and ice climbing standards and guidelines. As a result, there is no change in effect on rock and ice climbing in this alternative.

Outfitter/Guide and Group Use

The Forest Service manages outfitter/guide use through the special use permit process. This alternative allows management actions to disperse outfitter/guide groups from high to low use areas, as identified by current trail use levels (very high, high, moderate, and low). There are exceptions to this in Wilderness and Appalachian Trail management areas, where standards and guidelines prohibit this dispersal. The effect of this would be that low use trails may become more intensively used by outfitter/guides, in turn resulting in fewer low use trails. This direction for outfitter/guide permits may be putting the range of backcountry trail experience opportunities at risk.

Alpine Zone Recreation

This alternative does not designate a special management area for the alpine zone. Although standards and guidelines are functional, there is no explicit recognition of this unique natural and recreational resource.

Appalachian National Scenic Trail

This alternative does not designate a special management area for the Appalachian National Scenic Trail for its full length within the Forest. Much of the AT on the National Forest passes through management areas with AT-consistent direction. This, together with standards and guidelines, has proven successful in protecting the Trail. However, the lack of a management area for the AT's full length on the Forest differs from many other National Forests and does not provide consistent direction for this nationally recognized trail.

Cumulative Effects

Cumulative effects based on recreation management approaches, ROS objectives, etc. are covered in the General Recreation section. Those factors that do not differ by alternative are covered in the section on effects common to all alternatives. In this section, the cumulative effects address those things that differ by alternative.

There is expected to be increasing development in and around the Forest, as well as increasing population in the market area for Forest recreation visitors. This will likely lead to increased visitation to the region and the Forest, and will affect developed, motorized, and non-motorized recreation activities. Planned increases in facilities are likely insufficient to meet the projected growth in visitation. White Mountain National Forest

campgrounds provide about 12 percent of the number of campgrounds in Coos, Grafton, and Carroll Counties. The increase in number of campground sites (5 percent in this alternative) would mean that, if use projections hold true, campground opportunities would increasingly have to be provided by private or non-federal public sector entities. There is expected to be increasing demand for motorized trail recreation in the region. This alternative may have up to 30 miles of new snowmobile trail and up to 60 miles of summer motorized trail. These new summer motorized trails would be unlikely to meet demand for these activities, however. Over the long term, visitors desiring these experiences would likely need to seek other places on private and non-federal public land that provide this type of recreation activity.

There is expected to be increasing demand for non-motorized trail recreation in the region. This alternatives increases trails by 5 percent from the current level and adds another 5 percent to the existing capacity of backcountry facilities. It can be assumed that increasing overnight visitation to the backcountry not accommodated at backcountry sites would overflow as dispersed camping to nearby locations on the Forest. It is uncertain whether increased use will necessarily mean more dispersed sites. Either way, if history is any teacher, these would be hardened to minimize impacts and could eventually become new backcountry facilities (see the subsection on Recreation Management Approaches).

Mountain bike use is increasing. The Forest is open both on- and off-trail to mountain bikes unless closed. Wilderness and the AT are closed to mountain biking. This alternative has the most potential to result in mountain bike use being spread through the majority of the Forest, on- and off-trail.

Snowmobile registrations are increasing, and increased use — with corresponding increased sound levels, can be anticipated from existing and new snowmobile trails. The potential for up to two ATV trail systems would extend motorized trail sound impacts (even though limited) through the full year. Counteracting this is the increased emphasis by both the public and industry on controlling sound emissions.

Alternative 2

Direct and Indirect Effects

Developed Sites

This alternative allows up to 32 additional campground sites. Most increases and changes would address problems with the current facilities, but there would be some increase in existing campground capacity. New campgrounds would not be constructed. Any changes would probably affect the larger, more highly developed campgrounds with the greatest demand.

The 32 additional campground sites would accommodate 14,400 additional visitors annually (see calculations footnote under Alternative 1). When added to current capacity of the larger campgrounds, the total visits accommodated would be 279,400 per year, or 36 percent of the projected increase in use. Visitors who could not be accommodated would act as described in Alternative 1, including going to other campgrounds in the private sector.

Because the allowed increase is half that of Alternative 1, it would be expected that these actions would occur sooner than under Alternative 1. For the same reason, this alternative would lead to greater challenges in responding to requests to increase development levels at the smaller, lower developed campgrounds.

Snowmobile Trails

This alternative allows for up to 20 miles of additional snowmobile trails. Although most increases would address problems with current trails (e.g., alternate trails for corridor segments), there would also be a limited increase in total snowmobile trail miles.

Limiting new trails to 20 miles rather than the 30 miles in Alternative 1 may result in a snowmobile system with less secondary trail access to corridor trails, corridor linkages, etc., depending on the specifics of individual proposals and the results of their analysis. There would be increased use on Forest snowmobile trails, resulting in more traffic and congestion than under Alternative 1. There would be less chance for increased snowmobile sound levels than in Alternative 1.

Summer Motorized Trails

This alternative prohibits summer motorized trails. With summer motorized trails prohibited, the current mix of recreation activities would remain the same. Summer visitors would not be affected by sound or other characteristics of this type of use. There would be no change in sound levels from this use compared to the current condition.

Backcountry Use

This alternative allows an increase in capacity of up to 40 people at one time at backcountry camping facilities, and adds up to 25 miles of non-motorized trail. Although most increases and changes to trail miles and backcountry facility capacity would address problems with the current facilities (e.g., trail relocations that result in lengthened trails), there would also be an overall limited increase in miles of trail, increased capacity of existing backcountry camping facilities, and, perhaps, new backcountry facilities. These changes would most likely take place at or in the vicinity of the more highly used areas that have the greatest demand.

Under this alternative, increases in backcountry facility capacity could accommodate up to 3,600 backcountry facility visitors annually. Increases in trail miles could theoretically accommodate up to about 9,600 visitors annually. These changes in use will happen incrementally. There will be some dispersed campsites designated by the Forest Service, but the majority would be user-generated.

In general, the response of hikers — including overnight hikers — not accommodated by increases in facility capacity and trail miles, would be the same as under Alternative 1. It is expected to occur sooner, because increases in facilities and trails are smaller, while use would increase the same amount.

Management actions that respond to effects from increases in use would have to be initiated at some point. Because of the uncertainties of actual

growth rates, forecasting where people might go, visitor perception of what is acceptable, and impacts to the resource, site specific monitoring would be needed to determine appropriate mitigation measures to take. In this alternative, management actions call for the Forest Service to work with its stakeholders to fully understand specific effects of increasing and changing use patterns. Appropriate ways to respond, based on overall Forest-wide guidance, would also be considered. This approach proposes limited growth in the amount and type of facilities on the Forest and works to develop indicators of potential resource or social interaction concerns so the Forest Service can respond appropriately before they become major problems.

The basic premise of this alternative is that in order to maintain the range of quality recreation opportunities for the next fifteen years, the Forest Service and Forest stakeholders will need to closely monitor changes in use patterns and increases in use and respond early with a variety of both education and management controls to ensure the setting and quality of experience are maintained. The effects of these management approaches are described in the Recreation Management Approaches section.

Mountain Biking

Under this alternative, cross-country use is prohibited, and Forest development trails are open unless closed to mountain bike use. Wilderness and the AT continue to be closed to mountain biking. Travel corridors are open unless closed to mountain biking, with the intent that over the ten-year planning period the Forest Service will work with concerned parties to determine which travel corridors would be included in the Forest trail system. This is a change from current direction and use. However, the policy clearly prohibits user-developed trails. Additional education and enforcement will be necessary to address the prohibition on off-trail use.

This alternative would eventually focus mountain bike use on the Forest Trail System and to a specific set of identified travel corridors. As site-specific decisions regarding conversion of travel corridors to system trails are implemented, mountain bike use will be increasingly concentrated on system trails. There would be less potential for mountain bike use to spread beyond trails and identified travel corridors than under Alternative 1, but greater potential for impacts than Alternative 3. Over the planning period, it is expected this alternative would bring mountain bike use on the Forest into an identified trail system more quickly than under Alternative 3. The potential for uncontrolled trail development and associated resource impacts would be less than under Alternative 1.

Rock and Ice Climbing

Under this alternative, permanent climbing anchors on new climbing routes are prohibited in Wilderness and Recommended Wilderness; thus, these areas would favor traditional climbing opportunities over sport climbing. Table 3-66 lists the current rock climbing areas in Wilderness and Recommended Wilderness under this alternative.

Table 3-66. Rock Climbing Areas in Wilderness/Recommended Wilderness, Alternative 2.

Wilderness	Climbing Area
Great Gulf	None
Presidential Range/DryRiver	Texaco Slab Missing Wall Stairs Mountain
Pemigewasset	Garfield Cliffs The Captain Bond Cliffs
Sandwich Range	Square Ledge
Caribou Speckled	None
Recommended Wilderness	
Sandwich Ext.	Mt. Hedgehog Square Ledge
Wild River	Wild River

Outfitter/Guide and Group Use

The Forest Service manages outfitter/guide use through the special use permit process. This alternative has Forest-wide management direction that prohibits management actions to disperse outfitter/guide groups from high to low use areas, as identified by current trail use levels (very high, high, moderate, and low). The effect of this would be that low use trails across the Forest would not become more intensively used as a result of management dispersion of outfitter/guides. This direction for outfitter/guide permits would not put the range of backcountry trail experience opportunities at risk from this one activity.

Alpine Zone Recreation

This alternative has established a special management area (MA 8.1) for the alpine zone. Although standards and guidelines are functional, there is also explicit recognition of this unique natural and recreational resource.

Appalachian National Scenic Trail

This alternative has established a special management area (MA 8.3) for the Appalachian National Scenic Trail over its full length in the Forest. This is viewed by some Forest stakeholders as positive, because it makes possible more consistent management along the entire 2,100 mile length of the AT.

Cumulative Effects

The same general cumulative effects that apply to Alternative 1 also apply to this alternative in most recreation activities, with the difference that there is a lower level of infrastructure allowed in this alternative. The number of campground sites increased in this alternative is 4 percent, compared with

5 percent in Alternative 1. This alternative allows up to 30 miles of new snowmobile trail, which would have little impact on the region-wide system. This alternative prohibits summer motorized trails. It establishes the possibility that this use will never become part of the mix of Forest recreation activities, a positive or a negative depending on viewpoint.

Alternative 2 increases trails by 4 percent from the current, and adds another 3.5 percent to the existing capacity of backcountry facilities, both slightly less than in Alternative 1. It can be assumed that increased overnight backcountry visitors not accommodated at backcountry sites would overflow as dispersed campers to nearby locations on the Forest. It is uncertain whether increased use will necessarily mean more dispersed sites. Either way, these would be hardened to minimize impacts and eventually could become new backcountry facilities. Working against this change would be recreation management approaches developing the need for the Forest Service to work with stakeholders to look at appropriate ways of responding to increased use.

The Forest trail system is open unless closed to mountain biking, off-trail travel is prohibited, and travel corridors are open to mountain bikers unless closed. Wilderness and the AT continue to be closed to mountain biking. This alternative has the most potential to limit mountain bike use to system trails or identified travel corridors, and this is positive or negative depending on viewpoint.

Sport climbing is growing region-wide. The increasing public demand for the sport has led to a reduction in the number of traditional climbing sites. The restriction on permanent anchors, used in sport climbing, at new climbs in Wilderness or Recommended Wilderness, counters this trend. Traditional climbing generally offers a higher degree of uncertainty and a greater sense of exploration than sport climbing.

There is an additional 34,500 acres of Recommended Wilderness in this alternative, which could mean fewer opportunities for mountain biking and sport climbing than under Alternatives 1 and 4, but more than under Alternative 3 (see the Recreation Activities section discussion of the Recommended Wilderness affect on mountain biking).

Snowmobile registrations are increasing, and increased use — with corresponding increased sound levels, can be anticipated from existing and new snowmobile trails. The prohibition on ATVs would maintain the sound impacts from motorized tails to winter months only. Counteracting this is the increased emphasis by both the public and industry on controlling sound emissions.

Alternative 3

Direct and Indirect Effects

Developed Sites

This alternative allows for an increase of up to 10 additional campground sites. Although most increases and changes would address problems with the current facilities, there would be minor increases in capacity of existing

campgrounds; new campgrounds would not be constructed. These changes would most likely take place at the larger, more highly developed areas that have the greatest demand.

The ten additional campground sites would accommodate an increased demand of 4,500 visitors annually. When added to current capacity of the larger more highly developed campgrounds, the total is 269,500 visits per year, or 12 percent of the projected increases in use at the larger more highly developed campgrounds. After that, visitors not accommodated would act as described under Alternative 1. Because the allowed increase is less than that of Alternative 1, it would be expected that these actions would occur sooner than under Alternative 1. Alternative 3 would have a greater burden in responding to requests to increase development levels at the smaller, less developed campgrounds.

Snowmobile Trails

This alternative allows up to 10 miles of additional snowmobile trails, which is the smallest proposed increase. Almost all of these limited increases would be based on addressing problems with the current trails (trail relocations that result in lengthened trails, alternate trails for corridor segments, etc.); there would be minimal increase in total snowmobile trail miles. Snowmobile sound level changes would be the lowest under this alternative because Alternative 3 provides for the fewest miles of new snowmobile trail. The minimum miles allowed would also tend to focus these increased sound levels at existing, rather than new, locations more so than any other alternative.

Limiting new trails to 10 miles means that this alternative would result in a snowmobile system with the least secondary trail access to corridor trails or corridor linkages. The projected growth, based on 9 percent annual increases in registrations, would result in increased use on the regional network of snowmobile trails. Because of the interconnectedness of Forest trails with the regional network, the Forest snowmobile trail user should encounter the most increased traffic of any alternative.

Summer Motorized Trails

The direct and indirect effects of Alternative 3 are the same as under Alternative 2.

Backcountry Use

This alternative allows an increase in capacity up to 35 people at one time at backcountry camping facilities, and allows up to an additional 10 miles of non-motorized trail. These are the smallest increases of any alternative. Although some increases and changes to trail miles and backcountry facility capacity would address problems with the current facilities (e.g., trail relocations that result in lengthened trails), there would also be overall limited increase in capacity of existing backcountry camping facilities and very limited increase in miles of trail. These changes would most likely take place at or in the vicinity of the more highly used areas that have the greatest demand.

In this alternative, increases in backcountry facility capacity could provide up to 3,150 backcountry facility visitors annually. Increases in trail miles could theoretically provide for about 4,800 visitors annually. These changes in use will happen incrementally.

In general, the response of hikers — including overnight hikers — not accommodated by increases in facility capacity and trail miles, would be the same as under Alternatives 1 and 2. It is expected to occur sooner, because increases in facilities and trails are the smallest, while use would increase the same amount.

Implementation of management actions to respond to changes in use would be the same as described in Alternative 2.

Mountain Biking

Under this alternative, the Forest trail system is open unless closed to mountain bike use, while travel corridors are closed unless open to mountain biking. Cross-country use is prohibited. This is a change from current direction and use; the policy clearly prohibits user-developed trails. Additional education and enforcement will be necessary to enforce this, as well as the closure of travel corridors until case-by-case decisions can be made concerning their future use.

This alternative focuses mountain bikers on the Forest Trail System and any travel corridors that are designated open to mountain biking. It represents the lowest potential for mountain bikers to spread away from trails of all alternatives. It could, therefore, have greater impact on hiking trail users. The potential for uncontrolled trail development and associated resource impacts would be the least of any alternative.

Rock and Ice Climbing

The direct and indirect effects of Alternative 3 differ from Alternative 2 only in the identified climbing areas. Table 3-67 lists the inventoried rock climbing areas in Wilderness and Recommended Wilderness under this alternative.

As a result, there will be no additional sport climbing opportunities on new climbs in these management areas.

Outfitter/Guide and Group Use — Recreation Specific

The direct and indirect effects of Alternative 3 are the same as under Alternative 1.

Alpine Zone Recreation

The direct and indirect effects of Alternative 3 are the same as under Alternative 2

Appalachian National Scenic Trail

The direct and indirect effects of Alternative 3 are the same as under Alternative 2.

Cumulative Effects

In general, the cumulative effects of Alternative 3 are very similar to those of Alternative 2, with only small differences in infrastructure change allowed in this alternative compared to Alternative 2.

Table 3-67. Rock Climbing Areas in Wilderness/Recommended Wilderness, Alternative 3.

Wilderness	Climbing Area
Great Gulf	None
Presidential Range/DryRiver	Texaco Slab Missing Wall Stairs Mountain
Pemigewasset	Garfield Cliffs The Captain Bond Cliffs
Sandwich Range	Square Ledge
Caribou-Speckled	None
Recommended Wilderness	
Wild River	Wild River
Kilkenny	None
Dartmouth	None
Pemi Extension	Potash Knob The Captain

There is an additional 97,800 acres of Recommended Wilderness in this alternative. Based on the ultimate designation of acres recommended, this alternative provides the greatest future reduction in area available for mountain biking and new sport climbing opportunities than any alternative. See Recreation Activities section discussion of Recommended Wilderness affect on mountain biking.

Alternative 4

Direct and Indirect Effects

Developed Sites

This alternative allows up to 99 additional campground sites. Although some increases and changes would address problems with the current facilities, there would be increases in capacity of existing campgrounds. This alternative would be the most likely to see an entirely new campground. The changes would most likely take place at the larger, more highly developed areas that have the greatest demand.

The 99 additional campground sites would result in the ability to accommodate 44,550 visitors annually. When added to the current capacity of the larger, more highly developed campgrounds, the total visits accommodated is 310,000 per year. This alternative has the potential to be most responsive to requests for increased development levels at the smaller, lower developed campgrounds.

Snowmobile Trails

This alternative allows up to 50 miles of additional snowmobile trail. Although some increases would address problems with the current trails (trail relocations that result in lengthened trails, alternate trails for corridor segments, etc.), there would be a considerable increase in total snowmobile trail miles, more than in any other alternative.

This alternative could result in a snowmobile system with the most secondary trail access to corridor trails, corridor linkages, etc., depending on the specifics of individual proposals and the results of their analysis. This alternative may result in the least traffic and congestion on the proposed Forest snowmobile trail system of any alternative. There would be, however, the highest level of increase in snowmobile sound emissions under this alternative, and they would likely be widespread through Management Areas 2.1, 6.1, 6.3, and perhaps MA 8.2, even though they would still be restricted to designated routes within the management areas.

Summer Motorized Trails

This alternative provides for a pilot (3-year test period) summer motorized trail proposal in either the Landaff area (about 7,500 acres north of Route 112 and west of Route 116) or the Moat Mountain area (about 3,400 acres of National Forest land west of the West Side Road). If this alternative is chosen, the Record of Decision will identify the selected area.

A proposal for a summer-motorized trail in the area selected would result in a self-contained trail system up to 30 miles in length and limited to ATVs and trail bikes. In addition, as part of the alternative there would be pre- and post-construction monitoring.

Potential approval of a summer motorized trail proposal in one of these two areas, though a pilot program, could lead to summer motorized trails becoming a permanent recreation activity provided by the Forest. This is a change from the current mix of recreation activities in the Forest recreation niche. The particular location of the pilot trail would be dependent on the area selected and the results of site-specific environmental analysis. The effects of this trail would be about half that in Alternative 1, because this alternative allows half the miles of trail.

There could be increased sound levels in either the Landaff or Moat Mountain area, depending on which was selected. These sound impacts would be new to the Forest, since there is currently no authorized ATV use. Even so, use would be limited to designated trails, and only on one of the two identified locations.

Backcountry Use

This alternative allows an increase in capacity of up to 65 people at one time at backcountry camping facilities, and allows up to 100 miles of additional non-motorized trail. Although some increases and changes to trail miles and backcountry facility capacity would address problems with the current facilities (e.g., trail relocations that result in lengthened trails) this alternative would have the greatest allowable increase in capacity of existing backcountry camping facilities and miles of trail. It also has the greatest

potential for new facilities. These changes would most likely take place at or in the vicinity of the more highly used areas that have the greatest demand.

In this alternative, increases in backcountry facility capacity could accommodate up to 5,850 backcountry facility visitors annually. Increases in trail miles could theoretically provide for about 48,000 visitors annually. These changes in use will happen incrementally. There will be some dispersed campsites designated by the Forest Service, but the majority of dispersed sites will be user-created.

In general, the response of hikers — including overnight hikers — not accommodated by increases in facility capacity and trail miles would be the same as under Alternative 1. It is expected to occur later, because increases in facilities and trails are the greatest, while use would increase the same amount. This would likely result in the greatest trail density increase among the alternatives.

This alternative allows the greatest increase in backcountry infrastructure, but the other recreation management approaches used in Alternatives 2 and 3 still apply. In this alternative, management actions are directed by recreation management approaches that define the need for the Forest Service to work with stakeholders to understand use patterns and begin looking at appropriate ways to respond, based on Forest-wide guidance. The recreation management approaches develop indicators of potential resource or social interaction concerns so the Forest Service can respond appropriately before they become major problems. The basic premise of this alternative is this: in order to maintain the range of quality recreation opportunities for the next fifteen years, the Forest Service and Forest stakeholders must closely monitor changes in use patterns and increases in use. An early response will be needed, using a variety of education and management controls to, ensure that the setting and quality of experience are maintained. The effects of these management approaches are described in the Recreation Management Approache subsection above.

Mountain Biking

Under this alternative, the Forest trail system and travel corridors are open unless designated closed to mountain bike use. Cross-country use is prohibited. The Forest Service would identify travel corridors closed to mountain biking, and this process would be on a case-by-case basis. This is a change from current direction and use, and is similar to Alternative 2. The policy prohibits user-developed trails. Additional education and enforcement will be necessary to enforce this, as well as those travel corridors identified for closure. The enforcement effort may be greater than under Alternative 2, because closures would be decided on a case-by-case basis rather than through an area-wide evaluation. It would be less than under Alternative 3, because closures would not be applied to all travel corridors.

This alternative would focus mountain bikers on the Forest Trail System. The time period would be determined by the rate of case-by-case travel corridor closures as site-specific resource impact situations arise. Over the life of the Plan, this alternative may lead to the greatest number of travel corridors open to mountain bike use. Limitations for travel corridor use are

similar under Alternatives 1 and 4, but off-trail use is prohibited under Alternative 4. This may force mountain bike use increasingly onto travel corridors.

The potential for uncontrolled trail development and associated resource impacts would be less than under Alternative 1. This alternative would bring mountain bike use into a "managed" configuration over the longest time period compared to the other alternatives because the travel corridors would be open to mountain biking and the onus would be on the Forest Service to identify problems leading to closure.

This alternative would have more potential than Alternative 3 for mountain bikers to move away from the trail system because there are additional travel corridors available. It could, therefore, have fewer potential impact on hikers. Compared with Alternative 2, there may be more movement of mountain bikers off the Forest in search of off-trail opportunities. Although there may be some movement off-Forest by those mountain bikers seeking additional trail use, the "open unless closed" travel corridor policy should lessen this.

Rock and Ice Climbing

The direct and indirect effects of Alternative 4 differ from Alternative 2 only in the identified climbing areas. Tables 3-71 (Alternative 2) and 3-72 (Alternative 3) identify the inventoried rock climbing areas in current Wilderness and Recommended Wilderness. No climbing areas have been inventoried in the additional 18,000 acres of Recommended Wilderness under Alternative 4, so the current opportunities for sport climbing would not change.

Outfitter/Guide and Group Use — Recreation Specific

The direct and indirect effects of Alternative 4 are the same as under Alternative 1.

Alpine Zone Recreation

The direct and indirect effects of Alternative 4 are the same as under Alternative 2

Appalachian National Scenic Trail

The direct and indirect effects of Alternative 4 are the same as under Alternative 2.

Cumulative Effects

The same general cumulative effects that apply to Alternative 1 in most recreation activities apply here, with a difference in magnitude beyond Alternative 1 due to a higher level of infrastructure allowed in this alternative (except for summer motorized trails — one system as opposed to two systems in Alternative 1), the greatest infrastructure increase of any alternative. It includes a 12 percent increase in campground sites, 12 percent increase in snowmobile trails, 5 percent increase in backcountry facility capacity, and an 8 percent increase in non-motorized trails.

An additional 18,000 acres of Recommended Wilderness is included in this alternative. Depending on the ultimate designation of acres recommended, this alternative provides the least reduction in area available for mountain

biking and new sport climbing opportunities of all the alternatives except Alternative 1. See Recreation Activities section discussion of Recommended Wilderness affect on mountain biking.

Effects on Non-priced Benefits

The values placed on recreation on the WMNF extend beyond those that can be accounted for in a purely economic analysis, and are generally described in terms of outcomes derived from recreation experiences. A number of these outcomes, both positive and negative, have been identified by researchers, and most often, they have been referred to as benefits which are "improved or desired conditions to individuals, groups, and society ... from production and use of leisure service." (Driver et al., 1991) These outcomes are manifested at different scales, and again are not always positive. Below, the non-monetary values of recreation are examined at these different scales.

At the community or societal level, the effects of available recreation activities and programs can be significant. This is clearly the case in areas surrounding the WMNF. Some of the positive, non-monetary societal outcomes that can be attributed to the presence of recreation activities are:

- A sound environment from preserved open space for recreation;
- Increased family and community bonding, due to time spent together recreating;
- Better collective health due to physical and activities and stress relief achieved from recreation; and
- Greater perceived quality of life compared to places where recreational amenities are not available (Pandolfi, 1999).

These beneficial outcomes are difficult to quantify in economic terms, but can have profound effects on communities and regions.

Alternatively, there are a number of negative outcomes that are related to recreation and recreational development. Among these negative outcomes at the community or societal scale are:

- Increased crowding from recreational visitors;
- A number of seasonal or low-paying jobs that support recreational services; and
- Changing community character during times when outside visitation numbers are at their highest.

In many places, these negative outcomes are serious issues. However, only in the most unusual cases have communities declared that the negative effects of recreational development outweigh the positive outcomes.

At the level of the individual, many closely related outcomes of recreation and recreational activities exist. These include:

- Health benefits, both physical and mental, from physical activities and stress release;

- Increased self-esteem and self-confidence, most commonly gained from succeeding at challenging activities or participating in activities that help individuals reach an idealized notion of who they would like to be;
- Increases in knowledge, either from participating in organized interpretive activities, from casual conversation, or from individual study before, during, or after an activity;
- Closer relationships and increased social bonding, derived from recreation with friends and relatives; and
- Increased physical skills from taking on new or challenging activities.

This is perhaps the most tangible level at which the outcomes of recreation manifest themselves. For many in the industrialized world, recreational activities have become mechanisms for defining identities and social groups. The simple fact that recreation activities, by definition, reflect choices made with one's discretionary time underscores the importance that individuals often place on those activities. Put another way, one's choice of recreational activity is one of few ways in which an individual can define him- or herself.

This is not to say that all individual outcomes of recreation are positive. Especially when considering the connections between individuals and communities, recreation activities can carry negative consequences (e.g., injuries, and phobias that stem from recreational activities). Again, though, the positive outcomes nearly always heavily outweigh the negatives.

Finally, at both an individual and societal level, recreational programs and amenities are typically valued for their existence. These existence values generally do not correlate to a person's use history, that area's proximity to an individual, or even that person's intentions to use a given area for recreation. Simply knowing that areas exist for different types of recreation is enough for people to cast value and meaning onto that place. This is most easily evidenced by large, notable areas in remote locales, such as national parks in Alaska. Relatively few Americans will visit these remote places, but social science data repeatedly demonstrate these same individuals care deeply that their character remain undisturbed. In the case of the WMNF, studies have shown that both local and non-local individuals recognize the unique existence of large undeveloped areas in a heavily populated region like New England. Economists have attempted to assess what the monetary equivalents of these existence values might be, but thus far have been able to only come up with a loose approximation.

The goal of the Forest recreation program is to provide a range of quality recreation opportunities to meet the myriad needs of individuals. Although each locale and recreational resource will have a different set of recreational opportunities, the WMNF recreation niche has a strong component of recreation opportunities provided in a natural setting; the White Mountains are an ideal location for those individuals who seek self-fulfilling experiences through their pursuit of recreational activities.

Alpine Skiing

Affected Environment

Alpine Ski Area Permits and Potential Expansion Areas

Permitted ski areas serve to increase the range of recreation activities on the Forest by providing quality recreational opportunities at the developed end of the ROS objectives scale. They are provided in partnership with the private sector, allowing private investment on public land to meet public recreation needs. In terms of public costs, these areas represent the most cost-efficient management scenario.

Loon Mountain, Waterville Valley, Attitash/Bear Peak, and Wildcat ski areas are operated under special use permit authority, consistent with permit language and the Forest Plan. The Forest retains the areas identified in the current Plan, as amended by the approved Loon Mountain Ski Resort Development and Expansion FEIS, for potential ski area expansion (MA 9.2). This includes lands adjacent to Loon Mountain, Attitash/Bear Peak, and Snows Mountain in Waterville Valley, as well as the former Mittersill Ski Area (see Table 3-68).

Forest Plan guidance for the White Mountain National Forest supports a continued partnership between the Forest Service and Special Use Permit holders to provide developed recreation opportunities. The Forest encompasses some of the most suitable terrain for downhill skiing in New Hampshire, and the expansion of existing areas is appropriate and consistent with the concept of multiple-use management and the Forest's recreational objectives. The Final Environmental Impact Statement for the 1986 Forest Plan and the Record of Decision further define the role of ski areas in fulfilling the Forest's developed recreation niche.

Alpine ski areas are assigned Management Area (MA) 7.1, in which the purpose includes to "broaden the range of recreation opportunities by recognizing the potential for year-round recreation facilities at alpine ski areas managed by the private sector." (WMNF, 1986) This MA allows modifications to the natural environment to enhance recreation activities, while maintaining vegetation and preventing soil erosion. Human activity is evident, and facilities within the area are designed for use by a large number of people while remaining compatible with the values that make the area attractive to users. Additional direction for MA 7.1 addresses criteria for withdrawals of water from streams or ponds for snowmaking (e.g., allowing withdrawal only when flows or water levels exceed the minimum established requirements — WMNF, 1986; see also the Water Resources section).

The majority of skiers seek intermediate terrain conditions; there is less demand for beginner and expert terrains. A more precise assessment of terrain offerings compared to market demand is important for resort planning, because an appropriate mix of terrain that closely matches market

demand assures that skiers have adequate terrain to explore, helps separate skiers on the slope by ability level (thus improving safety), and is linked to visitor satisfaction.

Because the ski industry has not grown significantly in the past two decades, ski resorts are attempting to accommodate and foster growth in the newer segments of the snow sports market. The popularity of snowboarding, in particular, as well as snow tubes, shaped skis, fat skis, short skis, blades, snow bikes, and other methods of getting down the hill, has changed the way a growing segment of the skiing public uses ski terrain. Snowboarders are the fastest growing segment of the ski industry, representing 28 percent of the national skier market and 20.7 percent of the Loon market for the 1997-1998 season (BBC, 1999). Snowboarders are probably one of the greatest contributors to the drive for reshaping skiing terrain. Compared to traditional alpine skiers, snowboarders seek out wider trails and more uneven terrain features, such as those found in terrain parks. The differing terrain demands of skiers and snowboarders contribute to crowding and a need to redesign terrain to reduce the risk of collisions.

Skier enjoyment is inextricably tied to consistent and high-quality snow conditions. However, the unpredictability of natural snowfall and freeze/thaw events are a fact of life for the ski industry in the Northeast. To viably compete, it is important for Northeastern resorts to have reliable snowmaking systems, with both adequate total capacity (available water) and instantaneous pumping capacity (the ability to deliver water up-mountain quickly during times conducive to snowmaking) (LMRC, 1999a). Adequate snow coverage is also considered essential in terms of percentage of trails covered by snowmaking and the number of times trails are covered to specific depths due to inadequate natural snow and freeze/thaw events. There are many periods when providing adequate snow coverage is critical. Most important is the Christmas holiday season, that sometimes lasts two weeks, and is often the first coverage of the season if natural snowfall and snowmaking temperatures have not been available. Martin Luther King, Jr., holiday weekend in January can be a high use time as well, and the President's Day holiday, spanning two weeks in February, is the last key period. Without the ability to make snow during these periods, particularly when natural snowfall is lacking, many ski areas would not be able to provide high-quality, consistent skiing and riding conditions as they compete against other vacation opportunities.

The New England geography strongly influences the visitor dynamics of the regional ski industry. The density of resorts in New England is relatively high, and most are located within a reasonable driving distance from major metropolitan areas. Consequently, several resorts in multiple states compete for a share of the same pool of skiers and recreationists. The six-state New England area encompassed about 84 ski areas and experienced approximately 9.2 million skier visits in the 1997-1998 season (BBC, 1999). Table 3-69 shows winter use on White Mountain National Forest permitted ski areas.

Table 3-68. Key Factors of Current Permitted Ski Areas and Acres of Expansion Areas.

White Mountain Resort Offerings Ski Area Characteristics									
Resort	**Permit Acres**	**Identified Expansion Areas (MA 9.2)**	**Vertical Terrain (feet)**	**# Trails**	**Skiable Terrain (acres)**	**Terrain mix (% Novice/ Intermed./ Expert)**	**# Lifts**	**Snow-making Coverage (acres/%)**	**Distance from Boston (hours)**
Loon Mountain (facilities existing pre-1993)	1,366 (as amended by Loon Mtn ROD)	609 (as amended by Loon Mtn ROD)	2,100	43	274 266	19/56/25 22/53/25	8 9	264/97 220/83	2.5
Waterville Valley	790	387	2,020	52	255	36/44/20	11	255/100	2
Attitash/Bear Peak	279	770	1,750/ 1,450	68	280	20/47/33	12	272/97	2.5
Wildcat	903	0	2,100	44	225	25/40/35	4	225/100	2.5
Mittersill	**NA**	**471**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**2.5**

Sources: Hyperski (2000); New England Ski Guide (2000); Ski New Hampshire (2000); Sunday River (2000).

Table 3-69. Winter Use on White Mountain National Forest Permitted Ski Areas.

	Skier Visitation Numbers 1991 – 2002										
	Season										
Ski Area	**91/92**	**92/93**	**93/94**	**94/95**	**95/96**	**96/97**	**97/98**	**98/99**	**99/00**	**00/01**	**01/02**
Loon Mountain	343,000	347,000	331,000	301,500	337,500	340,000	337,500	350,000	297,000	303,000	231,000
Waterville Valley	334,000	335,000	301,000	215,000	256,000	215,000	257,000	236,000	232,00	204,000	235,000
Attitash/ Bear Peak	140,000	161,000	158,500	177,300	208,000	204,000	197,000	233,000	210,000	194,000	220,000
Wildcat	125,000	115,000	116,000	95,000	110,000	99,000	100,000	87,000	74,000	71,000	80,000
TOTAL	**942,000**	**958,000**	**906,500**	**788,800**	**911,500**	**858,000**	**891,500**	**906,000**	**813,000**	**772,000**	**765,000**

Sources: Pioneer (1997); Lewis (2000)

Alpine ski resorts also offer numerous summer and fall recreational opportunities, most of which involve environmental education or physical activity in an outdoor setting. Examples are gondola rides, mountain biking, sight-seeing, nature appreciation, hiking, in-line skating, horseback riding, living history exhibits, nature trail hikes, and special events.

The Forest Plan goal for MA 9.2 is to "recognize the potential need for ski area expansion and manage the lands so as not to preclude future ski area development." (WMNF, 1986) Lands within this MA are adjacent to existing ski areas, and have been set aside for expansion by current ski area permit holders, after required NEPA analysis. Although development of new ski areas was not considered in the Forest Plan, the expansion of existing ski areas was identified as a cost-efficient approach for addressing future demand. The Forest's ski areas contain some of the most suitable terrain for alpine skiing in northern New Hampshire, and offer a greater diversity of trails at varying skill levels.

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

Alpine Ski Area Permits and Potential Expansion Areas

Changes in other management area direction or allocation will have no effect on alpine ski area operations or MA direction.

Development within the permit boundaries depends on permit holder proposals and Forest Service action on those proposals, using the site-specific environmental analysis process. The same holds true for any ski area proposal for expansion beyond the permit area into the identified expansion areas. These developments are the result of the Forest Service working in partnership with private industry to ensure the ski areas remain capable of providing a quality recreation opportunity in a natural setting on NFS lands. As a result, a substantial infrastructure designed to provide a quality ski experience to the public visiting the Forest has been developed on NFS lands at all the ski areas and would be possible on the areas for potential ski area expansion.

The potential of natural, social or economic resource impacts from ski area development can be quite varied between ski areas and by projects. Potential effects could include:

- Scenic Value. This issue is related to concerns of visual degradation and reduced aesthetics from the proposed expansion activities
- Noise, and the effect of increased noise from ski resort expansion and operating activities, and increased automobile traffic.
- Recreation, and the differing views on trail expansion of the skiers themselves, and impacts to other recreational opportunities, such as hiking, on adjacent lands.

- Socio-economics, and the impacts of resort expansion on local businesses, real estate values, municipal services, and quality of life.
- Transportation, and the effects of increased traffic and parking conflicts, associated with the increased number of skiers.
- The kinds of natural resource impacts from ski area development can be quite varied because of their high level of development. However, actions are taken specifically to identify, evaluate, and mitigate any impacts. One example is the high level of monitoring and reporting required of the ski areas for water withdrawal.

Cumulative Effects

Cumulative impacts were assessed for past, present, and reasonably foreseeable future development that could impact resources within the study area. They are similar for all alternatives. "As ... four-season resorts in the WMNF region have grown, tourism has also grown and become an important segment of the economy in the surrounding local communities. Visitors to this region of New Hampshire have become increasingly important to the businesses that provide tourism services. Four-season resort facilities are an integral part of this tourist-based economy, particularly in the winter months, when alpine skiing is one of the largest draws to the WMNF area. Winter sports are actively promoted by state and local organizations, including the state tourism department, and by the resorts themselves. This active marketing has resulted in a healthy, winter recreation- based economy that provided 180.9 million dollars to the local region in 1995-1996 (Institute for New Hampshire Studies, Plymouth State College 1996). ... This economic relationship between the local community and the ski area[s] provides the impetus for the Forest Service to ensure [ski resorts remain] an attractive recreation offering to the public. Sustainability of local communities is one of the components of Forest Service ecosystem-based management, in which social and economic values are considered as important resources along with the physical and biological environment (16 U.S.C. 531)." (WMNF, 2002)

Wilderness

Affected Environment

Overview of National and Regional Wilderness

The analysis area is the proclamation boundary of the White Mountain National Forest. Because Wilderness is an interconnected system across the country, there is also some discussion of the national and regional context in which Forest Wilderness is found. The analysis area is the same for direct, indirect, and cumulative effects.

The White Mountain National Forest contains approximately 114,000 acres of Congressionally-designated Wilderness within five separate areas: Great Gulf, Presidential Range/Dry River, Pemigewasset, Sandwich Range, and Caribou-Speckled Mountain. The Caribou-Speckled Wilderness is the only one of these in Maine. Although there are larger tracts of state wilderness in the Adirondacks of New York, the Forest has the largest amount of federal Wilderness in the Northeast. The Forest Wildernesses were established as follows:

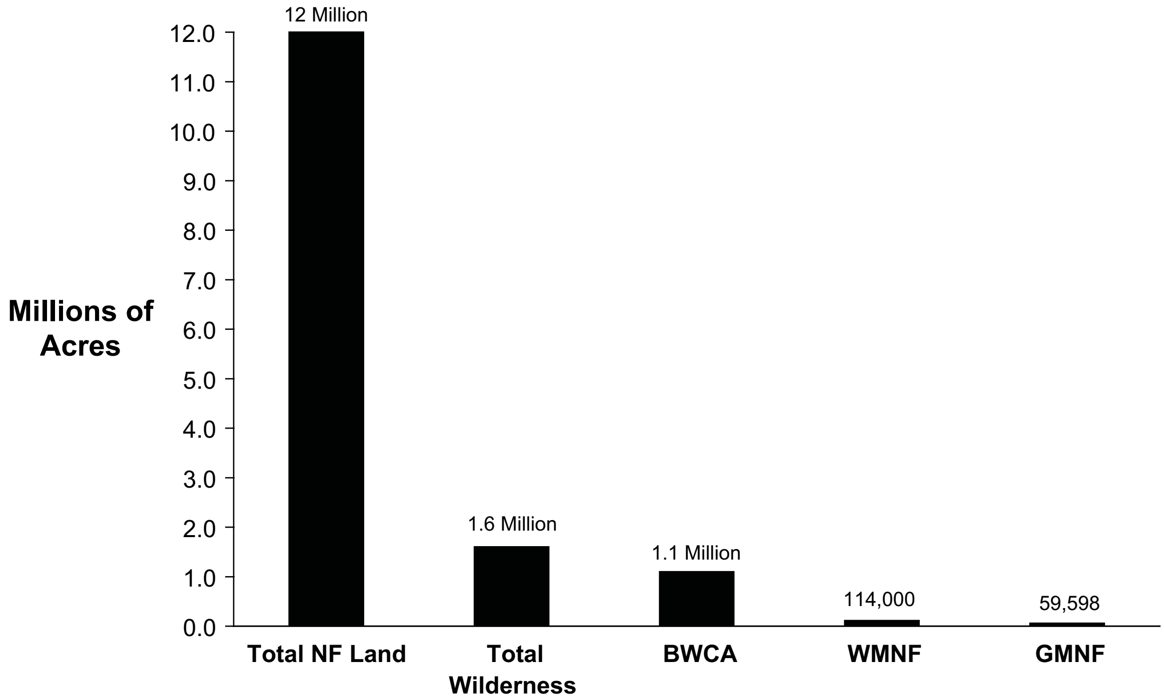
- Great Gulf (5,552 acres): 1964 Wilderness Act.
- Presidential Range/Dry River (27,280 acres): 1975 Eastern Wilderness Act (with extension in 1984 NH Wilderness Act).
- Pemigewasset (45,000 acres), Sandwich Range (25,000 acres): 1984 NH Wilderness Act.
- Caribou-Speckled Mountain (12,000 acres): 1990 Maine Wilderness Act.

All of the White Mountain National Forest Wilderness areas are part of a national Wilderness preservation system totaling approximately 105,700,000 acres across the United States. The Forest Service, National Park Service, Bureau of Land Management, and Fish and Wildlife Service manage the system. Approximately 54 percent of the national Wilderness preservation system is in Alaska (www.wilderness.net).

Out of a total 12 million acres under National Forest management in the Eastern Region (New England, west to Minnesota, south to West Virginia), there are approximately 1.6 million acres of designated Wilderness, or about 13 percent (see Figure 3-34). Of these acres, 1.1 million are in the Boundary Waters Canoe Area, with another 500,000 acres spread throughout the Region (including the 114,000 acres on the White Mountain National Forest, and 59,598 acres on the Green Mountain National Forest in Vermont). The National Park Service manages approximately 133,250 acres of designated Wilderness within the same general geographic area, and the Fish and Wildlife Service administers another 63,500 acres (Romanowski, 2003).

Because of its popularity and visibility, recreation is often considered the primary value of Wilderness. Wilderness, however, was set aside to preserve a variety of values, including "… ecological, geological or other features of

Figure 3-34. Wilderness Acres in USFS Eastern Region.



scientific, educational, scenic or historical value." (Wilderness Act) The Wilderness Act also recognizes that designated Wilderness should have "... outstanding opportunities for solitude or a primitive and unconfined type of recreation …."

According to the 2000 National Survey on Recreation and the Environment (NSRE, 2002), the top three benefits which people cite for Wilderness are protecting air quality, protecting water quality, and protecting wildlife habitat (USDA, 2002).

In addition to those values cited in the Wilderness Act, historian Roderick Nash cites these values (Nash, 1990):

- Spiritual: "For many people wilderness is as important as temple or church …"
- Aesthetic: "… awe in the face of large, unmodified natural forces and places such as storms, waterfalls, mountains and deserts …"
- Heritage: "… grounded on the fact that wild country has been a major force in the shaping of character and culture …"
- Psychological: "When these civilized environments become repressive ... wilderness offers a unique opportunity for psychological renewal — literally recreation."
- Cultural: "… Because in the words of Ralph Waldo Emerson, it permits an opportunity for an original relationship to the universe …. Artists, musicians, poets and writers have turned to (wilderness) repeatedly in their quest to shape a distinctive and distinguished culture."

- Intrinsic: This "… derives from the … idea that nonhuman life and even wild ecosystems themselves have *intrinsic* value and the right to exist. From this perspective wilderness is not *for* humans at all, and wilderness preservation testifies to the human capacity for restraint."

It is this combination of long-term values that makes Wilderness designation fundamentally different than other forest management areas, such as MA 6.2 lands, which do not allow habitat management, timber harvesting, or any commodity extraction. In many people's minds, Wilderness designation signifies both a long-term commitment that cannot easily change with Forest planning cycles, and recognition of a range of values beyond recreation and human use.

Wilderness Management

Once Wilderness is designated, there are specific management and stewardship needs to ensure that Wilderness values are protected. Examples include managing visitor use, effectively monitoring for air and water quality, and adhering to the overall requirements of the Wilderness Act.

In 1999, the four federal Wilderness management agencies asked the Pinchot Institute for Conservation to study the quality of management of the National Wilderness Preservation System. "The purpose of the study was to examine the critical management issues facing the four agencies 35 years after the Wilderness Act of 1964 …" (Pinchot Institute for Conservancy, 2001. vii) The panel's report identified the following Wilderness stewardship principles (Pinchot Institute for Conservancy, 2001. 13-16).

- Adhering to the Wilderness Act is a fundamental principle for Wilderness stewardship in the US.
- US Wilderness is to be treated as a system of Wildernesses.
- Wildernesses are special places and are to be treated as special.
- Stewardship should be science-informed, logically planned, and publicly transparent.
- Non-degradation of Wilderness fundamentally should guide stewardship activities.
- Preservation of Wilderness character is a guiding idea of the Wilderness Act.
- Recognizing the wild in Wilderness distinguishes Wilderness from other land classes.
- Accountability is basic to sound stewardship.

Wilderness management is guided by Forest Service Handbook and Manual direction. More recently, Forest Service policy specified that six of the following ten standards must be met for a Wilderness to be managed to standard:

1. Fire plans are in place that allow for the full range of management responses.

2. Wildernesses are covered by noxious/invasive plant management plans.
3. Air Quality Related Values monitoring is conducted and baseline is established.
4. Wilderness education plans are in place and implemented.
5. Wildernesses have adequate Forest Plan standards, and opportunities for solitude or primitive and unconfined recreation are stable or increasing.
6. Wildernesses should have completed recreation site inventories.
7. Outfitter and guide permits contain operating plans that direct outfitters to model appropriate wilderness practices and incorporate appreciation for wilderness values in their interaction with clients.
8. Wildernesses will have a full range of adequate standards which prevent degradation of the wilderness resources.
9. Wildernesses have wilderness managers who believe their priority information needs have been addressed through data collection and corporate applications.
10. Wildernesses have baseline workforce in place.

Summary of Existing WMNF Wilderness

Great Gulf Wilderness

Just over 5,000 acres, the Great Gulf is the smallest Forest Wilderness and one of the few eastern Wildernesses that was designated under the original 1964 Wilderness Act. Surrounded by part of the northern Presidential mountains, the Great Gulf consists of rugged terrain that was largely untouched by historic logging efforts in the White Mountains. Use takes place primarily in the summer months, and is largely concentrated along the Great Gulf trail and at designated campsites. The Great Gulf is one of two designated Class I airsheds on the Forest. Elevations range from 1,700 feet to 5,799 feet.

Presidential Range-Dry River Wilderness

The Dry River Wilderness is one of the least used Wildernesses on the Forest. It has many opportunities for solitude and unconfined recreation throughout the year. The Dry River has a long history of human use, and parts of it were heavily logged early in the 20th century. The Dry River is one of two designated Class I airsheds on the Forest. Elevations range from 895 feet to 5,500 feet.

Pemigewasset Wilderness

The "Pemi" is the largest Wilderness on the Forest. It has a long history of human use, including extensive logging and subsequent fires during the early 20th century. In general, it receives heavy recreation use. It contains one developed backcountry campsite with a seasonal caretaker at 13 Falls. Elevations range from 1,271 feet to 5,249 feet.

Sandwich Range Wilderness

Located in the southeastern corner of the White Mountains, the Sandwich Range is made of a series of valleys, glacial cirques, and high mountain passes. Many of its trails date to the turn of the 20th century, and provide visitors a direct connection to the long recreation history of the area. Elevations range from 1,180 feet to 4,140 feet.

Caribou-Speckled Mountain Wilderness

Caribou-Speckled is the largest designated Wilderness in the state of Maine, and the only White Mountain National Forest Wilderness in Maine. Use is primarily concentrated along a small number of trails, including a popular day hike to the summit of Caribou Mountain. Elevations range from 1,100 feet to 2,906 feet.

Summary of Roadless Area Inventory and Evaluation Process

One requirement in revising the Forest Plan is to consider lands on the Forest for Wilderness recommendation. This is done by first identifying areas that meet Wilderness criteria. The primary or sole purpose of this roadless area inventory is to identify those lands that could be considered for a Wilderness recommendation. Lands recommended for Wilderness are allocated to Management Area 9.4 while those not recommended are allocated to other management areas in response to issues. The roadless area inventory and evaluation plays a key role in determining which areas are recommended for Wilderness designation.

Because most of the lands in the east have had a history of heavy use, the inventory criteria allow for some disturbance in eastern roadless areas. For example, while an area must still be at least 5,000 acres in size and provide for some opportunity to experience solitude, the relaxed criteria allow potential Wilderness areas to have a limited degree of facilities, past timber harvesting, and improved roads.

The inventory process first identifies where significant disturbances such as power lines, improved roads, ski areas, railroads, and campgrounds exist. Core areas between these disturbances are mapped to determine if they are large enough for a user to experience the solitude a Wilderness provides. Core area boundaries are then extended to natural features or relatively permanent man made features such as roads or trails that can be readily identified on the ground. While the boundaries may include some roads, clusters of roads and narrow fingers as well as other improvements were avoided. Areas were checked to ensure they were at least 5,000 acres in size (unless adjacent to an existing Wilderness); and, the amount of past harvesting and improved roads were checked against the limits allowed. If necessary, an area boundary was adjusted to eliminate roads that may have pushed the area over road density limits. The results became our inventory of roadless areas. Twenty-seven of these inventoried roadless areas covering a total of 403,144 acres were identified. A more thorough explanation

summarizing the results of the inventory can be found in Appendix C of this FEIS. Table 3-69a below lists the twenty-seven areas.

Table 3-69a. 2005 Inventoried Roadless Areas.

Inventoried Roadless Area	Acres	Road Density Miles/1000 Acres
Caribou — 1	9,306	0.50
Caribou — 2	3,987	0.30
Cherry Mountain	8,637	0.51
Chocorua	10,368	0.18
Dartmouth Range	12,304	0.24
Great Gulf	17,066	0.11
Jobildunk	16,577	0.24
Kearsarge	10,325	0.47
Kilkenny	37,096	0.07
Kinsman	11,306	0.11
Mt. Wolf – Gordon Pond	12,388	0.25
North Carr Mountain	9,111	0.38
Pemigewasset	65,781	0.14
Presidential/Dry River — 1	7,207	0.13
Presidential/Dry River — 2	4,915	0.08
Presidential/Dry River — 3	3,837	0.29
South Carr Mountain	22,265	0.08
Sandwich — 1	771	0.06
Sandwich — 2	186	0.00
Sandwich — 3	1,364	0.27
Sandwich — 4	21,400	0.05
Sandwich — 5	9,630	0.36
Sandwich — 6	339	0.32
Sawyer River	6,718	0.22
Table Mountain	15,628	0.25
Waterville	13,395	0.30
Wild River	71,387	0.15
Total	**403,144**	

Following the inventory - each of the inventoried roadless areas was evaluated for its Wilderness characteristics and the tradeoffs that would come with Wilderness designation. An overall evaluation was also completed that assessed the need for additional Wilderness on the Forest.

Public input from comments to the Notice of Intent to revise the Forest Plan as well as comments from the DEIS are considered. The evaluations can also be found in Appendix C of this FEIS.

The Forest used public input, the evaluations of the Inventoried Roadless Areas, and the overall evaluation to determine which of the areas should be recommended for Wilderness designation to Congress.

Recommended Wilderness areas (see Alternatives, Chapter 2) were derived from the existing inventoried roadless areas, based on several criteria that were developed using Forest Service Manual direction and an interdisciplinary process (see Administrative Record). These criteria are:

- Consists of representative landscapes not currently found in existing White Mountain National Forest Wilderness.
- Degree of development in the inventoried roadless area.
- Manageability of the area.
- Meets Wilderness values of opportunities for solitude and unconfined recreation.
- Levels of public interest.
- Meets Wilderness values of aesthetics and scenery.
- History of roadless area disposition.
- Meets Wilderness values for research, education, and historical/ cultural.
- Regional size significance (Project File).

Inventoried roadless areas and associated Recommended Wildernesses are described below:

Summary of Inventoried Roadless Areas Recommended for Wilderness in the Alternatives

Pemigewasset Inventoried Roadless Area

This inventoried roadless area consists of approximately 65,781 acres encircling the Pemigewasset Wilderness. It includes an elevation range of 880 feet, near Lincoln Woods, to 5,260 feet, at the summit of Mt. Lafayette. Currently, the area is managed primarily for non-motorized recreation use, such as hiking and backpacking. There is, in general, heavy summertime recreation use, and the area also includes three Appalachian Mountain Club Huts (Greenleaf, Galehead, and Zealand Falls) as well six shelters and tent platform sites along the Appalachian Trail. There is some motorized winter recreation along designated snowmobile trails near Sawyer River and the Lincoln Woods Scenic Area. Approximately 12 percent of the area is suitable and planned for timber harvest.

The Recommended Wilderness (Alternative 3) is made up of 26,200 acres that would add to the existing Pemigewasset Wilderness. It does not include

the areas around AMC Huts, or the Appalachian Trail and its associated shelters.

The Pemigewasset Inventoried Roadless Area was determined to highly meet the following criteria: consists of representative landscapes not currently found in existing Wilderness; meets Wilderness values of opportunities for solitude and unconfined recreation; level of public interest; meets Wilderness values of aesthetics and scenery; history of roadless area disposition; meets values of research, education, and historical/cultural; and regional size significance (Administrative Record).

Sandwich Range Inventoried Roadless Areas

Six separate inventoried roadless areas were evaluated (see Map 2-01, Chapter 2). Areas 1, 2, 3, and 6 are adjacent to the southern and eastern boundaries of the existing Wilderness. Area 4 is adjacent to the existing Wilderness to the north and west, while Area 5 is adjacent to the southwest border of the existing Wilderness (Administrative Record). The total area contains approximately 33,690 acres. These inventoried roadless areas encompass diverse terrain, dense vegetation, ponds, streams, numerous trails, and many opportunities for solitude and unconfined recreation. The primary recreation activity in this area is hiking and backpacking. There is also winter motorized use along approximately 6 miles of snowmobile trails (in Areas 4 and 5). Approximately 11 percent of the total roadless area is available and planned for timber harvest.

Recommended Wilderness areas in Alternatives 2 and 3 include adding 10,800 and 13,900 acres, respectively, to the existing Sandwich Range Wilderness. There would be no snowmobile trails affected in either area.

The Sandwich Range roadless area was determined to highly meet the following criteria: degree of development; level of public interest; and meets Wilderness values of aesthetics and scenery (Administrative Record).

Kilkenny Inventoried Roadless Area

This area of approximately 37,096 acres is located at the north end of the Forest in the towns of Jefferson, Lancaster, Randolph, Berlin, Stark, Milan, and Kilkenny. Elevations range from 1,250 feet, near Route 110 in Stark, to 4,080 feet, on Mt. Cabot. In general, the area is one of the least visited on the National Forest, with many opportunities for solitude and unconfined recreation. Hunting and fishing are popular activities. There is one recreation cabin and two designated campsites with outhouses. Approximately 11 percent of the area is currently suitable and planned for timber harvest.

The Kilkenny Inventoried Roadless Area includes "holding areas," Management Areas 9.4 and 2.1A. These MAs were created as a result of an appeal resolution to the 1986 Forest Plan. They "Serve as a 'holding area' which recognizes the potential for all future uses and maintains an undisturbed forest through the plan period …." (WMNF, 1986)

The 23,800 acres of Recommended Wilderness in Alternative 3 would be composed mostly of areas that are currently managed to emphasize semi-primitive non-motorized recreation.

The Kilkenny Roadless Area was determined to highly meet the following criteria: degree of development; meets Wilderness values of opportunities for solitude and unconfined recreation; meets Wilderness values of aesthetics and scenery; and history of roadless area disposition (Administrative Record).

Dartmouth Range Inventoried Roadless Area

The Dartmouth Range Inventoried Roadless Area contains 12,304 acres. It has a more gentle topography than many areas of the Forest, with elevations ranging from 1,560 to 3,700 feet. It has some of the lowest use levels on the Forest, with no developed or maintained hiking trails. There are just over 3 miles of snowmobile trails, including the heavily-used Mt. Mitten snowmobile trail connecting Mill Brook Road to Jefferson Notch Road through the northern section of the area. Other snowmobile trails include a portion of the 25 Dollar Trail connecting the Mt. Mitten Trail to Route 2 and a short section of the Appleby Trail providing the ultimate connection to Cherry Mtn. Road in the northwest. The Dartmouth Cut-off is at the extreme southeast corner of the Inventoried Roadless Area. Hunting is a popular recreation use, and there is a small amount of hiking along an historic trail that is no longer officially maintained. Approximately 59 percent of the roadless area is currently suitable and planned for timber harvest.

The Dartmouth Recommended Wilderness in Alternative 3 would comprise 7,300 acres of this roadless area. It would not include any snowmobile trails.

The Dartmouth Range roadless area was determined to highly meet the following criteria: meets wilderness values of opportunities for solitude and unconfined recreation; level of public interest; meets values of research, education, and historical/cultural (Administrative Record).

Wild River Inventoried Roadless Area

The Wild River Inventoried Roadless Area encompasses approximately 71,387 acres, with elevations ranging from 800 feet to 4,832 feet atop Carter Dome. The area is the headwater for numerous rivers and brooks, including the East Branch of the Saco, Wildcat, and Rattle rivers, and Mill, Charles, Bog, 19-mile, Cowboy, Townline, Clay, Stony, Pea, Josh, East, and Connor brooks. This area is primarily used for recreation, from walks along flat terrain to steep and rugged approaches to the higher ridges. While hiking and backpacking are the predominant recreation uses, trails in the lower reaches receive mountain bike use, and several snowmobile trails are coincident with the eastern, northern, and southeastern boundaries of the roadless area. There are six shelters (Spruce Brook, Blue Brook, Rattle River, Imp, Perkins Notch, and Baldface), one Appalachian Mountain Club Hut (Carter Notch), one developed campground, and about 18 miles of the Appalachian Trail. While the area has a natural-appearing landscape, like most of the eastern US it has a long history of human use, including extensive logging that continued until the 1980s, remnants of logging railroads, and numerous cultural and historic artifacts. Approximately 21 percent of the area is currently suitable and planned for timber harvest.

The Wild River Inventoried Roadless Area also includes a "holding area," Management Area 9.4. This MA was created as a result of an appeal

resolution to the 1986 Forest Plan. The MA "Serves as a 'holding area' which recognizes the potential for all future use and maintains an undisturbed forest through the plan period …." (WMNF, 1986)

Recommended Wilderness would range from 23,700 acres in Alternative 2 to 26,600 acres in Alternative 3 to 18,000 acres in Alternative 4. None of the alternatives recommend areas that include the Appalachian Trail, the AMC Hut, or existing snowmobile trails. All would include some number of backcountry shelters.

The Wild River roadless area was determined to highly meet the following criteria: consists of representative landscapes not currently found in existing Wilderness; manageability of the area; meets wilderness values of opportunities for solitude and unconfined recreation; level of public interest; meets wilderness values of aesthetics and scenery; history of roadless area disposition; meets values of research, education, and historical/cultural; and regional size significance (Administrative Record).

Recreation

(Also see Recreation Affected Environment and Effects)

Consistent with the high levels of overall recreation, Wilderness recreation is a popular use of the Forest. Recreation use in designated Wilderness includes human-powered, non-motorized, and non-mechanized activities such as hiking, backpacking, and cross-country skiing. Mountain biking and motorized equipment are prohibited. The recreation value of solitude and unconfined recreation mentioned above is not unique to Wilderness; these opportunities may be found in other management areas on the Forest or in public and private areas off the National Forest. However, many of these areas may also include recreation or management activities that are not compatible with Wilderness designation, such as motorized recreation.

There are just over 207 miles of Wilderness trails on the Forest. Although shelters and developed facilities generally do not exist in Wilderness, they are allowed based on local management plans or particular Wilderness enabling legislations. There are currently three Adirondack-style shelters and one developed campsite within White Mountain National Forest Wilderness. There are also over 400 user-developed Wilderness campsites (WMNF Campsite Survey, ongoing). These are areas that have developed by repeated use and have no facilities or infrastructure.

Use

Current wilderness use on the Forest is estimated at 153,900 visitors per year, with the following breakdown by individual Wilderness.

Great Gulf	31,100
Presidential Range/Dry River	15,600
Pemigewasset	34,400
Sandwich Range	49,300
Caribou-Speckled	23,400

Anecdotally, the Pemigeswasset is the Forest's most heavily used Wilderness. The figures showing the Sandwich Range with more use may derive from the way in which the data were collected, using trails that accessed both Wilderness and non-Wilderness without determining how many of the visitors were actually entering the Wilderness.

Furthermore, since establishing accurate use figures is difficult, and the numbers above are estimates based on modeling (not actual counts), these numbers have a high margin of error. Therefore, they should be used as a guide and not as an absolute tally. Reliable, long-term, site-specific use counts to indicate local trends have not been gathered.

Nationwide, the National Survey on Recreation and the Environment indicated that 33.2 percent of the US population had visited a Wilderness or other primitive, roadless area. Overall, participation in walking for pleasure and day hiking were among the fastest growing recreation activities from 1994 to 2000 (NSRE, 2002).

Current Management Strategies

Each White Mountain National Forest Wilderness has a Wilderness Management Plan and a Wilderness Implementation Schedule. These were developed about the time each Wilderness was designated. They provide guidance for each area, but do not specifically consider the areas as part of a national, or even a Forest-wide Wilderness system.

Wilderness is intended to be a landscape where natural processes and disturbances predominate. Disturbance on the Forest consists primarily of wind events, such as large blowdowns. Fire plays a much smaller, although still potentially important, role. See the Wildland Fire section for a discussion of current management strategies for fire.

Wilderness Elevations and Land Type Associations

Land type associations (LTAs) are broad ecological categories generally reflective of elevations, but based on geomorphology, soils, and climax forest associations (see Vegetation section).

- **Valley Bottoms** primarily encompass the lowest elevations on the Forest. They consist mostly of red spruce, balsam fir, hemlock and mixed hardwood forests.
- **Mountain Slopes** take in the lower to mid-slopes of the Forest. They are typically a classic northern hardwood forest or a northern hardwood-spruce forest.
- **Upper Mountain Slopes** are along the mid to upper slopes of the Forest. They are mostly steep, rocky ground with red spruce and balsam fir. Paper birch often occurs where disturbance has impacted the vegetation.

- **Mountaintops** occur at relatively high elevations, often above 2,900 feet and along some lower ridges. Vegetation is primarily balsam fir, with some black and red spruce in places. The mountaintop LTA also includes the alpine zone.

Land Type Associations of the Forest and current Forest Wilderness are shown in Table 3-70 and Table 3-71.

Table 3-70 Land Type Associations (LTA) for the WMNF and for WMNF Wilderness.

LTA	Acres in WMNF	Percent of Forest	Acres in Wilderness	Percent of Wilderness
Mountaintop	179,500	23%	46,800	42%
Upper Mountain Slope	162,000	21%	35,800	32%
Mountain Slope	277,000	35%	15,800	14%
Valley Bottom	166,500	21%	13,800	12%
Total	**785,000**	**100%**	**112,200**	**100%**

Table 3-71. Land Type Associations (LTA) in Acres by individual WMNF Wilderness

	Mountain Top	Upper Mountain Slope	Mountain Slope	Valley Bottom
Caribou-Speckled	4,600	2,800	3,700	190
Great Gulf	4,000	1,700	51	260
Pemigewasset	15,100	15,700	4,800	8,100
Presidential Range-Dry River	12,300	8,100	4,200	3,400
Sandwich Range	11,800	7,700	3,200	1,900
Total	**47,800**	**36,000**	**15,900**	**13,850**

Environmental Effects

Alternative 1

Direct and Indirect Effects

Wilderness Allocation

There is no change from the current condition. This alternative does not respond to that segment of the public that has expressed a desire for increased Wilderness on the Forest, or for increased emphasis on any of the Wilderness values outlined in the Affected Environment.

Recreation Use (Also see Recreation for discussion of effects to recreation opportunities)

Overall demand for wilderness recreation can be expected to continue to grow. One way to meet this demand is to designate more Wilderness since "… avoidance of problems associated with increased future use (crowding and associated resource damage) continues to be a valid reason for designating additional wilderness." (Cole, 1994. 9-10) Alternative 1 will not meet any increased demand for Wilderness recreation. This may lead to increased pressure on existing Wilderness, a potential erosion of Wilderness character, and possibly the need for more intensive management actions or restrictions on Wilderness use.

Wilderness Management

By continuing to implement separate Wilderness management plans and implementation schedules, it will be difficult to manage the Forest's Wildernesses as an interrelated system. Although it is not an inherent flaw in having separate rather than one overall Wilderness plan, there are currently no standards by which to measure or monitor recreation use and no strategy to ensure that future use does not exceed desired levels or outcomes.

It is possible to manage Wildernesses to standard under this alternative, but a lack of direction and consistency makes it more difficult.

Wilderness Distribution—Elevations and Land Type Associations

There would be no change from current condition, with the majority of Wilderness above 1,000 feet and not proportional to the total amount of low elevation lands on the Forest. This would not meet the demand from those who have expressed an interest in increasing low elevation areas within White Mountain National Forest Wilderness.

Cumulative Effects

Wilderness Allocation

There will be no new areas in which to accommodate any increases in demand for Wilderness recreation. Over time, this may put more pressure on existing Wilderness, potentially leading to increased restrictions or more intensive management. This may, in turn, encourage visitors to modify their expectation for Wilderness recreation and to seek out alternatives on other private or public lands.

The Northeast will continue to have increasing populations and development. Fewer areas will be left where natural processes take precedence over human uses. There will be fewer opportunities for primitive and unconfined recreation, or to realize the Wilderness values outlined in the Affected Environment.

Wilderness Management

Over time, without further management action beyond the existing individual Wilderness management plans, there may be a decline in the quality of Wilderness values and character, including recreation opportunities in some areas and at busy times of year. There likely will be increased recreation use without systems in place to manage biophysical or social impacts. Because of a lack of a consistent, Forest-wide approach, it will be harder to manage the Wildernesses to meet national standards or the intent of the Wilderness Act.

Wilderness Distribution—Elevations and Land Type Associations

There will be fewer areas, especially at lower elevations, where natural processes are allowed to predominate. This alternative will not further the criterion that potential Wilderness "consists of representative landscapes not currently found in existing Wilderness." As more low elevation areas in the Northeast are developed or impacted by increasing population, the existing low elevation Wilderness acres may become increasingly important as representative communities.

Effects Common to Alternatives 2, 3, and 4

Direct and Indirect Effects

Wilderness Management

In Alternatives 2, 3, and 4, the Forest would manage Wildernesses under one Forest-wide Wilderness Management Plan, with shared standards and goals. In order to meet standards, the Wilderness Plan necessitates closer monitoring, and management action such as closing campsites, when thresholds are met. Managing in accord with one overall Wilderness Management Plan will help ensure consistent management, monitoring, and recognition of the interconnected nature of each area.

The Wilderness Plan, as well as other revised program area standards and guidelines, will make it easier to manage Forest Wilderness to standard, in accordance with Forest Service policy and the intent of the Wilderness Act. It would specifically address the following standards:

- Fire plans are in place that allow for the full range of management responses.
- Wildernesses are covered by noxious/invasive plant management plans.
- Air Quality Related Values monitoring is conducted and baseline is established.

- Wilderness education plans are in place and implemented.
- Wildernesses have adequate Forest Plan standards, and opportunities for solitude or primitive and unconfined recreation are stable or increasing.
- Wildernesses have completed recreation site inventories.
- Wildernesses have a full range of adequate standards which prevent degradation of the wilderness resources.
- Wildernesses have baseline workforce on place.

***Recreation Use* (Also see Recreation for discussion of effects to recreation opportunities)**

It is often stated that recreation use in an area increases when that area is designated as Wilderness. This, in turn, could lead to greater impacts and more challenge in maintaining the range of Wilderness values. While "there may be some empirical support for this conclusion." (Cole, 1994), research has also shown that visits to an area are based on many factors other than its designation as Wilderness (McCool, 1985). It also seems likely that in the White Mountains, with a limited land base, any increase in use after Wilderness designation would be caused by a redistribution of existing recreation use and not by an overall increase solely from new Forest visitors.

Nevertheless, overall demand for Wilderness recreation can be expected to continue to grow. One way to meet this demand is to designate more Wilderness. Increasing the available Wilderness and "consequently, avoidance of problems associated with increased future use (crowding and associated resource damage) continues to be a valid reason for designating additional wilderness." (Cole, 1994. 9-10)

Distribution of Land Type Associations

Alternatives 2, 3, and 4 increase the amount of potential Wilderness within Valley Bottom land type associations. Since, currently, the majority of Forest Wilderness is contained in elevations above 1,000 feet and land type associations are not proportionally represented in existing Wilderness, these alternatives would help provide a greater variety of land types within the Forest Wilderness system. Increasing lower elevation lands in Wilderness would provide a greater number of permanently protected areas and more opportunities for people to experience low-elevation protected areas where natural processes predominate.

Wilderness Values

The ability to provide for the full range of Wilderness values described in the Affected Environment would be met in any of the alternatives. Alternatives 2, 3, and 4 increase the amount of potential Wilderness and therefore, to varying degrees, meet the needs of that segment of the public who believe the values of Wilderness designation outweigh other potential uses of the land.

Cumulative Effects

With the addition of standards, indicators, and an increased emphasis on monitoring, the quality of Wilderness management should increase in Alternative 2, 3, and 4.

Given the limited amount of federal land within New England, any new proposed Wilderness will likely come from a very limited source on either the Green or White Mountain National Forests. The White Mountain National Forest currently has the majority of land that would be suitable for Wilderness designation. Adding potential Wilderness represents a choice in long-term uses of the land and potential changes in how and for what purposes that land is managed.

Alternative 2

Direct and Indirect Effects

Wilderness Allocation

This alternative would recommend that approximately 34,500 acres be added to the Wilderness system: an additional 10,800 acres to the existing Sandwich Range Wilderness and 23,700 acres to create the Wild River Wilderness (see Alternative descriptions and maps, Chapter 2). This is approximately a 30 percent increase over the current acres of Wilderness. The majority of these acres would be taken from areas that are currently managed to emphasize non-motorized recreation, so there would be little change in the balance of general forest management and other forest uses or objectives. (See Table 3-72 and Table 3-73; see also Recreation section).

Table 3-72. Current MAs Comprising MA 9.1 for the Wild River Recommended Wilderness.

Management Areas	Acres
2.1	120
6.2	18,300
6.3	230
9.4	5,050

Table 3-73. Current MAs Comprising MA 9.1 for Sandwich Recommended Wilderness.

Management Areas	Acres
2.1	3,900
3.1	2,800
6.1	1,500
6.2	2,600

Wild River: The Wild River inventoried roadless area rated high in almost every category for consideration for Wilderness recommendation (Administrative Record). The only area in which it rated in the middle was based on the level of development, due to the AMC Hut and the number of shelters. However, most of these developments, including Carter Notch Hut, are not included within the proposed boundary of the Recommended Wilderness.

Sandwich Range Extension: The Sandwich Range rated generally in the middle in almost every category for consideration as potential recommended Wilderness. It rated highest in level of public interest, degree of development, and meeting values for aesthetics and scenery. Alternative 2 would increase the area's manageability by widening the narrowest section of the existing Wilderness and giving the area more physical integrity, and would also meet some of the public interest in increasing the existing Wilderness.

Wilderness Distribution — Elevations and Land Type Associations

The total changes in LTAs potentially added to the Wilderness system under this alternative are shown in Table 3-74.

Table 3-74. Land Type Association Acres by Recommended Wilderness

	Mountain Top	Upper Mountain Slope	Mountain Slope	Valley Bottom
Sandwich	2,600	2,400	3,500	2,300
Wild River	8,600	5,700	7,000	2,400
Total	**11,200**	**8,100**	**10,500**	**4,700**

With these additions, there would be an increase in Valley Bottom areas by approximately 4,700 acres. This would help meet public demand for an increase in low elevation Wilderness to make Wilderness more representative of the Forest.

Alternative 3

Direct and Indirect Effects

Wilderness Allocation

This alternative recommends that approximately 97,800 acres be added to the Wilderness system: 13,900 acres to expand the existing Sandwich Range Wilderness; 26,200 acres to expand the existing Pemigewasset Wilderness; 26,600 acres to create a new Wild River Wilderness; 23,800 to create a new Kilkenny Wilderness, and 7,300 acres to create a new Dartmouth Range Wilderness. (See Alternative descriptions, Chapter 2.) This would almost double the amount of White Mountain National Forest Wilderness to about 211,800 acres, or more than 25 percent of the Forest.

Because this alternative proposes to add the most new Wilderness, it would favor Wilderness values over other management activities and uses. It would do the most to meet public demand for Wilderness.

The majority of the potential recommended Wilderness would be derived from land that is currently managed to emphasize non-motorized recreation, although this alternative would also have the greatest impact on the General Forest Management area (MA 2.1, and 3.1 in Alternative 1) where timber harvesting is currently allowed.

Dartmouth Range: The Dartmouth Range is in the low or middle range for most categories used to determine inventoried roadless area Wilderness suitability (Administrative Record). Though it is surrounded on all sides by developed areas, it rates on the higher end for meeting opportunities for solitude and unconfined recreation; for level of public interest; and for meeting values of research, education, and historical/cultural qualities. The proposed area for the Dartmouth Range Wilderness currently has no designated trails, although there are some user-created "bushwhacks" that have developed into low-level trails. The proposed Wilderness plan would prohibit new trails from being constructed. The limited trails and lower use levels would provide many opportunities for a unique experience within Forest Wilderness. It would also be the only Forest Wilderness that did not begin with an overarching emphasis on recreation. This may more easily allow management to emphasize and support other Wilderness values in addition to recreation. This area has the greatest amount of current and potential future timber harvesting (see MA delineations, Table 3-75).

Table 3-75. Current MAs Comprising MA 9.1 for the Dartmouth Recommended Wilderness.

Management Areas	Acres
2.1	80
3.1	5,000
6.1	1,250
6.2	930

Wild River: See Alternative 2. Alternative 3 includes the largest proposed area for a potential Wild River Wilderness, and includes the greatest amount of low elevation area (Table 3-80).

See Table 3-76 for changes to MA delineations.

Table 3-76. Current MAs Comprising MA 9.1 for the Wild River Recommended Wilderness.

Management Area	Acres
2.1	1,800
6.2	19,600
6.3	230
9.4	5,000

Sandwich Range Extension: See Alternative 2. This alternative would increase manageability of parts of the existing Wilderness, but would also create a relatively narrow section in one corner, which in turn would theoretically be less manageable due to conflicts from other non-Wilderness uses than a contiguous block of land.

See Table 3-77 for changes to MA delineations.

Table 3-77. Current MAs Comprising MA 9.1 for the Sandwich Recommended Wilderness.

Management Area	Acres
2.1	3,900
3.1	3,100
6.1	4,020
6.2	2,850

Kilkenny: The Kilkenny rates in the middle to high end for all categories used to determine inventoried roadless areas Wilderness suitability (Administrative Record). While it does not meet a demand for increased low elevation areas, it does generally have richer habitats than other areas of the Forest. It has relatively low development, and many opportunities for solitude and unconfined recreation. It would decrease the availability of recreation opportunities in low use, non-Wilderness areas (Also see the Recreation section.)

See Table 3-78 for changes to MA delineations.

Table 3-78. Current MAs Comprising MA 9.1 for the Kilkenny Recommended Wilderness.

Management Areas	Acres
2.1A	600
6.1	12,700
6.2	8,500
9.4	2,000

Pemigewasset Extension: The Pemigewasset Extension rates on the high end of almost all of the criteria used to determine the suitability of inventoried roadless areas for potential Wilderness recommendation. The inventoried roadless area rates low in the degree of development because of existing huts and shelters, although the proposed Wilderness boundary does not include this development. Although, in general, increasing the size of an existing Wilderness would increase its manageability, the Pemigewasset Extension rates low for manageability because of its proximity to high use areas

See Table 3-79 for changes to MA delineations.

Table 3-79. Current MAs Comprising MA 9.1 for the Pemigewasset Recommended Wilderness.

Management Areas	Acres
2.1	2,200
3.1	100
6.1	9,400
6.2	14,400

Wilderness Distribution—Elevations and Land Type Associations

The total changes in LTA's and the additions by each potential Wilderness under this alternative are in Table 3-80.

Table 3-80. Land Type Association Acres by Recommended Wilderness.

	Mountain Top	Upper Mountain Slope	Mountain Slope	Valley Bottom
Dartmouth	1,100	3,500	600	2,100
Kilkenny	4,300	9,300	8,000	2,200
Pemigewasset	10,000	8,900	4,600	2,700
Sandwich	3,600	3,600	3,700	3,000
Wild River	9,000	5,700	8,900	3,000
Total	**28,000**	**31,000**	**25,800**	**13,000**

These additions would increase Valley Bottom areas by approximately 13,000 acres. This alternative would do the most to meet public demand for low elevation Wilderness.

Cumulative Effects

See Cumulative Effects common to Alternatives 2, 3, and 4.

Alternative 4

Direct and Indirect Effects

Wilderness Allocation

This alternative would recommend that 18,000 acres in the Wild River be added to the Wilderness system.

The majority of the proposed Wilderness area would be derived from land that is currently managed to emphasize semi-primitive non-motorized recreation. It would include only part of the lands that are currently in MA 9.4, allowing the remainder of those lands to be in the General Forest Management area (MA 2.1) where timber harvesting and other activities would be allowed (Table 3-81). (Also see Alternative descriptions, Chapter 2.)

Table 3-81. Current MAs Comprising MA 9.1 for the Wild River Recommended Wilderness:

Management Areas	Acres
2.1	39
6.2	15,000
6.3	230
9.4	2,900

This alternative would do less than Alternatives 2 and 3, and more than Alternative 1, to meet demand for Wilderness recreation or other Wilderness values.

Wilderness Distribution—Elevations and land Type Associations

The total changes in LTA's by acres potentially added to the Wilderness system under this alternative are shown in Table 3-82.

Table 3-82. Land Type Association Acres by Recommended Wilderness

LTA	Mountain Top	Upper Mountain Slope	Mountain Slope	Valley Bottom
Wild River	6,100	5,000	5,100	1,800

With this addition there would be an increase in valley bottom areas of approximately 1,800 acres. This alternative would do less than Alternatives 2 and 3, and more than Alternative 1, to meet public demand for low elevation Wilderness.

Cumulative Effects

See Cumulative Effects common to Alternatives 2, 3 and 4.

Effects on Non-priced Benefits

Through time, Wilderness designation has become a primary mechanism for the preservation of landscapes (Watson and Landres, 1999). Thus for some, Congressionally-designated Wilderness becomes the ultimate protection for an area. The knowledge that an area has been protected against certain activities and intrusions creates a value for that place's existence, regardless of whether an individual intends to visit it or not (Nash, 1982; Oelschlager, 1991). These existence values are significant drivers in determining individual's attitudes and values toward wilderness.

Existence values themselves stem from the idea of Wilderness, most commonly expressed in the language of the 1964 Wilderness Act. The idea of an area "untrammeled by man," which retains "primeval character and influence," and that has "outstanding opportunities for solitude" certainly resembles a common idea of nature in the vernacular sense. Though not universally accepted (also see Cronon, 1995; Merchant, 1990; Soper, 1995), the connotation of a natural area ties directly to non-priced benefits. The knowledge that extensive areas of land are being held in preservation, with

a limited number of allowed activities, is enough for many people to value those areas (Callicott, 1998). As mentioned above, these existence values remain, regardless of whether the individual holding the value has visited or even intends to visit these wildernesses. Existence values represent a significant portion of what drives controversies in large areas far removed from any significant human population.

In the case of the WMNF, existence value takes on additional meaning, in that there are far fewer acres of Wilderness in the Eastern U.S. than in the West. The relatively few Wildernesses in the East hold deeper significance given their contrast with the generally high population density of New England and the proximity of WMNF Wilderness to large population centers such as Boston, Montreal, and New York.

Non-price benefits of Wilderness also extend to the types of activities allowed or prohibited within Wilderness boundaries. Given the prohibitions on logging and motorized/mechanized travel in Wilderness, the opportunities for recreation experiences are somewhat specialized. Within Wilderness, emphasis is placed on assuring users have opportunities for remoteness and solitude. Opportunities for individuals to travel by foot in areas where they are assured of not running into conflict with wheeled or motorized users are rare, and thus create non-priced benefits for Wilderness users. The outcomes of unconfined recreation include better physical and mental health, greater self-esteem and self confidence, and higher skill levels, all of which are commonly valued in non-priced terms. These recreational benefits also tie to existence values, in that the simple existence of a place where such unconfined recreation opportunities are available is enough to create value in certain individuals' minds. (See also Recreation non-priced benefits FEIS, Chapter 3. Though not exclusive to Wilderness, recreation benefits certainly apply within Wilderness.)

Finally, non-priced benefits of Wilderness include ecosystem services. These are services provided from functioning ecosystems (Hammitt and Cole, 1998), although they are not necessarily unique to designated Wilderness. Among these services is the provision of clean water. The streams and rivers that run through Wilderness typically flow through well-established ecosystems without the presence of significant industrial or suburban pollution. Thus, water that comes from Wildernesses is generally cleaner than that flowing from these less-protected watersheds. Similarly, the mature forests of WMNF Wildernesses help to filter pollutants and provide clean air. These forests also act as a carbon sink, in that they trap elemental carbon from carbon dioxide and remove it from the air, thus helping to minimize greenhouse gases in the atmosphere. Finally, the relatively unbroken landscapes of Wilderness areas provide habitat for numerous species of plant, animal, fish, reptile, etc., that may not be able thrive in more fragmented areas. Clearly, none of these benefits can be adequately priced by conventional methods.

The non-priced benefits of Wilderness depend on the amount of designated Wilderness. Therefore, there are potentially the most non-priced benefits from Alternatives 3 and 2, and the least in Alternatives 1 and 4.

Wild and Scenic Rivers

Introduction

The National Wild and Scenic Rivers Act (NWSRA) requires that river segments of eligible rivers be classified and administered as wild, scenic, or recreational, depending on the condition of the river corridor at the time of study. The classification of a river segment is based on the level of existing watershed and shoreline development, as well as the degree of accessibility by road or trail. As part of the 1991 river studies, each eligible river was assigned a classification, defined in the NWSRA as follows:

Wild River Areas — Those rivers or segments of rivers that are free of impoundments and generally inaccessible except by trail, with watershed or shorelines essentially primitive and unpolluted water. These represent vestiges of primitive America.

Scenic River Areas — Those rivers or segments of rivers that are free from impoundments, with shorelines or watersheds still largely primitive and shorelines undeveloped, but accessible in places by roads.

Recreational River Areas — Those rivers or segment of rivers that are readily accessible by road or railroad, that may have some development along the shorelines, and that may have undergone some impoundment or diversion in the past.

Affected Environment

In October 1988, Congress passed legislation designating approximately 15 miles of the Wildcat River and its tributaries as components of the National Wild and Scenic River System (NWSRS). The NWSRA of 1968 (16 USC 1271-1287), as amended, protects rivers' free flowing condition, water quality, and outstanding remarkable values for the "benefit and enjoyment of present and future generations." Designated tributaries to the Wildcat River are Wildcat Brook, Bog Brook, and Great Brook.

The Wildcat River is a tributary of the Saco River in northern New Hampshire. It originates above Carter Lakes and flows south through the Forest, over Jackson Falls and through the small town of Jackson, before entering the Ellis River just north of the Jackson Covered Bridge. There are approximately 1,200 acres of river corridor with the majority of acres (1,010) in White Mountain National Forest ownership. The remaining acreage is divided between the Town of Jackson (100 acres) and private ownership (90 acres).

On private land, the boundary of the corridor is the 100-year floodplain, which varies from 75 feet to several hundred feet. On federal land, the corridor boundary is described as 500 feet from the center of the river. The analysis area for this resource is the entire corridor, which encompasses all designated lands.

The Wildcat River and its tributaries are divided into three segments based upon land use patterns, watershed conditions, and the level of existing shoreline development. The river units, along with their classification, are

identified as the Headwaters (scenic), Intervale (scenic), and the Jackson Falls (recreational) segments. The segment boundaries and their existing characteristics and conditions are described below.

Headwaters Segment

The Headwaters segment, the northernmost section of the Wildcat River and its tributaries under the Wild and Scenic designation, lies predominantly within the boundaries of the National Forest. Inholdings at the lower end of this segment are properties of private land owners and the Town of Jackson.

The Wildcat River watershed, and particularly the river's origin near the height of land in Carter Notch with its two ponds, is one of the most scenic areas in the Northeast. The brilliant fall color from the hardwood trees is spectacular. This watershed has a long history of intensive timber management and has demonstrated excellent regeneration and growth rates. Timber harvesting activities have not occurred on National Forest System lands within the river corridor since the Wildcat River was designated, pending final approval and direction from the Comprehensive River Management Plan (CRMP).

People visit this area because it offers tranquility, solitude, and high quality recreation experiences. It is particularly popular with mountain bikers during the summer and rabbit hunters in winter months. There is moderate fishing and hiking during summer and fall; fall and winter are considered the heavy use periods.

The Headwaters section has a trail network consisting of the Bog Brook, Wildcat River, Wild River, Wildcat Valley, Dana, Rainbow, and Marsh Brook trails. The Jackson Ski Touring trails are also located here, and operate under a Forest Special Use Permit.

The Town-owned, 300 acre Prospect Farm is located in the southern part of the Headwaters segment river corridor, and was bequeathed by the Baker family for the enjoyment of Jackson citizens. Once a productive, high-altitude farm, it is now a forest preserve enjoyed by hikers, hunters, and cross-country skiers.

Wildcat Brook Road provides access to the lower portion of this segment, and crosses Wildcat Brook, Wildcat River, and Davis Brook. Treated-timber bridges span Wildcat Brook and Wildcat River. Bog and Davis Brooks have culvert crossings. There is an existing road right-of-way, of approximately one mile on the Carter Notch Road, that extends from the Jackson town line (near Camp Gout) north to the National Forest boundary.

The water quality of the area meets or exceeds all federal and state standards for conservation, recreation, and other uses.

Intervale Segment

The Intervale segment extends from the Forest proclamation boundary, downstream to the Valley Crossroad Bridge above Jackson Falls. The majority of the land in this segment is privately owned or managed by the Town of

Jackson. The Intervale segment includes Great Brook, from the Route 16B Bridge at Whitney's Pond to its confluence with Wildcat Brook.

Wildcat River and Great Brook, below Whitney's Pond, are free of impoundments. Whitney's Pond is used for swimming during the summer, and is a source of water for snow making at Black Mountain Ski Area during early and mid-winter. Some Great Brook water flow is diverted to refill Whitney's Pond during the winter months.

The area is largely undeveloped, but not primitive. Human activity is evidenced in small clusters of residential buildings, dispersed dwellings, and agricultural buildings, with the Eagle Mountain Hotel and Golf Course, private homes, and farm buildings being the major improvements. The corridor lies within the River Conservation District of the Jackson Zoning Ordinance, which regulates land uses. Forestry and other agricultural uses are dominant activities, and most of the private land is enrolled in the current use program.

The Intervale section receives relatively heavy public use compared to the Headwaters segment, but it is less used than the Jackson Falls segment. The Eagle Mountain House and its golf course attract many visitors who swim, picnic, fish, golf, hike and cross-country ski in the river area, depending on the season. The Jackson Ski Touring Foundation trail system brings many winter visitors to the area. Many private landowners also recreate in the area, with fishing, swimming, and skiing among their favorite pastimes.

The area is accessed by Carter Notch Road, which parallels Wildcat River. Five-mile Circuit Road (Route 16B) crosses the brook.

The water quality of the area meets or exceeds all federal and state standards for conservation, recreation, and other uses.

Jackson Falls Segment

The Jackson Falls segment extends from the Valley Crossroad Bridge above Jackson Falls to the confluence with the Ellis River.

This segment has outstanding scenic values and provides high quality recreation experiences (scenic viewing, sunbathing, walking, wading, swimming, photography, and picnicking). Recreation use is heavy and concentrated around the upper part of the falls; parking is limited. The Wildcat River is free of impoundments.

The area around Jackson Falls and the center of the Town of Jackson is developed, and represents substantial evidence of human activity. The area includes quality commercial and residential development, as well as town offices, an elementary school, and Memorial Park.

Public lands are the dominant element in the Jackson Falls segment. They include Valley Crossroads bridge; Jackson fire station, town hall, and town garage; the former Gray's Inn property; the easement on the west bank granted to the Town of Jackson by the Wentworth Resort; Jackson Elementary School and an adjacent historic barn; and Memorial Park.

The Jackson Falls segment shows past alterations to the streambed, including a hydropower diversion structure, a breached swimming pool, dikes, highway bridges, fire pond, and golf course. The Jackson Memorial Park and Wentworth Golf Club have experienced flooding and erosion.

The area is accessed by Carter Notch Road, New Hampshire Route 16A and 16B, and other community roads and bridge crossings.

The water quality of the area meets or exceeds all federal and state standards for conservation, recreation, and other uses.

Eligible Wild and Scenic Rivers

In order to be considered eligible for Wild and Scenic River designation, a river must be free-flowing and possess one or more outstandingly remarkable values (ORV). The NWSRA defines these values as those characteristics that make a river worthy of special protection. ORVs can include scenery, recreation, fish and wildlife, geology, history, cultural, and other similar values. As a result of the broad definition of ORVs, Forest resource professionals developed and interpreted criteria for evaluating river values (unique, rare, exemplary) for 38 rivers. Of the 38 rivers studied, 36 meet the outstanding criterion for one or more of the river values (see Forest Plan, Appendix C for Eligible Wild and Scenic Rivers). The Forest continues to manage these 36 rivers to protect their eligibility and highest possible classification. The 36 rivers and river segments described in Appendix C comprise the analysis area for eligible Wild and Scenic Rivers.

For the sections of the designated river system located off National Forest System lands, Public Law 100-554, which designated the Wildcat part of the NWSRS, identified the Forest Service as the federal river-administering agency. As stated in this law, the Forest Service will administer the river segments located outside the boundary of the Forest through a cooperative agreement with the Jackson Board of Selectmen and the State of New Hampshire. The law further directs the Forest Service to complete a Comprehensive River Management Plan (CRMP) pursuant to Section 3(d) of the National Wild and Scenic Rivers Act. The CRMP serves to protect and enhance the values of the Wildcat Wild and Scenic River by defining goals and desired conditions for protecting river values, recognizing responsibilities of stakeholders, and identifying agencies' regulatory roles. The public law also established the Wildcat River Commission to assist in the implementation of the cooperative agreement and completion of the CRMP.

Wild and Scenic River Administration

The Secretary of Agriculture appointed Commission members in February of 1990, and the Commission coordinated and promoted the cooperative effort between the Town of Jackson, the State of New Hampshire, and the Forest, as well as preparation of the CRMP. The Wildcat River Advisory Commission ceased to exist in 1998 — 10 years following its enactment and

per direction of Public Law 100-554. The Commission can be credited with providing the management direction included in the CRMP.

In 2003, a Memorandum of Understanding, among the Town of Jackson, the State of New Hampshire, and the White Mountain National Forest, described the roles and responsibilities of the participating parties in the management of Town-owned lands on the non-federal portion of the river system.

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

Effects from recreational use within the Headwaters segment are expected to be low. Although this segment may be used for camping, hiking, swimming, cross-country skiing, fishing, and other recreation activities, the anticipated impact of these activities on the characteristics and conditions of the segment should be minimal.

Timber management practices are allowed in the three designated segments of the Wildcat River. On National Forest System lands Headwater Segment, natural processes or events will be the primary means through which vegetative change occurs, though silvicultural practices may be prescribed to meet critical habitat, salvage, or visual quality objectives. The effects from these activities are expected to be low.

Protection of the free-flowing condition and ORVs for Wildcat River and its tributaries is provided by Section 7 of the NWSRA, which directs all federal agencies to protect the values of the designated river from the harmful effects of water resource projects. These include dams, water diversions, fisheries habitat and watershed restoration, bridges, bank stabilization, channelization, levees, boat ramps, and fishing piers that affect the designated river's free-flowing condition. Water resource projects will have no direct or adverse effect on the designated river segments due to the Section 7 protection.

Activities in eligible river areas include, but are not limited to, hiking, mountain biking, swimming, fishing, and timber management. These activities have not changed the character and condition of these segments in any way that would adversely affect their eligibility and classification as Wild and Scenic Rivers, nor would these effects change across alternatives.

Cumulative Effects

In addition to the approximately 15 miles of the currently-designated river segments, there are some 227 miles, along 36 rivers, that are eligible for Wild and Scenic designation on the White Mountain National Forest.

Although the effects of non-designation would not significantly impact river values or free flowing condition, non-designation presents a lost opportunity to fully study the river through a CRMP planning process, or to address in detail protection measures and attributes specific to the river system.

On private and town-owned lands, timber harvesting is permitted, providing harvesting complies with state statutes and Jackson River Conservation District guidelines. While this creates the potential to change the character and condition of the river and adjacent area, effects are anticipated to be minimal.

Recreation use in the Jackson Falls segment is heavier than that in the other segments, and is concentrated around the upper part of the Falls. This intense use is causing soil erosion along the stream bank. The presence of litter and human waste are concerns in the Jackson Falls segment, but mitigation measures would prevent degradation of the area's natural beauty.

Effects on Non-priced Benefits

Passage of the National Wild and Scenic Rivers Act recognized the non-priced benefits gained by protecting these areas. The Act protects rivers' free flowing condition, water quality, and outstanding remarkable values for the "benefit and enjoyment of present and future generations." Benefits provided by the Wildcat River and eligible rivers on the WMNF include high water quality, diverse recreational uses, scenic beauty, and protection of cultural resources, fish, wildlife, and geologic features. All alternatives protect the free-flowing condition and outstandingly remarkable values of the Wildcat River and its designated tributaries. All eligible rivers would remain eligible under all alternatives. Therefore, the non-priced benefits afforded by these areas would be maintained by all alternatives.

Prescribed fire treatment, White Brook (WMNF photo by Terry Miller)

Wildland Fire

This section discusses the two components of Wildland fire:

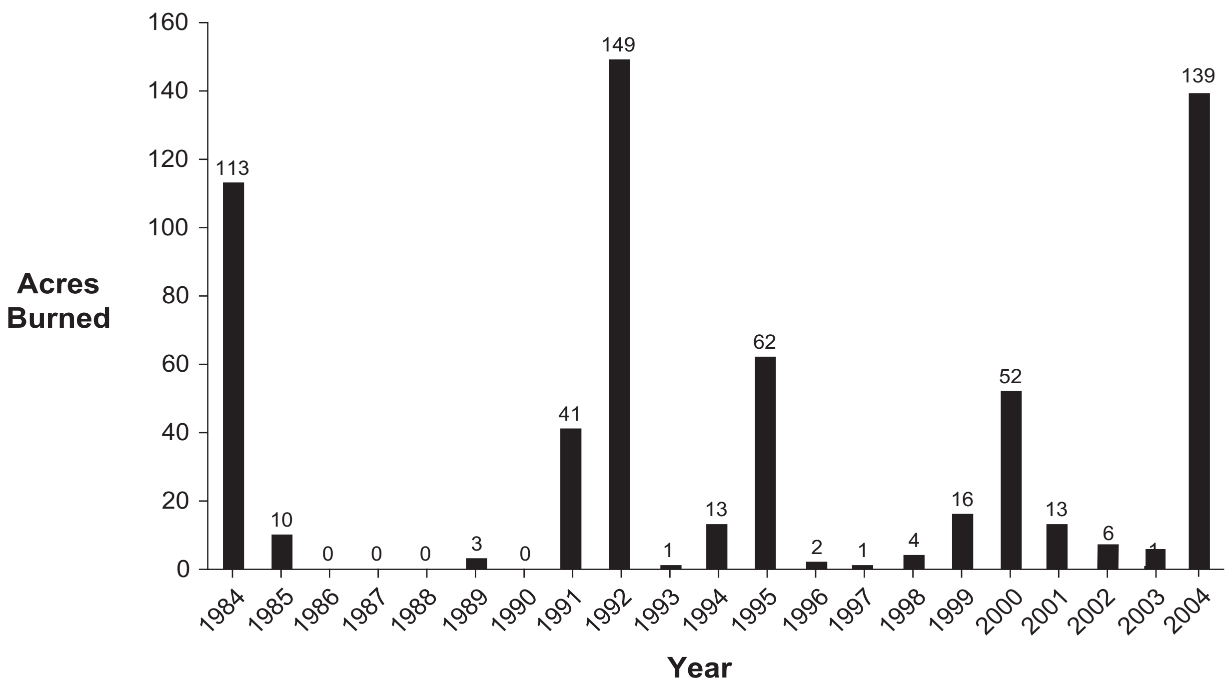
- Wildfire: An unwanted wildland fire.
- Fire Use: Includes both wildland fire use and prescribed fire application.
    - Wildland Fire Use — The management of lightning-ignited wildland fires to accomplish specific, pre-stated resource management objectives in predefined geographic areas, as outlined in the Fire Management Plan.
    - Prescribed Fire — Any fire ignited by management actions to meet specific objectives.

Wildfire

Affected Environment

Wildfire has typically played a small-scale disturbance role within the White Mountain National Forest ecology. Although large fires have occurred in the past, most were based on human activities such as turn-of-the-century fires in logging slash (Figure 3-35). The affected environment for wildfire will describe aspects of past fire history, fire as a natural disturbance factor, and fire effects on certain forest types. The analysis area is the area within the boundaries of the Forest.

Figure 3-35. Acres burned, 1984-2004.



Fire History

The largest fire on the Forest in the last 50 years, the 2004 Lucy Brook Fire was probably caused by a hunter and burned 140 acres on the Saco Ranger District. Most current-day wildfires, though, are relatively small. There is a history of large fires during the early 1900s, many of which resulted from large fuel accumulations coupled with drought. Unnatural fuel accumulations, slash left during the railroad-logging era, were often ignited by the wood- (and later coal-) burning locomotives. The latter would shoot out exhaust sparks and drop hot “clinkers” without discretion (Belcher, 1980).

Before the federal government purchased land to form the National Forest, it sent out forest examiners to determine land value. The examiners surveyed and mapped each prospective tract, and information from their reports indicates that at least 21 percent of the Forest (127,500 acres) had burned during the century prior to purchase by the federal government. This total probably underestimates burned area, however, as some sites burned repeatedly (but are counted only once); old fires were likely overlooked when the forest had regrown sufficiently; and in a few cases, fires occurred after completion of the examiners’ surveys. Old burns, between 1800 and 1880, covered 5 percent of the mapped area, or at least 30,000 acres. As logging increased sharply between 1885 and 1925, burn rates increased sixfold, covering a total of 97,500 acres (Goodale, 2003).

Logging-era fires enhanced views from peaks such as Chocorua, Crawford, Moat, Welch, Hale, the Sugarloafs, and the Baldfaces. On these and other mountains, past forest fires cleared the low summits of view-blocking trees. Subsequent erosion washed away much of the soil that might have supported regrowth, leaving rock and subalpine vegetation. Elsewhere, stands of paper birch owe their origin to fires 90 to 120 years ago (Goodale, 2003).

Fires were extremely rare prior to the logging era. Records from early surveys of northern New England suggest that the fire return interval (the number of years between fires in a particular area) is 1,500 to 2,500 years (Lorimer, 1977; Fahey and Reiners, 1981).

It was wind that dominated the natural disturbance regime, ranging from single-tree windfall gaps to large blowdowns caused by the occasional hurricane, most notably in 1815 and 1938.

More recent factors that have contributed to increased fuel loadings and potential fire hazard include ice storm damage and encroaching development along and within the Forest boundaries.

The White Mountain National Forest has had 129 fires, totaling 488 acres, from 1983 to 2002. This averages approximately six fires per year, burning a total of 25 acres annually (Figure 3-35 and Figure 3-36).

In recent years, most wildfires on the Forest were human-caused, although about 14 percent were ignited by lightning, as depicted in Figure 3-37.

Figure 3-36. Number of fires, 1984-2004.

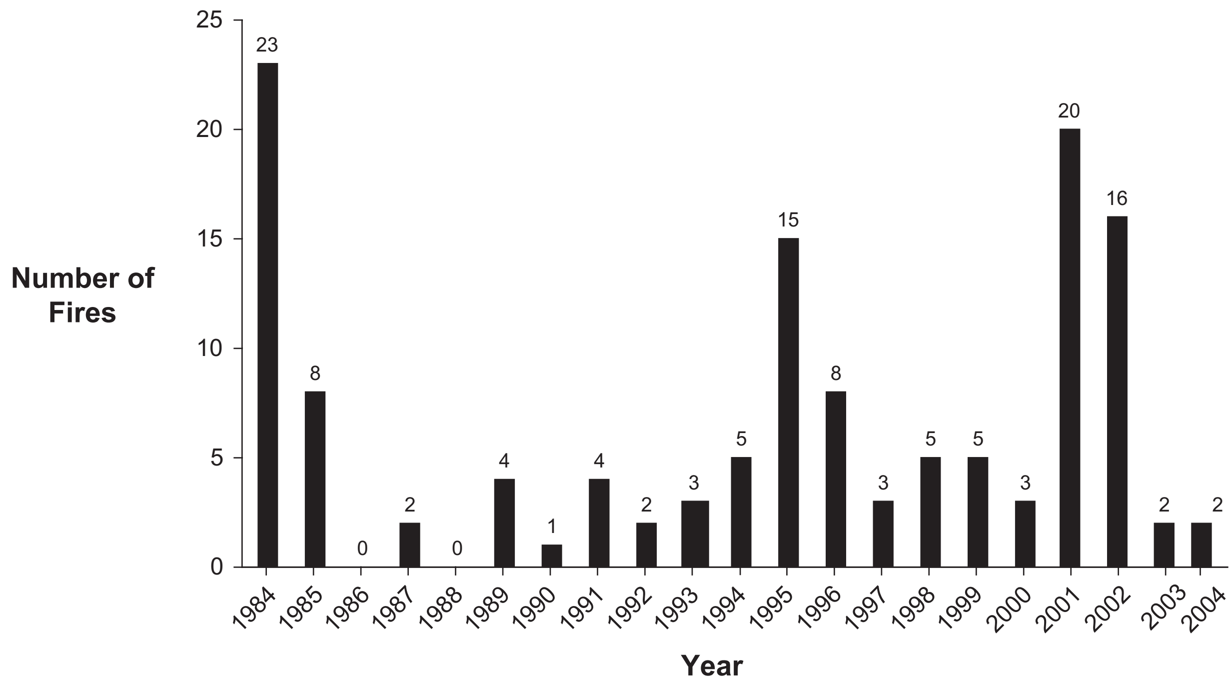
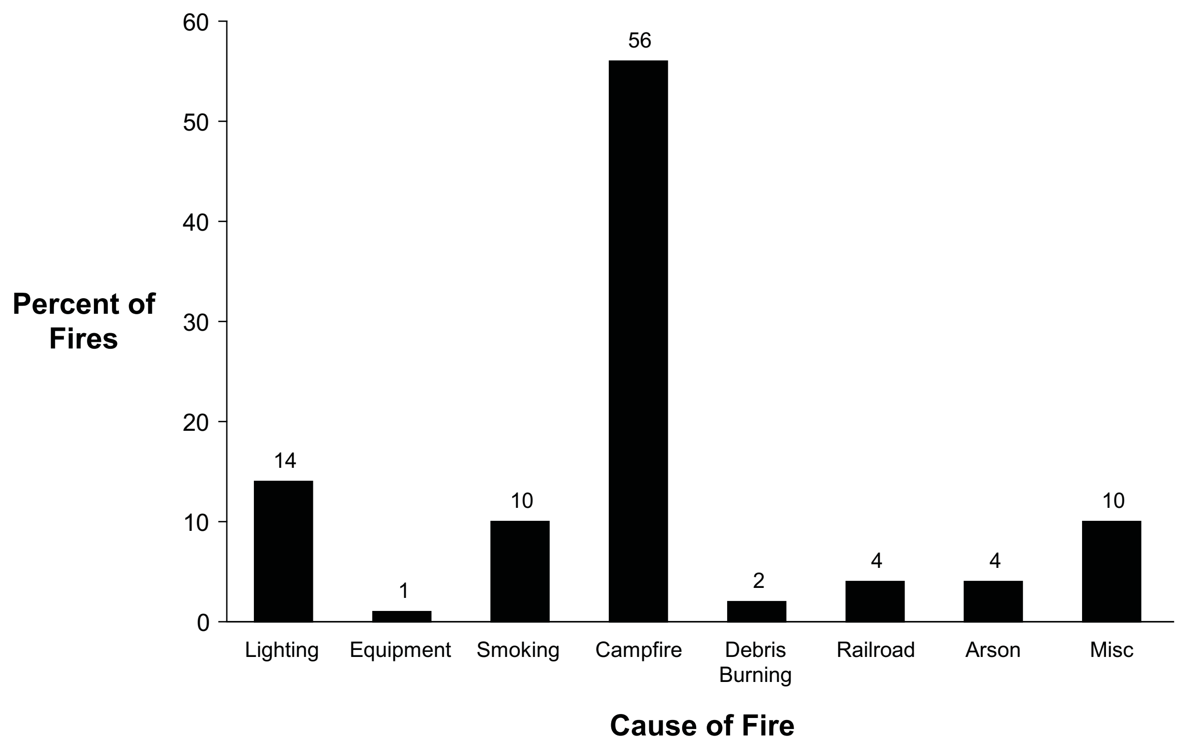


Figure 3-37. Fire causes, 1972-2002, based on WMNF fire reports.



Fire as a Disturbance Factor

A disturbance is an ecological event that "disrupts ecosystem, community or population structure, and changes resources, substrate, or the physical environment" (White and Pickett, 1985). Examples of natural landscape disturbance include fire, flooding, insects and disease, landslides, and wind throw of trees. The frequency and distribution of species that dominate a given site commonly change following a disturbance. Community composition commonly reverts back to the original assemblage in the absence of continued disturbance. Succession refers to the process of changes in species composition following disturbance.

The repeated, often patchy, distribution of disturbance patterns across the landscape (including fire) creates a mosaic of vegetation. From the summit of a mountain, for example, a wide variety of plant communities at various points along the successional continuum can be observed. Disturbance can be a powerful influence on community composition and biodiversity. Typically, the greater the variety of disturbance types and the number of communities represented, the greater will be the total biodiversity of a given region.

There is a common understanding among scientists that pre-European settlement disturbance regimes were variable in time and space. There is also evidence that many ecosystems in eastern North America were greatly shaped by a long history of Native American-caused fires (Lorimer, 2001).

While fires appear to have been less frequent in the forests of northern New England, experts are not in universal agreement about this. It seems more likely that there was a gradient in fire occurrence on the landscape, with some regions burning more than others (Richburg and Patterson, 2000).

Occasional periods of short but intense drought can increase fire danger, especially in conifer stands which have thick duff due to slow decomposition and a general lack of burning. Other conditions beyond drought and source of ignition influence fire frequency: fuel accumulation and flammability are important contributors. Historically, logging contributed significantly to increased fuel loads and the incidence of extreme fire behavior, especially in conifers. Windstorms, ice damage (like that resulting from the 1998 ice storm in northern New England), and insect/disease outbreaks similarly may create fuel loads that could support intense fires. In the Pisgah Forest in southwestern New Hampshire, more than half the recorded fires occurred within twenty years of windstorms. Thus, disturbances coupled with locally intense drought can lead to conditions that will allow fire to burn in the otherwise non-flammable deciduous forests.

Variation in the occurrence of fire in the Northeast is due to regional variations in climate, topography, and soils. The pattern of fire occurrence generally increases from east to west. In the north-central United States and south-central Canada, lightning ignitions are common, and fire is frequent even in the absence of human actions. In contrast, dry lightning strikes and

resulting fires are rare in the northern hardwood forests of New Hampshire and Vermont, and it is not surprising that humans have historically caused most of the large conflagrations in New England.

Fire in Northern Hardwoods

Bormann and Likens (1979) note that the record of fire occurrence in northeastern forests, based on even-aged stands, fire scars, or charcoal, is far less complete than with the northern hardwoods of the Lakes States region. Historical evidence for the deliberate use of fire by Native Americans in northern New England also seems to be lacking, as their populations in the mountainous regions were small and migratory. The available literature suggests that fires were common in pre-settlement times in the areas surrounding the White Mountains and northern Vermont, but uncommon within the northern hardwoods of the White Mountain region.

Although fire may be a rare disturbance factor in northern hardwoods, in some cases it is important for maintaining the structure of natural forest communities, such as the beech-pine-oak woodlands found in some places in the Sandwich Range and Caribou-Speckled Wildernesses.

Normally, fire is a natural disturbance agent capable of converting northern hardwood forests to aspen, paper birch, white pine, oak, and other early- to mid-successional species. However, intense fire is not common in mature maple-beech-hemlock stands on loam soils, in part because the finely compacted duff layer does not dry out readily and does not carry fire well. Although the ecological role of fire in northern hardwoods is not well understood, the rate of fire spread and intensity are often sluggish, even during periods of severe drought.

In some situations, fire has played a more important role in northern hardwoods. In the first few years after catastrophic blowdowns, fine fuels remain very flammable. In northern Maine, the massive blowdown of 1795 caught fire about eight years later, and has been recorded in land surveyor notes from 1820.

Fire is more common where northern hardwoods mix with conifers such as hemlock, white pine, red spruce, and balsam fir, especially following catastrophic wind storms (Foster, 1988; Lorimer, 1977; Stearns, 1949).

Periodic fire caused by Native American practices or lightning seems to be responsible for oak dominance in pre-European settlement, southern New England forests. Red oak does not require fire to be present in an area, but fire does seem to be an important factor in perpetuating oak dominance because it reduces nonresistant competitors. The recent decrease in fire frequency as a result of human suppression may be a significant factor in the decline of red oak (Lorimer, 1985).

Fire In Softwoods

White and Red Pine

Before fire protection, many red and white pine stands were subject to a mixture of lethal and nonlethal fires. Recurrent nonlethal fires eliminated

shade-tolerant competing vegetation and prepared seedbeds for trees. Red pine, rather than white pine, regeneration was probably more closely associated with high intensity fires because of the greater intolerance of red pine to shade and humus.

White and red pine ecosystems, because of their fuel characteristics and arrangements, are often fire-prone under droughty conditions, and regenerate well after a fire. This attribute makes prescribed fire an effective management tool for regeneration and removal of competing vegetation.

Red Spruce

Red spruce slopes and red spruce flat forests usually are considered low fire risks, as they are in areas of abundant rainfall, snowmelt, or on somewhat poorly drained soils. Under drought and extreme fire weather conditions, however, fires of high intensity covering large areas, or severe surface fires are possible in red spruce. In old stands where red spruce is associated with balsam fir, the periodic outbreak of the spruce budworm causes heavy tree mortality, first to the fir but also to longer-lived spruce. This can make these stands more susceptible to wildfires due to crown breakage and the proliferation of highly flammable fine fuels like needles, dry twigs, and bark. Fire potential is greatest five to eight years after tree mortality. During this period, fires of great intensity tend to spread quickly due to evenly distributed fuel.

Balsam Fir

Owing to the high sensitivity of this species to fire, balsam fir survives only extremely low intensity fires, or in patches of unburned forest. Even if trees are merely damaged, fungal diseases and insect attacks will quickly destroy the stand structure. Because balsam fir has little fire tolerance, fire in balsam fir-dominated forests tends to eliminate most of the existing stems and favors conversion to other tree species (Brown et al., 2000).

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

The effects of wildfire will not vary by alternative, since wildfires are not a planned management action.

The effects of wildfires on the White Mountain National Forest's natural resources are small because the scale of acres involved is small. The Forest has had 129 wildfires, totaling 488 acres, over the last 20-year period (1983-2002). This averages to approximately six fires per year, burning a total of 25 acres annually.

It was noted previously that campfires cause over 50 percent of the wildfires on the Forest. Forest Protection Areas (FPAs), typically created to address social concerns or to protect sensitive resources, prohibit the use of campfires. Forest Supervisor Orders are the authority for creating FPAs, and would not vary by alternative.

The chance of a wildfire occurrence may be higher in Alternatives 1 and 4 because of the potential for increased summer all-terrain vehicle (ATV) use. Sparks or carbon deposits emitted from mufflers, or from user-associated activities such as smoking and campfires, are possible sources of ignition. Designated areas may include soils that are sandy or those that are shallow to bedrock because of higher tolerance to ATV use. In both cases, the soils tend to be dry and may also grow vegetation that is more prone to wildfire, such as pitch pine and oak.

Cumulative Effects

Because of their small size and infrequent occurrence, wildfires are expected to have minimal effect on the Forest's Class I airsheds.

Increased ATV use in areas of fire-prone vegetation could increase overall fire danger in those areas. The concern increases if these areas are in the proximity of private land, including subdivisions and individual homes or other structures and improvements.

The Lucy Brook fire,in November 2004, the largest wildfire to occur entirely on the WMNF in the last 50 years, burned approximately 140 acres and was likely caused by a hunter's warming fire. Kori Marchowsky (r) and Tom Brady (l) at work. (Aerial photo: courtesy Fred Lavigne; insets: WMNF photos by Erin Small)

Fire Use

Affected Environment

Fire as a Management Tool

There are two different processes by which fire can be used to accomplish management objectives. Fires can be managed for resource benefits either through the use of management-ignited prescribed fire or lighting-ignited wildland fire. The combination of wildland fire use and prescribed fire application to meet resource objectives is called fire use.

On the White Mountain National Forest, prescribed fire accomplishes specific purposes in management areas (MAs) that allow its use. Some of these objectives include:

- Reducing hazardous fuel loading.
- Creating, maintaining, or improving wildlife habitat.
- Preparing sites for restoration of species such as oak, pine, birch, and aspen.
- Creating, maintaining, or improving plant community composition by influencing the scale and pattern of vegetation across the landscape, including changing successional patterns, while maintaining ecological functions and processes.
- Controlling interaction between plant communities and insects and disease.
- Promoting blueberry production.
- Creating or maintaining scenic vistas.

Records of the Forest's prescribed fire program began to be kept in 1989. The program complements mechanical fuel treatment, which includes the use of chainsaws, brushsaws, brush-hogs, and related equipment to remove or reduce specific vegetation from a site. The accomplishments are shown in Figure 3-38.

Wildland Fire Use

Wildland Fire Use (WFU) is the management of lightning- ignited wildland fires to accomplish specific, pre-stated resource management objectives in predefined geographic areas, as defined in Fire Management Plans.

WFU is allowed in all alternatives, but only in the management areas indicated in Table 3-83.

The main objectives of WFU include restoring fire to its natural role in the ecosystem (e.g., in MA 5.1, 8.x, 9.1, 9.3), as well as maintaining the viability of fire-adapted communities (e.g., in MA 6.x). Objectives are accomplished in a manner that remains consistent with the safety of people, property, and other resources.

Figure 3-38. Fuel Treatment Accomplishments

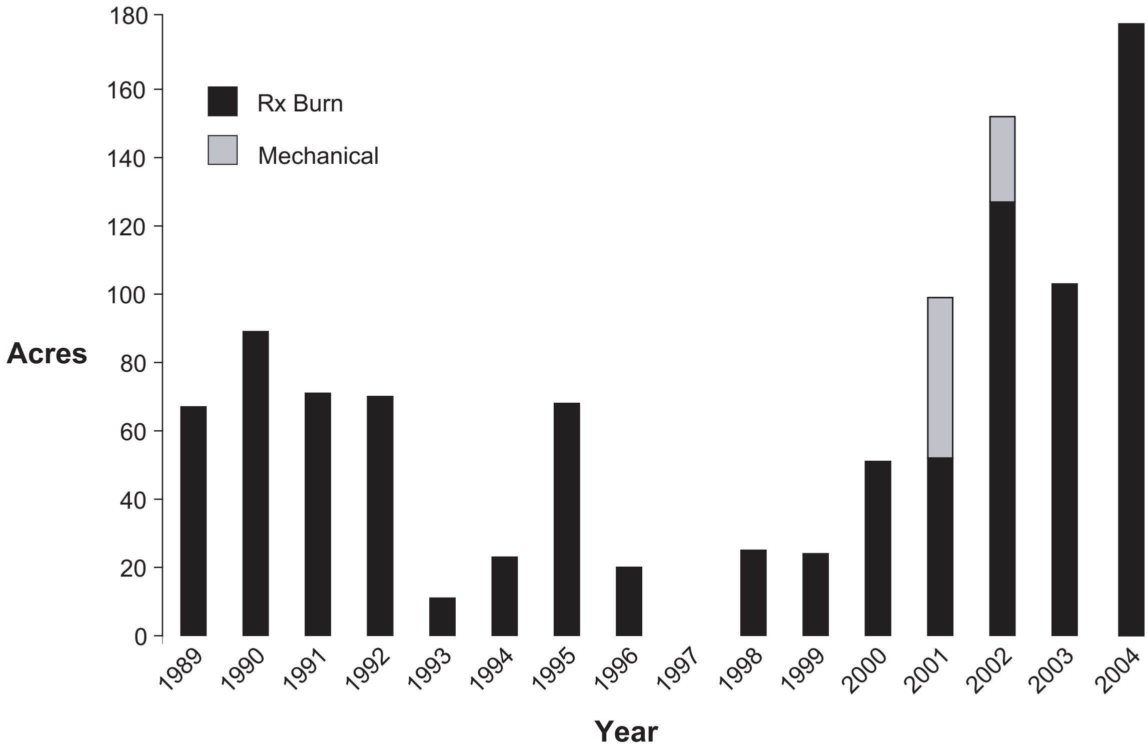


Table 3-83. Management areas where Wildland Fire Use is permitted.

MA	Description	MA	Description
5.1	Wilderness	8.3	Appalachian Trail (only where adjacent MA allows WFU)
6.1	Semi-Primitive Recreation	8.4	Research Natural Areas
6.2	Semi-Primitive Non-Motorized Recreation	9.1	Candidate Wilderness
6.3	Semi-Primitive Winter-Motorized Recreation	9.3	Candidate Research Natural Areas
8.1	Alpine Zone		

The Forest manages lightning-ignited fires as WFU under conditions that constitute low risk to firefighter and public safety. The goal is to allow these fires to function as a natural ecosystem process within a maximum allowable area, such as within certain management areas. The role of natural fire on the Forest historically has been to create small patch disturbances with a long fire return interval. Fire is not as significant a disturbance factor as other agents of change, such as wind, but the influence of fire may have cumulative effects on ecosystem function and diversity.

Specific criteria must be met before a fire can be managed under Wildland Fire Use. These criteria will consider such factors such as:

- Firefighter and public safety.
- Proximity to the Management Area boundary.

- Proximity to Class I Airshed boundary.
- Potential public and private values at risk.
- Smoke influences.
- Weather parameters (wind, temperature, humidity, days since last rain, predicted weather, drought indicators).
- Fuel parameters (fuel moisture, arrangement, loading, flammability).
- Effects on trail and campsite users.
- Concurrent fire incidents that draw down available resources.

The details and implementation of these criteria are described in the Fire Management Plan of the White Mountain National Forest. Wildland fires that do not meet the established criteria will be managed using the full range of suppression options available to confine, contain, and control the fire.

Fire Regimes and Fire Condition Classes

A national scale assessment was completed in 2001 that quantifies land condition in the United States (Schmidt et al., 2002). It describes the degree of departure from the fire regime and from historical fire cycles due to fire exclusion and other influences, such as timber harvesting, grazing, insects and disease, and the introduction of non-native plants.

This coarse-scale analysis identifies changes to key ecosystem components, such as species composition, structural stage, tree or shrub stand age, and canopy closure. It characterizes the landscape by five "Fire Regime Groups" and three "Fire Condition Classes." The natural historical frequency and severity of fire within an ecosystem is the identified Fire Regime; the Fire Condition Class identifies the departure of current conditions from the historical condition (Table 3-84). Wildfire risk conditions are identified by the Fire Regime Groups and are measured by the Fire Condition Classes.

Table 3-84. Historic Natural Fire Regimes

Fire Regime Group	Fire Frequency (years)*	Fire Severity**
I	0-35	Low severity
II	0-35	Stand replacement severity
III	35-100+	Mixed severity
IV	35-100+	Stand replacement severity
V	>200	Stand replacement severity

*Fire frequency is the average number of years between fires.
**Fire severity is the effect of the fire on the dominant overstory vegetation.

A fire regime is a generalized description of the role of fire within an ecosystem, characterized by fire frequency, predictability, seasonality, intensity, duration and scale.

The three Fire Condition Classes categorize and describe vegetation composition and structure conditions that currently exist within the Fire Regime Groups. They serve as generalized wildfire risk rankings. The risk of loss of key ecosystem components from unwanted wildfire increases from Condition Class 1 (lowest risk) to Condition Class 3 (highest risk) (Table 3-85).

Table 3-85. Condition Class descriptions

Condition Class*	Fire Regime	Example Management Options
Condition Class 1	Fire regimes are within an historical range and the risk of losing key ecosystem components is low.	Where appropriate, these areas can be maintained within the historical fire regime by use of prescribed fire, mechanical treatments, or preventing the invasion of non-native weeds.
Condition Class 2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate.	Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
Condition Class 3	Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high.	Where appropriate, these areas may need high levels of restoration treatments, such as hand or mechanical treatments, before fire can be used to restore the historical fire regime.

*Current conditions are a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. One or more of the following activities may have caused this departure: fire suppression, timber harvesting, grazing, introduction and establishment of exotic plant species, insects or disease (introduced or native), or other past management activities

It is generally believed that the bulk of the White Mountain National Forest falls into Fire Regime III, mixed severity, and Fire regime V, stand replacement severity (softwoods), and is described by Condition Classes 1 and 2.

Description of Fire-Adapted Ecosystems-Communities-Species

There are several natural community types that occur on the White Mountain National Forest that are likely to be fire-adapted and require restoration of their fire regimes. These types are taken from Sperduto's (2000) natural community classification for New Hampshire and combined into four broad types:

- Oak-pine types (including hemlock-oak-beech-pine forest, and dry transitional oak-pine forest).
- Jack pine rocky ridge woodlands.
- Red pine and other rocky summit outcrops (including red pine rocky summit woodland, red oak-pine/heath rocky ridge woodland/barren, Appalachian/transitional oak-pine rocky summit woodland, and red spruce/heath/cinquefoil rocky ridge).
- Mixed pine types (including pitch-red-white pine-red oak/heath forest/woodland, and pitch pine scrub oak barrens).

A possible fire-adapted rare species is piled-up sedge (*Carex cumulata*).

When grouped together as an amalgamation of oak/pine forest types, the natural communities listed above constitute approximately 1.1 percent (or 8,542 acres) of the White Mountain National Forest (based on 1999 data). The Forest is largely dominated (over 75 percent of the land area) by northern hardwoods and high elevation spruce-fir forests. Since there is little evidence that fire has played an important or frequent role in maintaining these matrix forest types (Bormann and Likens, 1979; Fahey and Reiners, 1981; Lorimer and Frelich, 1994; Cogbill, pers. comm.), fire should be considered a small-scale natural process on the White Mountain National Forest. Restoring fire regimes on the Forest, either through Wildland Fire Use or prescribed fire, will largely benefit small patch communities that are either disjunct (jack pine communities) or at the periphery (oak-pine types) of their distribution.

Environmental Effects

The scope of the fuels program (prescribed fire and mechanical) is roughly proportional to the natural role that fire has played on the Forest. Although weather conditions may limit the scope of the program, it is anticipated that approximately 150-400 acres could be treated annually.

The use of prescribed fire will almost always accomplish multiple objectives within the same treatment area or unit. For example, a prescribed burn to maintain wildlife habitat may also reduce fuel loadings. An understory burn to promote fire-adapted oak may also benefit individual fire-adapted ground flora.

Effects Common to All Alternatives

Direct and Indirect Effects

The Forest-wide effects of wildfire and fire use, based on average and historical conditions, will generally be of small–scale across all alternatives. The effects may be more pronounced on a local or site-specific scale.

The effects of fire use, both prescribed fire and wildland fire use, will not vary by alternative.

The management areas where prescribed fire and WFU is allowed are shown in Table 3-86. This use applies to all alternatives.

Table 3-86. Management areas where fire use is allowed.

Prescribed Fire	Wildland Fire Use (WFU)
2.1, 6.1, 6.2, 6.3, 7.1, 8.2, 9.2	5.1, 6.1, 6.2, 6.3, 8.1, 8.3, 8.4, 9.1, 9.3

A Missoula, Montana-based contractor, conducting a WFU analysis for the Forest, modeled lighting-started fire growth and behavior in each of the five current Wildernesses (Stratton, 2003). Although modeled in Wilderness, the results would be similar for all management areas in which WFU is allowed. In fact, because the aggregated area in which WFU is allowed encompasses a larger area than Wilderness alone, there should be more opportunities for using WFU to accomplish objectives successfully.

The computer simulation was done using FARSITE (**F**ire **A**rea **S**imulator), a two-dimensional deterministic model for spatially and temporally simulating the spread and behavior of fires under conditions of heterogeneous terrain (i.e., elevation, slope, aspect), fuels, and weather (Finney, 1998). FARSITE requires Geographic Information System (GIS) data, including elevation, slope, aspect, fuel model, and canopy cover.

Table 3-87 displays the FARSITE estimation of fire size for each Wilderness for the low (60^{th}), moderate (80^{th}), and severe (97^{th}) percentile weather and fuel conditions. This table applies to WFU in all alternatives.

Table 3-87. FARSITE estimation of fire size for each Wilderness.

Wilderness	60^{th}-Low (acres)	80^{th}-Moderate (acres)	97^{th}-Severe (acres)
Sandwich Range	40 - 120	150 - 300	1,000 - 1,800
Pemigewasset	30 - 250	50 - 400	300 - 2,000
Great Gulf	30 - 50	70 - 120	100 - 200
Presidential Range	10 - 250	50 - 300	300 - 800
Caribou Speckled	100 - 400	200 - 700	600 - 1,500

Model results for the 60^{th}, 80^{th}, and 97^{th} percentiles are based on *consecutive* days of persistent weather, wind, and fuel conditions until a season-ending event (i.e., 23 days later). These recurring conditions are very unlikely on the White Mountain National Forest — particularly at the 97^{th} percentile — but they are provided as examples of a "worst-case" and "marginally possible" (80^{th}) outcome. *It is much more likely any lightning-caused fire that is simply monitored will be similar to sizes represented by the 60^{th} percentile.* This statement is consistent with historic fire analyses of the Green and White Mountains over the last 60 years (Richburg and Patterson, 2000).

The modeling analysis concluded that WFU would be a very feasible management option given the low frequency of fire on the Forest, the rapidity of fire-ending events, considerable barriers and favorable vegetative conditions, and nominal fire growth under all but the most severe conditions.

Fire use will result in the consumption and subsequent reduction in the amount of woody fuels within the treated area. The amount of reduction will depend on the initial set of conditions, including fuel moisture, type, size, and arrangement. The reduction in fuel is temporary, lasting the time period it takes for the vegetation to become reestablished. This can be as little as one year for fine, grassy fuels.

A burn usually results in a mosaic pattern consisting of a mixture of burned, partially burned, and unburned vegetation.

Burning forest fuels produces smoke emissions. However, the effects of prescribed fire on air quality are limited and of short duration. Burn plans prescribe particular ranges of conditions under which a burn is conducted, in order to minimize the volume of particulate matter produced and the impact of the smoke. Prescribed fires are typically planned for ignition when fuel moistures are low to promote more complete combustion. Using proper firing techniques and patterns, knowing the site specific fuel properties, and working under weather conditions that promote good smoke dispersion can effectively minimize smoke production and impact.

Particulate output from prescribed fire, as determined by site-specific computer models, is usually below Environmental Protection Agency thresholds. Prescribed burns normally produce less particulates than wildfire because of the controlled conditions.

Typical prescribed burn units are relatively small (usually between 2 and 50 acres), spatially well-distributed, and take up to several hours to complete after ignition. These attributes also contribute toward minimizing smoke impacts.

The smoke produced by prescribed burns and WFU could temporarily affect air quality in the Class I airsheds of the Great Gulf and Presidential Range/ Dry River Wildernesses. There are many factors, however, that will serve to eliminate or minimize such an occurrence. Treatment units are usually well dispersed and small, and the total acres burned annually depicts a small-scale burn program. Individual burn plans will prescribe actions to minimize smoke impacts. Examples include not burning during periods of poor air quality, such as inversions, pollution episodes, or air stagnation advisories.

The vegetation mosaic created as a result of a prescribed burn produces a quick release of stored nutrients and a subsequent flush of new plant growth. This new growth is favored by many wildlife species. See the Rare and Unique Features section, and the Biological Evaluation (Appendix G) for details on species of concern that need fire.

Fire is used to restore or revitalize fire-adapted communities, such as certain pine and oak types. The effect of fire in these cases is to reduce understory competition and to favor those species that are adapted to, or tolerant of, fire. An example may be an oak or pitch pine stand that was originally created or subsequently maintained by fire. Over time, other, non-fire adapted species encroach and out-compete the oak or pine. Reintroducing or using fire may help restore the original community by reducing the competition and creating favorable conditions for seed dispersal, germination, and sprouting.

Cumulative Effects

Reducing the fuel load will temporarily reduce the probability of ignition in those specific areas treated. Reducing the probability of ignition is of greatest value when conducted in areas that have a higher than average fuel load, and that are located adjacent to or near improvements such as houses or other structures, administrative facilities, campgrounds, and communication sites.

Using fire to improve the viability of fire-adapted communities may help to increase or sustain community types or individual plant or animal species that are rare or uncommon on the Forest due to a lack of fire.

The effects of fire use, because of proper implementation and mitigation measures, are expected to have minimal effect on the Forest's Class I airsheds.

Effects on Non-priced Benefits

The wildland fire program on the Forest contributes toward and achieves goals that seek to maximize net public benefits in various ways.

These benefits are typically subjective in nature but ultimately are the reasons we conduct the activity or fund the program.

The highest priority is protecting human health and safety by providing the skills and equipment necessary to effectively manage wildfires. This includes local incidents on the White Mountain National Forest but also those of our partners off-Forest in the sub-regional, regional and national arenas. Assistance on all-risk incidents such as hurricanes, floods, search and rescue, and others is provided under the authority of the National Response Plan by employees trained through the wildland fire program in the Incident Command System (ICS).

Fire use includes both wildland fire use and prescribed fire application to meet resource objectives. Fires can be managed for resource benefits either through the use of management-ignited prescribed fire or lighting-ignited wildland fire use.

On the WMNF, prescribed fire can be used to meet particular objectives in management areas that allow its use, including:

- Reduction of hazardous fuel loading.
- Create, maintain or improve wildlife habitat.
- Preparation of sites for restoration of species such as oak, pine, birch and aspen.
- Create, maintain or improve plant community composition by influencing the scale and pattern of vegetation across the landscape including changing successional patterns while maintaining ecological functions and processes.
- Interactions between plant communities and insects and/or disease.
- Promotion of blueberry production.

- Create or maintain scenic vistas.

The use of prescribed fire will almost always accomplish multiple objectives within the same treatment area or unit. For example, a prescribed burn to maintain wildlife habitat may also reduce fuel loadings. An understory burn to promote fire-adapted oak may also benefit individual fire-adapted ground flora.

Using fire to improve the viability of fire adapted communities may help to increase or sustain community types or individual plant or animal species that are rare or are uncommon on the Forest because of a lack of fire.

Eagle Lakes near Greenleaf Hut (WMNF photo by Forrest Seavey)

Air Resources

Introduction

Air resource management includes the protection of Air Quality Related Values (AQRVs) in Class I Wildernesses, controlling and minimizing air pollutants from land management activities, and cooperation with air regulators to prevent significant adverse effects of air pollutants and atmospheric deposition on forest resources. Air quality is regulated in terms of National Ambient Air Quality Standards (NAAQS). Air quality affects water and soil characteristics when chemicals and particles from the air fall on the land and water. This process is referred to as atmospheric deposition. In turn, the air quality and atmospheric deposition affect other resources. AQRVs in Class I areas are protected from the effects of anthropogenic emissions, through the Clean Air Act's Prevention of Significant Deterioration (PSD) Program. This report includes a discussion of the affected environment of air, including air quality, emission sources, atmospheric deposition, and trends. The effects part of this section discusses the emissions to air that could change because of implementation of one of the alternatives.

Affected Environment

The affected area for air resources is the entire White Mountain National Forest. While the air masses that pass over the Forest have their origins in local, regional, and global locations, it is the air that is directly over the Forest that directly affects it. In some cases, areas outside the Forest are impacted by emissions which have their origin from Forest activities such as prescribed fire, and in these cases, the affected area is the area where emissions are modeled or expected to be of concern. This varies on a project-by-project basis, and would be addressed at that level using Forest standards and guidelines as well as other mitigations.

The White Mountain National Forest lies within an area characterized by some of the best air quality in the eastern part of the country. This is influenced regionally by one or the other of two main air masses, depending on the wind direction and origin. Measured aerosol chemical concentrations are the highest when the wind is from the mid-Atlantic corridor (Slater et al., 2002). When the wind is from the west/southwest, haziness is greater, and winds from the west also bring air masses across the Forest that are elevated in nitrogen and sulfur dioxides resulting from power plant and industrial emissions.

National Ambient Air Quality Standards

Air quality is regulated and measured in relation to the National Ambient Air Quality Standards (NAAQS), which are used to inventory the quality of air and trigger actions, if needed, for improvement. There are six criteria pollutants that the NAAQS regulates: ozone, particulate matter, nitrogen dioxide (NO^2), sulfur dioxide (SO^2), carbon monoxide (CO), and lead. Where

NAAQS are not met continually, a non-attainment zone is designated by EPA. The Forest is not located in a non-attainment area, although there are some to the south near large cities.

The trend for many of the NAAQS criteria pollutants is improving, with fewer violations and improved air quality. Sulfur dioxide emissions have decreased steadily in New Hampshire, and no violations of the ambient air quality standards have occurred since the early 1980s. As with sulfur dioxide, the trends in particulate matter concentrations and lead in New Hampshire, including the National Forest, show a clear reduction in pollutant levels at all monitoring sites. Higher levels of carbon monoxide (CO) are occurring in the more urbanized areas and where there is heavy, congested motor vehicle traffic (NHDES, 2003). In addition to these localized trends in carbon monoxide, ozone and nitrogen dioxide are two pollutants with increasing levels and impacts. No cap on total annual emission of nitrogen dioxide was set in the 1990 Clean Air Act Amendment, and it is expected that emissions will increase gradually in the future as both the U.S. population and fossil fuel consumption increase (Driscoll et al., 2001). Ozone levels follow a similar pattern, since the main cause of elevated ozone concentrations in the East is the emission of nitrogen oxides from automobiles and coal-fired electrical generators.

Lands designated as Class I areas under the Clean Air Act Amendments of 1977 and 1990 are afforded the highest level of protection from air pollutants in the nation. They consist of the national Wildernesses (U.S. Forest Service, Bureau of Land Management), parks (National Park Service), and wildlife refuges (U.S. Fish & Wildlife Service) in existence at the time the 1977 amendment was passed. All other lands in the nation are designated as Class II. The White Mountain National Forest manages two Class I areas, the Great Gulf and the Presidential-Dry River Wilderness areas.

Air Quality Related Values

Through the Clean Air Act and other requirements for Class I lands, federal land managers have another approach to protect the air, land, and water resources from degradation. The AQRV concept is used by the White Mountain National Forest to identify air quality character and effects as well as to make recommendations for improvements. In order to develop a consistent approach to evaluate air emissions on Class I areas, representatives from the agencies that administer them (Forest Service, National Park Service, Fish and Wildlife Service) formed the FLAG (Federal Land Managers' Air Quality Related Values Work Group). FLAG-developed goals include:

1. Define sensitive AQRVs, identify the critical loads (or pollutant levels) that would protect an area.
2. Identify the criteria that define adverse impacts.
3. Standardize the methods and procedures for conducting AQRV analyses.

The AQRVs that have been determined to be of importance for the Class I areas, and for the White Mountain National Forest overall, are air quality, water quality, visibility, human health effects from air quality, vegetative health, soil productivity, and aquatic resources. Various resource sections in this chapter discuss specific AQRV impacts on the resource.

The Prevention of Significant Deterioration section of the Clean Air Act (CAA) requires federal land managers to identify AQRVs. One example of an AQRV is visibility. PSD review is the process of responding to applications for new source emissions by assessing their effects on AQRVs in the Class I Wildernesses. Through this process, the Forest consults with the Environmental Protection Agency (EPA) and the officials from the state where a proposed major emitting facility is located as to whether there will be an adverse impact on AQRVs.

The 1990 Amendments to the Clean Air Act have resulted in significant reductions of sulfur emissions, which are a contributing factor in acid rain and visibility impairment. However, a new natural gas pipeline through northern New England has encouraged proposals for new natural gas power plants, and these would constitute new sources under the PSD (Prevention of Significant Deterioration) regulations, and have the potential to impact Class I areas and air quality on the Forest. In addition, the potential for new and larger coal fired power plants could lead to increased long range emissions outside of the PSD regulatory setting. These types of emissions are most often cited as the cause of acid rain and mercury inputs.

While the National Forest is located far from the largest sulfur dioxide (SO^2) emitters in the Ohio River Valley, impacts from these distant sources, as well as several large sources of sulfur dioxide to the south in New Hampshire, New York, and Massachusetts, are causing some level of acid deposition within the forest (Sams, 2002). Nitrogen oxides (NO^X) emissions are not as great as SO^2 but remain elevated with distant sources as well as regional inputs including motor vehicles. NO^X combines with volatile organic compounds (VOCs) to create ozone. Both SO^2 and NO^X are precursors to haze. On the WMNF, monitoring has indicated impacts to AQRVs related to these emissions.

Atmospheric Deposition

Atmospheric deposition refers to chemicals that are carried in the air and deposited on the land surface through precipitation or dry deposition. The most important chemicals are sulfur and nitrogen. Acid rain occurs when these pollutants are emitted into the atmosphere and dissolve in cloud droplets. Many air pollutants that are deposited in this manner result in effects to air quality related values such as water quality and soil productivity.

One example of atmospheric deposition is mercury. Mercury in the air is primarily from coal-fired power plant emissions. Its deposition leads to the formation of methyl mercury, a potent neurotoxin that is biomagnified through the aquatic food chain. In New Hampshire and Maine, fish consumption advisories due to mercury are in effect for all surface waters (Sams, 2002).

Sulfur and nitrogen oxides primarily come from the combustion of fossil fuels. Electric utilities account for the greatest proportion of sulfur dioxide emissions, while nitrogen oxide is mainly from vehicle emissions. Analysis of air currents shows that many states in the Ohio River Valley are the dominant sources for sulfur and nitrogen oxide emissions, traveling downwind to the northeastern U.S. (Driscoll et al., 2001). Ammonia emissions related to manure handling, especially from the Midwest, also contribute to nitrogen deposition. Where sulfur and nitrogen have been deposited, chemical reactions occur that degrade water quality by lowering pH levels (i.e., increasing acidity), decreasing buffering capacity, and increasing aluminum concentrations. As reported in Acid Rain Revisited (Driscoll et al., 2001), reductions of SO^2 emissions since 1970 have resulted in statistically significant decreases in sulfate in wet/bulk deposition and surface water. However, while sulfate concentrations in lakes and streams have decreased over the last 20 years, they remain high compared to background conditions (Driscoll et al., 2001; WMNF Monitoring, 1990-2003). Long-term data from Hubbard Brook show that the concentration of nitrogen in precipitation has been relatively constant since the early 1960s, when measurements began (Driscoll et al., 2003). These high deposition levels persist, since the 1990 Clean Air Act Amendments did not substantially limit nitrogen emissions. Regional monitoring of sulfur and nitrogen deposition shows that existing total inputs exceed the Forest Service "red line value" for AQRVs, indicating a concern with possible effects to terrestrial resources such as soil and vegetation. Red line values refer to levels of pollutants that are "sufficiently high that impacts are predicted" (Adams et al., 1991; Fox et al., 1989). Because of this, the 1993 Monitoring Report reported that these terrestrial AQRVs have already been adversely impacted by sulfur deposition, based on modeling results. However, soil productivity has not been affected, and continues to support a healthy forest (see the Soils section).

Acid Rain

Elevated levels of atmospheric deposition and related acid rain do occur on the White Mountain National Forest. The air pollution that causes acid rain and other AQRV effects largely originates outside the Forest and state of New Hampshire, making it difficult to address this issue. Although the 1970 and 1990 Clean Air Acts have had positive effects, emissions remain high compared to background conditions. Given the accumulation of acids and decrease in the buffering capacity in the soil, localized areas on the Forest are now more sensitive to acid deposition and have developed an inertia that will delay recovery. Computer model results presented in the report "Acid Rain Revisited" (2001) show that deeper emissions cuts will lead to greater and faster recovery from acid deposition in the northeastern United States.

Rainfall measured at the Forest's Hubbard Brook Experimental Forest has an average pH of 4.5, 10 to 15 times more acidic than unpolluted rainwater (Driscoll et al., 2003). The major parts of acid rain come from nitrogen and sulfur, nitrogen combining with water to form nitric acid; sulfur combining with water to form sulfuric acid. This lowers the pH of rain so that when it falls on the ground it is more likely to dissolve certain components in the

soil. As a result, acidic deposition causes increased concentrations of aluminum (Al) in soil water, lakes, and streams that can be toxic to plants, fish, and other organisms. Concentrations of aluminum in streams at the Hubbard Brook Experimental Forest (Driscoll et al., 2001) and across the White Mountain National Forest (WMNF Monitoring Reports, 1990-2002) are often well above those observed in forested watersheds receiving low levels of acid deposition.

At Hubbard Brook, the concentration of sulfate in streams declined 20 percent between 1963 and 1994, and their pH has increased from 4.8 to 5.0. Although this represents improvement in water quality, streams at Hubbard Brook and across the Forest remain acidic compared to background conditions. In addition, buffering capacity, a measure of a lake or stream's ability to buffer acid inputs, has not improved significantly at Hubbard Brook over the past thirty years (Driscoll et al., 2001).

Visibility

Visibility in the White Mountains has the potential to be excellent, as shown by its high "10 percent Clean" values, whose median annual value is 94 miles (151 km) (Figure 3-39a). In contrast, the lowest 10 percent values have an annual median value of 15 miles (24 km) (Figure 3-39b). The 1999 Monitoring report stated, "Monitoring has shown that during the spring and summer, visibility in the Great Gulf Wilderness is most often less than half of what it could be. Visibility in our Class I areas has been adversely impacted by regional haze pollution, comprised mostly of sulfates." Air sampling by the Appalachian Mountain Club (AMC) substantiates this by showing a significant relationship between visibility and fine mass particulates, further substantiating this, as the fine mass particulates are mostly sulfate particles.

Natural visibility conditions have been estimated to be 60 to 80 miles in the East. Under natural conditions, sulfur causes only 10 percent of the visibility reduction, whereas currently sulfur is responsible for 60 to 90 percent of the visibility reduction in the East (Malm, 1999).

Figure 3-39a. 10% Best Day, summer 1991.

Figure 3-39b. 90% Worst Day, summer 1991.

The 1993 Monitoring Report indicated that the median standardized visual range (SVR — the unit of measurement for visibility) at the Great Gulf and Presidential Dry River Wilderness areas varied from 30 to 56 miles (48 to 91 kilometers). A pilot study reported in the 1997 Monitoring Report assessed Forest visitors' perception of visibility. Initial results show that a SVR of 18 miles (29 km) or less was an unacceptable level of visibility for at least 70 percent of the respondents.

Ozone

Ground level ozone is formed from a combination of NO^x, VOCs, and sunlight. VOCs are always in abundance during the growing season due to forest species emitting them in great quantities; additional inputs are from motor vehicles. The largest point source of NO^x is from fossil fuel power plants, although nationally, motor vehicles emit more NO^x than power plants (Sams, 2002). Stagnant, sunny, hot weather is ideal for the formation of ozone, and data show the highest peaks occurring in summer. Ground level ozone (tropospheric) within the National Forest can reach levels that have been shown to be unhealthful to humans, as well as harmful to vegetation. The AQRVs related to ozone would be healthy air and vegetation.

Data collection for ozone occurs at the summit of Mt. Washington, and at two lower elevation sites, Camp Dodge, on Route 16 north of Pinkham Notch, and in Conway, New Hampshire. The two lower elevation sites consistently correlate more strongly with each other than with the Mt. Washington site, due to Mt. Washington having little daytime variability and with its air quality more representative of regional conditions. The daily mean of 1-hour averages for the Mt. Washington site was typically 10 ppb (parts per billion) or more during the 2002 monitoring season. All sites showed peaks on or near the same day, which indicates these peak periods are of a regional rather than local origin (Murray, 2003). Assessment of the data shows no consistent temporal trends evident in the best 10 percent air quality days, mean, and background ozone levels since 1990.

While ozone monitoring shows no clear trend, 1980s data exhibit high peak concentrations and high mean values, especially at the summit of Mt. Washington. In the early to mid-1990s, peak values decreased, but mean values increased, showing worsening background concentrations with less severe episodes. The highest peak concentrations were recorded in 1997, with a slightly reduced mean concentration from the previous year. Green line values for ozone have been exceeded at the peak of Mt. Washington every year except 1994, and at the base every year except 1989, 1995, and 1996. Green line values denote the threshold for pollutants above which AQRVs may be adversely affected (Fox et al., 1989).

In August 2002, the peak of Mt. Washington had the highest ozone concentration since 1989. The 8-hour standard for ozone was exceeded on four different days, although the lower elevation sites did not exceed the standard. Mt. Washington State Park staff on the summit reported treating three hikers with oxygen during the event. The use of an 8-hour standard accounts for longer exposure periods and does not capture these acute events. In response to the potential for ozone health effects, the State of

New Hampshire began issuing high elevation ozone forecasts for peaks greater than 3,000 feet, and in cooperation with the Forest Service and the AMC, reported the current forecast to backcountry huts and visitor information sites.

Elevated levels of ozone are a concern for vegetation as well. The most common visible effects are stipple (dark colored lesions on leaves resulting from pigmentation of injured cells), fleck (collapse of a few cells in isolated areas of the upper layers of the leaf resulting in tiny light-colored lesions), mottle (degeneration of the chlorophyll in certain areas of the leaf giving it a blotchy appearance), necrosis (death of tissue), and, in extreme cases, mortality. Aside from visible injury, ozone exposure can result in less obvious physiological impairment, such as decreased growth or altered carbon allocation. Monitoring of ozone affects on plants in 1994 and 1995 showed that injury is occurring at the Great Gulf and Presidential-Dry River Wilderness areas, and that "ambient ozone continued to be a pervasive air pollutant in the Great Gulf Wilderness and the Presidential Range-Dry River Wilderness during the growing season at concentration high enough to cause foliar plant injury." (Manning et al., 1994)

Emissions from Forest Management Activities

Activities from within the Forest that currently can have impacts on air quality include prescribed burning, wildfire emissions, road construction/ maintenance/use, and recreational use. As described in the Fire section, the use of prescribed burning on the White Mountain National Forest since 1989 has varied from about 0 to 180 acres each year. Burn plans for prescribed fires include modeling for expected emissions, and impact areas where smoke emissions are expected to be high. An average of six wildfires burn about 25 acres each year, according to records from the last 20 years (see the Fire section). Other fire-related emissions come from campfires, especially where concentrated use occurs, such as large campgrounds. Particulates are produced from road construction and maintenance, and from general use of gravel and other unpaved roads. Emissions from motor vehicles on these roads and adjacent non-forest roads from recreational use (as well as forest management uses) also contribute particulates.

Currently, no data are taken during forest activities to know their effect on NAAQS. Prescribed fires include modeling in the burn plan that estimates particulate matter levels. Air quality monitoring at fixed locations such as the IMPROVE site show that, overall, air quality standards are being met. These do not measure the emissions of specific activities; however none contributes to a non-attainment status for any of the criteria pollutants. Dust from road use and recreational campfires are relatively short term effects, and usually do not last for more than a few hours. This is often true for fire activity as well. The smoke from prescribed fire, however, does have the potential to exceed standards for short periods of time in localized areas when burning lasts more than a day. A burn plan is prepared for all prescribed fires on the Forest, and this includes smoke management

information and emission estimates. Mitigations are also specified that include notifying adjacent landowners and local populations.

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

Emissions produced from activities proposed by the revised Forest Plan are largely the same as what is currently occurring on the Forest. Emissions from Forest Service activities fall into one of three categories: emissions related to fires, emissions whose level is linked to visitor use, and emissions related to construction activities on the Forest. The first two categories are not changed by any of the alternatives, as described below. The third, emissions related to construction, varies by alternative, but since these activities are short lived and mitigated, the emissions are expected to be short-term, localized, and unlikely to contribute to violations of air quality regulations in terms of NAAQS or AQRVs. Therefore, the level of construction activity may vary, but the effects to air quality would not. This is described further below. The consequences of these emissions could be health effects, exceeding of air quality standards, and contributing to cumulative effects. Table 3-88 lists the types of activities which contribute emissions to the air, the direct and indirect effects, influencing factors, and mitigations.

Emissions Related to Fire

Fire activities that produce emissions include prescribed fire, wildfire, and wildland fire use. Management allocation does not affect emissions from forest activities, since fire could occur across the Forest. Vegetation management uses prescribed fire to maintain openings, but the amount of prescribed fire does not vary among the alternatives.

The acres burned by prescribed fire may increase to no more than 400 per year. The same burn plans and mitigations that are used at present would be used in the future, and would preclude burning during times of poor air quality and during weather conditions that would concentrate smoke and emissions in an area.

Wildland fire use manages naturally-occurring fires to accomplish specific, pre-stated resource management objectives in predefined geographic areas, outlined in the Fire Management Plan, that also includes parameters for expected smoke emissions. Emissions related to wildfires are harder to predict, although (as described in the Fire section) the natural fire regime is not conducive to large fires, and the number of wildfires has been low since the large fires related to uncontrolled logging practices in the 1800s and early 1900s. Fires that do not fall within the parameters of wildland fire use will be suppressed, and because of this, it is unlikely that long-term impacts from their emissions would become a problem or contribute to cumulative effects. In general, emissions from fire related to Forest management activities would be controlled either by mitigations found in burn plans or

Table 3-88. Forest Management Activities which Produce Emissions.

Activity	Direct and Indirect Effects	Influencing Factors	Forest Level Mitigation
Use of Unpaved Roads	Dust particulates	Varies with volume of traffic, condition of road, fraction of silt in road surface materials, vehicle weight, moisture content of road surface material	• Road Management Plan • S&Gs
Use of Paved Roads	Dust Brake wear Tire wear Pavement wear Particulates	Varies with amount of traffic, condition of road, temperature, vehicle weight, tire, and surface material. Also seasonal inputs related to snow/ice controls such as salt and sand.	• Road management Plan • S&Gs
Motor Vehicles including ATVs, Snowmobiles.	Exhaust Carbon monoxide Hydrocarbons Nitrogen Oxides Particulates	Varies with amount of traffic.	• Maintain FS motor vehicles • No control over non-FS motor vehicles
Wildfire, Wildland Fire Use, and Prescribed Fire	Smoke Particulates Carbon monoxide Volatile organics Nitrogen oxides Carbon dioxide	Varies with intensity and rate of fire, fuels type, topography,	• Fire management plan and associated mitigations • Burn plans
Construction and Building Activities	Dust Exhaust Particulates Carbon monoxide Hydrocarbons Nitrogen Oxides Air Toxics Carbon dioxide	Varies with size of equipment, size of area, weather conditions during activity,	• S&Gs • Contract provisions
Campfires	Smoke Particulates Carbon monoxide Volatile organics Nitrogen oxides	Varies with size, concentration, topography, weather conditions.	• Backcountry Rules • Forest Protection Areas

by suppression. The mitigations prevent health problems by alerting sensitive populations or individuals in the areas where fire is planned or occurring, and weather conditions are considered to make sure emissions are minimized and that winds are favorable. In these ways, health problems and increased emissions resulting from fires are reduced to short term. These emissions are common to all alternatives, and would continue much the same regardless of the alternative chosen.

Emissions Related to Visitor Use

Emissions that are expected to increase as a result of increased visitor numbers are the product of campfires, dust and other emissions from road use, and exhaust from motor vehicles such as cars and off road vehicles. Since these activities are related to the number of people recreating on the Forest, the emissions produced are proportional to the number of users. As discussed elsewhere, this number is expected to increase. The overall effect is expected to be similar across the four alternatives.

Emissions related to campfires are generally localized and short-lived. Concentrations of smoke from campfires can occur around developed and dispersed camping sites throughout the Forest, and may reach unpleasant levels in localized areas for short periods. As visitor use increases, this effect may also increase but would be limited by capacity. Due to the short term and local nature of these emissions, NAAQs are not likely to be affected. The AQRVs within Wilderness are unlikely to be affected, either, since these indicators monitor larger scale effects, such as visibility.

Emissions related to the use of paved and unpaved roads are also proportional to the amount of use. Thus, as visitor numbers increase, the amount of road use on the Forest is also expected to increase. The types of emissions that occur from these roads are described in the affected environment section and include dust particles. This effect is limited to the area along the roadway. When levels become a nuisance or cause safety problems, mitigations such as closure or surface treatments are employed. In some cases, during dry conditions, nothing is done and dust emissions remain a problem on certain roads. This condition does not occur often on the Forest, however, due to frequent rains. There is no difference among the alternatives as to how emissions related to the use of roads are treated because the number of roads, paved or unpaved, and their use, are not expected to vary by alternative. The increase in emissions from roads is a direct correlation to the amount of visitor use on these roads, and is not related to a particular alternative.

Emissions from motor vehicle exhaust are related to the amount of driving which occurs on the Forest, and are the most problematic for air resources. Motor vehicle exhaust emissions contribute to ground level ozone that has been shown to reach unhealthy levels during certain weather conditions in the summer. Increased exhaust from increased visitor use could exacerbate this effect. However, since none of the alternatives are expected to influence the number of visitors, and therefore the amount of emissions related to motor vehicles, there would be no difference on this effect related to alternative selection. Additive effects are discussed in the cumulative effects section of this report.

Emissions Related to Construction Activities

Construction and reconstruction activities are proposed in varying degrees under all the alternatives. The resulting emissions include particulates such as dust and exhaust. These are short term and unlikely to persist beyond the actual construction period. Mitigations, such as surface treatments, would reduce particulate emissions and minimize health and air quality effects.

Cumulative Effects

As described in the Affected Environment, the quality of the air that passes over the Forest is determined by where the air originates. These outside influences have the greatest effect on Forest resources, and are cumulative in nature. The future levels of these pollutants depend on regulations and national policy. None of the proposed alternatives changes this situation. However, the revised Forest Plan includes as a goal continued involvement with regional, local, and national air quality groups. The presence of Class I areas, with goals of high quality air and AQRVs, assist the Forest in assuring that these values are considered during policy and planning processes. In addition, the Forest can comment on new sources that are likely to affect AQRVs through the "Prevention of Significant Deterioration" part of New Source Review in the Air Quality regulations. This process can lead to improvements in air quality emissions for these new sources. In this way, the WMNF can provide information and be part of solutions to improve air quality that passes over the Forest.

Forest management activities do contribute amounts of emissions as described in the Affected Environment section. The cumulative effects area for air quality related to forest management activities is the air above the Forest, including the air above the private lands within the forest. Only emissions related to construction activities are expected to vary by alternative. The extent of emissions related to forest management activities is not expected to vary from these levels in the foreseeable future. In addition, it is unlikely that other emissions in the area of the Forest would increase appreciably with the possible exception of motor vehicle emissions.

Emissions from forest management activities are small when compared to the amounts already present in the air from outside sources. As described previously, the largest source of emissions from forest management activities is related largely to the amount of visitor use. Table 2 shows the forest management activities and relationship to cumulative effects. Of the various forest activities, motor vehicle use by the many people who drive to and around the forest, and to a much lesser degree motor vehicle use by the Forest Service, has the potential to increase cumulative effects. Motor vehicle emissions contribute to the formation of ground level ozone. This effect is already evident in the summer on the east side of the forest when weather conditions are favorable for the formation of ground level ozone from motor vehicle emissions. As the number of motor vehicles that operate in the cumulative effects area increase, this effect is also expected to increase. This effect will continue as long as motor vehicles use fossil fuels resulting in these emissions. The magnitude and trend are directly related to the numbers of motor vehicles operating in and around the Forest.

Effects on Non-priced Benefits

There are many reasons for protecting air resources, many of which cannot easily have an economic value assigned to them. Air resources include air that crosses over the Forest throughout the year. As described earlier, air is not a resource which the Forest has much control over. Emissions to the air from Forest activities are small compared to the cumulative effects which occur to the air from sources off the WMNF.

Non-priced benefits associated with air resource features are listed in the table below. The non-priced benefits associated with each of these features are not expected to vary by alternative since standards and guidelines associated with each alternative are the same. These standards and guidelines are expect to maintain the quality and quantity of these features, except for some short term localized impacts associated with various activities as described in the effects section. As described earlier in the EIS, effects to air quality are largely the result of emissions from off the Forest. Emissions from forest management activities can result in short term localized impacts but these effects dissipate quickly.

Table 3-88a. Air Resource Features and Associated Non-priced Benefits.

Air Resource	Non-priced Benefit	Indicator
Air quality	Clean air Clean smelling air	**Air quality** is not expected to change by alternative.
Visibility	Clear views	**Visibility** is not expected to change by alternative.

Preparing to airlift wood decking material for bog bridge construction in the Nancy Pond area, approximately a 4-mile hike into the backcountry. The airlift site is an old log landing in the Sawyer River area. (WMNF photo by Terry Miller)

Scenic Resources

Affected Environment

General Description

The White Mountain National Forest provides some of the most scenic mountainous environments in New England. Since their discovery, the beauty and diversity of the White Mountains have been major influences in drawing people to the area. A long history of varying land uses, ranging from agricultural clearing to intensive logging at the turn-of-century, has affected the landscape and the resulting scenic resources.

Today, the Forest presents a predominantly natural-appearing landscape. The forested mountain slopes, exhibiting a mixture of softwood and hardwood species, provide a backdrop to the numerous valleys, most containing streams or rivers that originate in the mountains. The variety in vegetation, including the largest alpine zone in the East; the occurrence of unique geological features and several mountain passes or notches; and the variety in the terrain, ranging from the dominate peaks of the Presidential Range to the valley bottoms, are just a few of the notable features that contribute to a landscape rich in scenic resources.

Other features visually important to the landscape consist of the occasional rock outcrop and ledges; unique water features in the form of clear, fast running, mountain streams; numerous waterfalls; and mountain ponds. The largest streams and ponds are located in the valley bottoms, although some ponds, such as Lake of the Clouds just below the summit of Mount Washington are found at higher elevations. Most of these ponds, and the settings associated with them, offer a unique and important visual feature within the mountain environment. Larger lakes associated with the Forest include Lake Tarleton and Stinson Lake.

Many of the Forest's scenic attributes are recognized through special designations that include a major segment of the Appalachian National Scenic trail, Wildcat Wild and Scenic River, several Scenic Areas, and the White Mountain Trail National Scenic Byway. The later includes the Kancamagus Scenic Byway, located in the corridor formed by the Passaconaway and Pemigewasset valleys. This highway has historically provided a focus for scenic drives and recreational activity on the Forest, and has national, as well as regional, significance.

Timber harvesting and recreation are the primary ongoing activities on the National Forest that have the most potential to create visual change. On private and adjacent lands, these, along with urban and residential development, have been contributors to changes in the landscape. Other uses, such as farming, constitute little activity. Although present, agricultural production is not considered a significant land use of the region. Some open field does remain in the broader valleys and flatter terrain that surrounds the Forest.

Dominant landscape-altering activities, such as mining, are not present. Wireless telecommunication facilities are becoming more obvious in the landscape adjacent to the Forest, particularly along the I-93 corridor.

Significant utility corridors found on the Forest include one running northwest from the Lincoln/Woodstock area, one running north-south along the western boundary of the Forest, and one running across the southern tip of the Forest in the Sandwich Notch area. Within the Forest boundaries, the ski areas represent the most visible alteration of the landscape.

Much of the commercial and residential development adjacent to Forest lands is associated with the larger communities of Conway, North Conway, Gorham, Lincoln, and Woodstock. Development also occurs around the major ski area resorts within the White Mountains, where the last 15 to 20 years have seen a proliferation of both housing developments and condominium construction. Recreational retreats and second homes account for much of the residential development that has occurred, and concern about visible vegetation management activity on the Forest originates from the owners of these properties, whose backdrop is the White Mountain National Forest.

Another concern for the scenic resources of the Forest is related to the high recreation use, especially driving for pleasure, hiking, and use of the many developed and dispersed recreation sites spread across the Forest. Hiking trails providing access to high mountain elevations, as well as scenic overlooks associated with both roads and trails, create many opportunities for viewing scenery, and this allows viewing of management activities as well.

Scenic Resource Management

The Forest Service recognizes that scenic resources are important to its overall management, and should be "treated as an essential part of and receive equal consideration with the other basic resources of the land." (FSM 2380) In the 1970s, the Forest Service developed a Visual Management System for the purpose of inventorying and managing scenic resources (Forest Service, 1974). The process under this system identified and classified scenic quality in the landscape, as well as esthetic concern for that quality on National Forest lands. It also established specific Visual Quality Objectives (VQOs) for management of the scenic resource.

The White Mountain National Forest fully embraced this system, completing the inventory for the Forest and establishing VQOs. This process and the resulting objectives, along with the guidelines that were established to meet the VQOs, are a component of the current Forest Plan (Forest Service, 1986) and have provided direction for managing scenic resources since the mid-1980s. Although the Visual Quality Objectives apply to all management actions that occur on the Forest, their application has concentrated on vegetation management activities. This has been the dominant activity on the Forest that has the potential to create visible, but temporary, alterations on a continuing basis within the landscape being viewed.

In an effort to improve on the application of guidelines applied to scenic resource management, the Forest participated in a research project to identify user perceptions of clearcutting in the White Mountains (Palmer, 1997). Directed at the visual element of temporary openings, the results provided valuable public input into the design and layout of temporary openings in those areas of the Forest actively managed for vegetation and habitat goals.

General findings of the research project provided support for the current observed acreage guidelines, which varied by assigned Visual Quality Objective and distance from the observer (WMNF, 1986). The dominant occurrence related to a Partial Retention VQO in a viewing zone one to three miles from the observer. Guidelines suggested a maximum of 10 acres of observed opening for this occurrence.

Other findings provided useful information regarding layout and distribution of units, as well as indications of acceptable limits of amount of area treated in temporary openings for a given period of time. Although no definitive limits were identified, computer simulations used for the project suggest that 3 percent of a viewshed in the 0-10 year age class at any given time period provides a reasonable or acceptable limit. The amount of landscape viewed, or landscape scale, is an important factor regarding this interpretation.

The Forest Service has recently updated the original Visual Management System to incorporate new technology, resulting in quality objectives that better incorporate the principles of ecosystem management. Now called the Scenery Management System (SMS), the process incorporates many of the original inventory elements, but differs in how scenic objectives are assigned (Forest Service, 1995). SMS Scenic Integrity Objectives have standards and guidelines similar to those used under the previous process.

Assigned Scenic Integrity Levels provide an indication of the alteration allowed in the landscape. Levels are designated Very High (unaltered), High (appears unaltered), Moderate (slightly altered), Low (moderately altered), and Very Low (heavily altered). The White Mountain National Forest has completed the inventory process outlined under the Scenery Management System and established Scenic Integrity Objectives. Standards and guidelines have also been developed or updated. For vegetation (habitat) management activities, guidelines were built on past experience, and incorporated results from the research project on user perception of clearcuts or temporary openings.

The overall goal for Scenic Resources is for all management activities to achieve the assigned Scenic Integrity Objectives, realizing the importance to society of a natural appearing landscape distinct from the human-made environments dominant in the East. By integrating scenic resource management into other resource activities, scenic quality is maintained that provides a desirable setting for Forest users, attracts visitors, and generates economic benefits to local communities and the state.

Scenic Resource Management Concerns

Although no specific scenic resource issues were identified through the scoping process completed as part of the Forest Plan revision, scenery is important to many Forest users and local landowners. Therefore, management of the scenic resource remains an integral part of Forest-wide and project level planning. Past experience has shown that Forest viewers react strongly to management activities that alter the landscape, especially those landscapes that serve as backdrops to residential areas or that are viewed from highly sensitive areas such as the Appalachian National Scenic Trail.

The White Mountain National Forest Plan proposes to transition from the current Visual Management System to the Scenery Management System. Elements of this transition important to revision are the assignment of Scenic Integrity Objectives to the Forest land base; recognition of changes in management activities, including different emphasis on cutting practices to achieve habitat management goals; recognition of new technology, such as telecommunication facilities, that have the potential to effect the scenic resources of the Forest; and the development of standards and guidelines that adequately address the potential effects of management activities on the scenic resources.

Analysis Area

The primary area of influence for addressing the Forest's scenic resources is that area within the Forest boundaries. However, management activities, especially those that result in temporary or permanent openings and that contrast with the existing landscape character, are often viewed from a distance, and view locations off the Forest become important. Completion of the scenic resource inventory component of the Scenery Management System took into account view locations that were outside the Forest boundary but within a reasonable distance for viewing of potential management activities. Most of these were associated with primary highways, population centers, or known view locations outside but adjacent to the Forest.

Existing Scenic Integrity

Implementation of the Scenery Management System included completing a landscape level inventory and map of the current visual condition of all Forest lands. Individual timber compartments served as evaluation units. The Integrity Levels previously outlined served as the unit of measure for Forest lands within the compartment units. Specific factors that influenced identification of existing condition included the presence of and extent of temporary or permanent openings, utility corridors, roads, and the presence of recreation or other facilities.

Results of this inventory established that 37 percent of the Forest reflects an Integrity Level of Very High. Areas associated with this Integrity Level

include the Wildernesses and the majority of the land base assigned to management areas where management activities are very minimal. This included those areas with special designations, such as Scenic Areas, and Research Natural Areas, and those where recreation was the primary emphasis.

Approximately 28 percent of the Forest has a current condition of High Integrity. These are primarily management areas that have vegetation (habitat) management as part of their management goal. They exhibit some level of vegetation management activity that has occurred, but where the characteristic landscape fully dominates when viewed. Some of the area identified with this High Integrity Level also includes portions of MAs 6.1, 6.2, and 6.3, where past cutting has occurred for salvage or other purposes.

The 27 percent of the Forest land base that is identified as Moderate Integrity is indicative of those compartments where vegetation (habitat) management is occurring. It is also indicative of compartments that have a higher degree of recreation development, roads, utility corridors, or other activity that may be more evident in the landscape. However, the existing landscape character still dominates within these compartments, and deviation from the existing landscape character is minimal.

The vegetation management activity within these compartments generally shows evidence of the even-aged harvest that has occurred over the last 20 years. Temporary openings resulting from past cutting activity, for the most part, have been implemented under scenic resource guidelines that call for openings to be in the range of 10 acres or less for most projects where the units are observed from known view locations. Other guidelines call for the layout and design of the units to draw upon relationships with natural features in the existing landscape. In some areas, past clearcuts implemented prior to the current Forest Plan are still evident, but are reaching a point in regrowth where they will become less of a visible factor in the landscape.

Group cuts accomplished under uneven-aged management are also a factor in achieving scenic resource standards and guidelines. Increasing use of this harvest prescription is becoming more evident in several areas of the Forest. Depending on site factors and observer position, group cuts can cause an unnatural appearance to the forest canopy. Inappropriate design and layout can cause small openings and highly observable textural changes laid out in a geometric pattern that do not relate well to the characteristic landscape being viewed.

The remaining compartments contain activities where management activities dominate the view. Approximately 7 percent of Forest lands are identified as having Low Integrity and 1 percent as Very Low. Low Integrity is found within a few compartments where creation of temporary openings has been more intense in order to achieve vegetation management goals, including regeneration of paper birch and aspen. The most intense areas of cutting that remain visible in the landscape include the Zealand Valley and a portion of the east side of the Kilkenny Unit. The amount of Forest land in Very Low includes those compartments where downhill ski areas dominate the landscape. These facilities appear as sinuous, fall-line trails separated by

forest, and lift lines with towers at varying intervals (Forest Service, 1986). Although appropriate scenic resource guidelines are applied to these developments, the cleared lift lines and ski runs tend to contrast highly with and dominate the existing landscape character.

In general, 92 percent of the Forest is natural-appearing, with little deviation evident. This condition is representative of those areas identified as having an existing Integrity Level of Very High, High, and Moderate. Those management activities implemented over the course of the last 20 years that had the potential to affect changes in the natural appearance of the landscape usually received a visual assessment that included computer simulations.

Environmental Effects

Introduction

A variety of management activities may contribute to changes in the existing character of the landscape and resulting scenic quality. Generally, these effects will introduce evidence of human activity and create change in the natural appearance of the Forest.

Distribution and ability to achieve assigned Scenic Integrity Objectives determines the degree of change that could occur, and how well the natural appearance of the Forest will be maintained. These are important comparison criteria in analyzing the potential effects of the alternatives.

Those activities that have the potential to cause significant (noticeable) changes and disturbance in the landscape are:

- Vegetation management and associated activities (roads, landings, etc.).
- Recreation and administration facilities.
- Downhill ski area expansion.
- Telecommunication facilities.
- Wind electrical generation towers.
- Utility corridors.
- Mineral extraction.

Of these activities, downhill ski area development, telecommunication facilities, wind generation towers, utility corridors, and mineral extraction have the greatest probability of creating highly visible and more permanent impacts on the landscape when they are implemented. Recreation facilities, while tending more toward permanent existence, can generally be integrated reasonably well into their settings. On a regular or ongoing basis, vegetation management practices have the highest potential to create frequent but temporary changes in scenic quality across the Forest.

Scenic Resource management guidelines affect both the timing and Forest-wide distribution of vegetation management activities. For individual projects, Scenic Resource management affects the location, distribution, design, and size of harvest areas. These considerations may relate to user

concerns associated with highways, scenic overlooks, recreation sites, trails, and other use facilities on or adjacent to the Forest.

Of all the different vegetation management activities, even-aged regeneration harvest cuts have the greatest probability of creating changes in scenic quality. Forest openings created by clearcuts in the 0 to 10-year age class indicate a new or recently created opening that is temporary but may present the most obvious visual changes. These changes can be positive by providing variety in the landscape or by maintaining a visually desirable species that cannot be maintained by other cutting methods. Forest stands in the 11 to 20-year age class present textural changes, but they are quickly reverting to a natural-appearing forest cover.

Increasing use of group cutting under uneven-aged vegetation management practices is also an important consideration in analyzing effects. Similar characteristics related to distribution, number of units, and size will affect the success in maintaining a natural-appearing forest character. Group cut units highly concentrated within a viewed landscape, and placed in a rigid or geometric pattern, can create an unnatural appearing landscape.

In many instances, Scenic Resource management corresponds well to a desirable distribution of wildlife habitat. Visual management may affect wildlife where larger harvest units and greater quantity of units may be desirable for wildlife but do not meet the visual management requirements. While existing guidelines may lead to conflict, new Scenic Resource standards and guidelines have been developed in coordination with wildlife habitat goals to better address these situations.

Roads are a minor component of vegetation management activities. Nevertheless, they are sometimes visible, especially where they intersect state and local highways. These, along with landings, are components that must be taken into account in considering total effects of vegetation management.

Evaluation Criteria

Three primary criteria are used to determine effects of the alternatives on Scenic Resources: comparison of total acres of the assigned Scenic Integrity Objectives (influenced by the mix of MA acreage allocation by alternative); comparison of vegetation management outputs, total acres under vegetation management, and acres in even-aged and uneven-aged management; and changes that might occur as a result of differences in management practices related to other facility and recreation activities.

Tables 2-02, 2-07, 2-12, and 2-17 (Chapter 2) list the acres in each MA by alternative. Scenic Integrity Objectives assignments were made by Scenic Class and by management area. The higher and more restrictive objectives will be tied in with the more sensitive and recreation related MAs. Generally, the more acres in MAs 5.1,9.1, 6.1, 6.2, 6.3, 8.1, 8.3, 8.4, 9.3, 8.5, and 8.6, verses MAs 2.1, 7.1, 9.2, and 8.2, will result in a higher percentage of Scenic Integrity Objectives at the Very High and High level. These are the most restrictive in maintenance of the existing Forest Character.

The Decision Matrix in Chapter 2 compares outputs for Forest resource areas by alternative. These include annual vegetation management harvest outputs, and a comparison for decades 1 and 2 for acres of regeneration, even-aged, and uneven-aged harvest. Generally, the less acres in even-aged regeneration management practices verses an increase in uneven-aged harvest methods will result in less noticeable changes or disturbances in scenic quality. Also, less overall acres of vegetation management activity will generally result in less noticeable change to the Forest landscape.

Effects Common to all Alternatives

Direct and Indirect Effects

All alternatives have the same effects related to alpine ski areas, telecommunication facilities, wind electrical generation towers, utility corridors, and mineral extraction.

The direction for ski area expansion remains the same for all alternatives. Scenic Resource effects of ski area expansion will appear as openings related to ski trails and lift lines. Towers will also appear at varying intervals, and other building structures may be constructed on Forest lands.

Telecommunication sites designated for Mt. Tecumseh (existing site), Loon, Wildcat and Attitash Mountains have the potential to add structures on mountain tops that are highly visible and noticeable in the landscape. Mountain tops and ridge lines are critical locations for management activities, and quickly draw the attention of a viewer. Facility attributes such as placement, height, color, type of antenna structures on tower, and reflective abilities are all important to reducing impacts. The general location of these proposed sites is in conjunction with ski area developments, which in themselves tend to be significant alterations on the landscape. Cumulative effects become a consideration.

Wind electrical generation towers would create new and highly visible changes to the viewed landscape. Placement to achieve the benefits of wind, heights above the forest canopy, contrast factors, and grouping of multiple towers are factors that contribute to high visibility and may make it difficult to achieve Scenic Integrity Objectives.

No new utility corridors are proposed in any of the alternatives, but could potentially occur. Utility corridors tend to follow straight lines, follow courses that cut across slopes at highly visible angles, and create openings with harsh edges. While there are guidelines that can be implemented to reduce visual effects, the terrain and vegetation patterns on the Forest will make it difficult to meet Scenic Resource Objectives in all situations. Current effects of the existing utility corridors will remain.

Mineral extraction sites also have the potential to occur in all four alternatives. This type of management activity has the possibility of permanently altering the landscape, especially landform. Contrast in soil coloration is often the dominant visual effect of this type of activity. Site rehabilitation plans put into place as part of mineral extraction operations

can often reduce visual effects to the site during and after the time it is in use. Scale of the operation will also be a factor in the ability to meet objectives.

Cumulative Effects

Observed landscapes from viewpoints within the White Mountain National Forest often include land that is outside the Forest boundaries or is in state or private ownership within the Forest boundaries. Significant private development visually evident within or adjacent to the Forest includes towns and communities, residential development, ski area and other recreation development, and telecommunication towers. While the management activities outlined previously and implemented within the Forest boundary (by the Forest Service or permittees) can usually be designed to achieve acceptable visual resource management standards and guidelines, their overall effect on the landscape can be influenced by management activities and development on these state and private lands. Management activities implemented in combination or within viewsheds that include landscapes where private development is a component of the view may make it more difficult to achieve desired visual standards and guidelines.

Alternative 1

Direct and Indirect Effects

Application of the Scenery Management System inventory process, and conversion from Visual Quality Objectives to Scenic Integrity Levels, will result in an allocation of Scenic Resource management objectives similar to what currently exist.

The general effects of Alternative 1 will exceed those that result from current management practices. This alternative provides for the highest level of output related to vegetation management activity. It also has the second highest total harvest acreage allocation and the highest expected for even-aged regeneration harvest. This mix suggests a higher opportunity for visible harvest activity, resulting in a higher level of change and impact on Scenic Resources compared to other alternatives.

Alternative 1 standards and guidelines will also allow for the potential of more intensive cutting within a given area or viewshed than the other alternatives. While other alternatives allow for 3 percent of a viewshed to be in the 0-10 year age class, Alternative 1 will allow for 6 percent. Based on Forest research, this intensity of cutting over time will exceed assigned Scenic Integrity Objectives. Openings and textural changes in the forest canopy will dominant the viewed landscape for some viewsheds.

Under Alternative 1, potential recreation facilities and site development could also result in more noticeable and visible effects associated with Scenic Resources. This alternative allows for the second highest potential increase in developed recreation campground and picnic sites. The potential construction of two or three 20 to 30 mile motorized trail systems, along with other recreation considerations, creates a situation where recreation activity can significantly affect Scenic Resources.

Cumulative Effects

Effects of vegetation management and recreation management activities as they increase in intensity of application, and in combination, over time have the potential to create greater impacts on the scenic resource. Opportunity for even greater effects can be influenced by the presence of other management activities such as those described as cumulative effects under Effects Common to all Alternatives.

Alternative 2

Direct and Indirect Effects

Alternative 2 will see a slightly higher acreage in Very High and High Scenic Integrity Objectives over Alternative 1, due to a higher amount of acreage allocated to the more sensitive and restrictive management areas.

While the total acreage allocated to vegetation management (MA 2.1) is similar to Alternative 1 (MAs 2.1 and 3.1), the total harvest acreage for decades 1 and 2 is reduced by 22 percent. Regeneration acreage for the same period is reduced 38 percent. Total outputs for vegetation management activities are reduced by 31 percent (from 35 MMBF/yr to 24 MMBF/yr.

While Alternative 2 allows for some increase in new developed recreation sites and backcountry camping capacity, it does not allow for summer motorized trails, is more restrictive in other new trail development, and creates a management area for the Appalachian National Scenic Trail that will be assigned a Scenic Integrity Objective of High.

These factors combined, especially the significant reduction in harvest outputs and regeneration harvest acreage, result in overall effects favorable to maintaining a higher percentage of the Forest as natural-appearing and benefiting Scenic Resources than Alternative 1.

Cumulative Effects

Because direct and indirect effects are reduced compared to Alternative 2, the combination of effects from vegetation and recreation management activities over time would be less. The potential for off-Forest activities to exacerbate impacts to scenery remain would be the same as for Alternative 1, but the cumulative effect would be less due to reduce impacts on-Forest.

Alternative 3

Direct and Indirect Effects

Alternative 3 will see a substantial increase in Scenic Integrity Levels that are Very High, primarily due to the number of acres allocated to Recommended Wilderness (MA 9.1). In general, there will also be an allocation to higher Scenic Integrity Objectives.

This alternative has slightly more total acres harvested than Alternative 2, but has the least amount of harvest acres in even-aged management for decades 1 and 2, and the lowest number of acres in even-aged regeneration harvest. It has the highest allocation to uneven-aged management. However, this could also be an indication of a higher intensity of group selection cutting

compared to the other alternatives, and it will be important to address distribution, size, and quantity of units in order to achieve Scenic Resource management objectives.

Planned outputs are the lowest of all alternatives. The reduced annual output, while still maintaining annual harvest acreage similar to Alternative 2, indicates a more widespread distribution of harvest activity which should be favorable to maintaining a natural-appearing forest.

Recreation improvements outlined are minimal, and will result in little effect on Scenic Resources.

Cumulative Effects

This alternative will provide the greatest benefits of all four alternatives to achieving Scenic Resource management goals. Therefore cumulative effects from the combination of activities and off-Forest management would be less than for other alternatives.

Alternative 4

Direct and Indirect Effects

Effects related to distribution of Scenic Integrity Objectives will be similar to Alternative 2 because management area allocation is similar.

Effects related to vegetation management will be similar to Alternative 1, but will not have as high a potential for creating visible change in the landscape. Moderate reductions in annual harvest output, along with a greater use of uneven-aged over even-aged management, will benefit the viewed landscape. However, high use of group selection treatment could reduce the benefits of uneven–aged management.

Recreation facility and site improvement is the highest of all four alternatives. ATV use would be permitted through a pilot project which, though of smaller size than the potential use in Alternative 1, could have a substantial impact. Both activities would noticeably affect the Forest's Scenic Resource. Overall, Alternative 4 allows for noticeable visual change in the landscape.

Cumulative Effects

Cumulative effects would be similar to those outlined in Alternative 1, but slightly less because the impacts of vegetation management on the Forest would be somewhat lower.

Effects on Non-priced Benefits

The benefits of high quality scenery found on the White Mountain National Forest are numerous despite the fact that a dollar value is seldom assigned. "Research has shown that high quality scenery, especially that related to natural appearing forest, enhances people's lives and benefits society. Research findings support the logic that scenic quality and naturalness of the landscape directly enhance human well being, both physically and psychologically, and contribute to other important human benefits."

"Findings from psychological and physiological studies of people under stress, people recovering in hospitals, people in recreation settings, and people in other various settings, prove that natural landscape scenes have restorative and other beneficial properties. This is particularly important when contrasted with the built urban environments."

"In turn, when people feel better mentally and physically, they have increased on-the-job productivity, increased community involvement, and expanded family interaction."* All are important and contribute to improving the well-being of society in general.

These considerations can be identified with the White Mountain National Forest, especially when one considers the high population density in the Northeast United States (within a day's drive of 70 million people) and the proximity to major metropolitan areas that include Boston, New York City, and Montreal, Quebec. The Forest is recognized for its dramatic landscapes and high recreation use over a wide range of activities, that are partially dependent on these landscapes. The dramatic landscapes benefit a large percentage of the population in the northeast. The scenic attributes of the White Mountains are also central to the tourism industry important to the State of New Hampshire.

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* Landscape Aesthetics, A Handbook for Scenery Management . Agriculture Handbook Number 701. USDA Forest Service. Page 17.

A busy summer day at Lower Falls (WMNF photo by Terry Miller)

Geologic and Mineral Resources

Affected Environment

The bedrock of the White Mountains is mostly composed of igneous and metamorphic rocks, with numerous intrusions and contact zones between different rock types (McNab and Avers, 1994). From the Conway granite of the White Mountain batholith to the thick deposits of the Moat Mountain volcanic rocks, all overlain by glacial tills, this geology has resulted in diverse but limited mineral deposits in various locations on the White Mountain National Forest. Currently, these geologic resources include crystals, sand, gravel, and unique landscapes.

In the U.S. Geological Survey (USGS) Mineral Commodity Summaries, 2002 figures show that New Hampshire ranked 47th, and Maine ranked 43rd, in nonfuel mineral production in the United States. Together, both states account for less than one percent of the U.S. total nonfuel mineral production. New Hampshire's principal minerals, in order of value, are sand and gravel, crushed and dimension stone, and gemstones. Principal minerals in Maine are sand and gravel, Portland cement, crushed and dimension stone, and masonry cement. The 2002 Mineral Yearbook notes that most mineral exploration and collection in New Hampshire is done by amateur mineral collectors. Amethyst, apatite, beryl, epidote, fluorite, garnet, smoky and clear quartz, and topaz were the most common minerals collected. On the National Forest, amethyst and smoky quartz have notable occurrences.

Early studies did not consider mineral resources on the Forest to be of any economic importance, given the costs and methods of mineral extraction and processing. In 1976, Forest resources were classified as of medium to medium-low importance on a nationwide scale (Hoag, 1976). A 1984 USGS report determined that the Forest ranks low in mineral potential except for tin (Moench et al., 1984), and used geochemical survey data from 1980 to 1982 to identify a 300 square mile geologic area (192,000 acres) with probable resource potential for tin. This area extends across most of the Sandwich Range, Pemigewasset, and Presidential Range-Dry River Wildernesses, and is associated with the Conway granite. The USGS report stated that the geologic terrain is not favorable for the occurrence of organic fuels, such as oil, coal, or gas. These, plus oil shale, would be of particular interest for their energy-producing potential, but do not occur anywhere on the White Mountain National Forest (Moench et al., 1984).

The 1995 energy resource assessment mentions that the New England Province does not produce oil or gas, and is not currently viewed as prospective for them. Nor is New Hampshire listed in the uranium resource assessment (USGS, 2003) as a current or future source. Overall, there are no viable energy related mineral resources on the Forest.

Analysis Area

The affected area for mineral resources is the entire White Mountain National Forest, because minerals occur throughout. Minerals on the Forest are managed differently depending on management area and type of mineral

resource. For example, Wildernesses were withdrawn from leasable mineral activity when designated by Congress. However, most management areas are currently open to various types of mineral activity. Gravel pits, a source of mineral materials, occur throughout the Forest, mostly to provide material for Forest projects. Recreational mineral collecting also spans the Forest landscape. Activities include panning for gold on the Wild Ammonoosuc River, collecting smoky quartz in the Moat Mountain area, and digging purple amethyst at Deer Hill.

Mineral resources are finite, and removal from the Forest is permanent.

Mineral Resources

Mineral resources on the Forest are grouped into four categories, according to the legal authorities regulating their use: 1) reserved or outstanding mineral rights, 2) leasable minerals, 3) mineral materials, which include common mineral varieties such as sand and gravel, and 4) recreational minerals.

Reserved and Outstanding Mineral Rights

There are reserved or outstanding mineral rights (rights retained all or in part by the seller or a third party when the lands became part of the White Mountain National Forest) on about 10,000 acres, most of which are located in the southwest corner of the Forest, except for two tracts of about 180 acres near Jackson, New Hampshire. There are no reserved or outstanding mineral rights in existing Wilderness. Management Area (MA) 6.1 contains 89 percent of the acres reserved or outstanding, almost 10 percent is in MA 3.1, 1 percent in 2.1, and minor amounts in MA 6.3 and the Appalachian National Scenic Trail (MA 8.1 in Alternative 1). At present, there is no mining activity or proposed activity on any of these lands.

Leasable (Commercial) Minerals

The Mineral Leasing Act of Acquired Lands (1947) extended the provisions of mineral leasing laws to Federally owned mineral deposits on acquired National Forest System lands. This includes the traditional leasable minerals, such as coal, oil, and gas, as well as "hard rock minerals," minerals associated with igneous and metamorphic rocks. Since most of the lands for the White Mountain National Forest were acquired by purchase, the mineral resources on the Forest are managed as leasable minerals. Development and removal (also known as disposal) of these minerals is regulated under 43 CFR 3500 – 3599 and FSM 2820.

Prospecting and Exploration: Prospecting is the gathering of evidence of mineral or energy resources through indirect methods, including, but not limited to, conducting geophysical or geochemical surveys, sampling outcrops, and geologic mapping. These activities can result in the delineation of an area in which exploration would follow. Exploration uses direct data collection methods to obtain further evidence of the size and grade of mineral resources. Direct data gathering techniques may include drilling holes, digging pits, and driving adits and drifts to sample, or test, a suspected zone of interest.

Both prospecting and exploration are allowed across the National Forest to determine the location and mineral potential of these lands. In Wilderness, and the Wildcat Wild and Scenic River corridor, these activities must not cause surface disturbance or otherwise affect Wilderness character.

More than twenty prospecting permits, on over 70 different tracts, have been filed with the Forest Service. Based on the current database, over half are located in MAs 2.1 or 3.1. Less than 20 percent are for metals, such as copper, zinc, lead, silver, and gold. The rest are to search for thorium, uranium or any associated fissionable source material. However, there has been no prospecting activity related to these permits, with no active leasable mining permits currently on the Forest.

Production and Development: If mineral resources are found that are economical to extract, then production and development activities could be proposed. A mineral lease is the process used to authorize this activity on the Forest's acquired lands. Table 3-89 lists the current management area direction for production and development of leasable minerals on the Forest.

Table 3-89. Current Management Area Direction for Extraction of Leasable Minerals.

Leasing Management	Management Areas
Leasing on case by case basis	2.1, 2.1a, 3.1, 6.1, 6.2, 6.3, 8.1, 9.2, 9.4
Withdrawn	5.1, 7.1
Restrictions	9.3

Figure 3-40 shows the relative percentage of the forest with different types of mineral management for leasable minerals. Almost 84 percent of the Forest is open to production and development activities through leasing, on a case-by-case basis, pending site specific analysis and NEPA. Fifteen percent has been withdrawn in Wilderness and ski areas. Mineral rights under 1.3 percent of the Forest are owned privately. Less than 1 percent is open with restrictions.

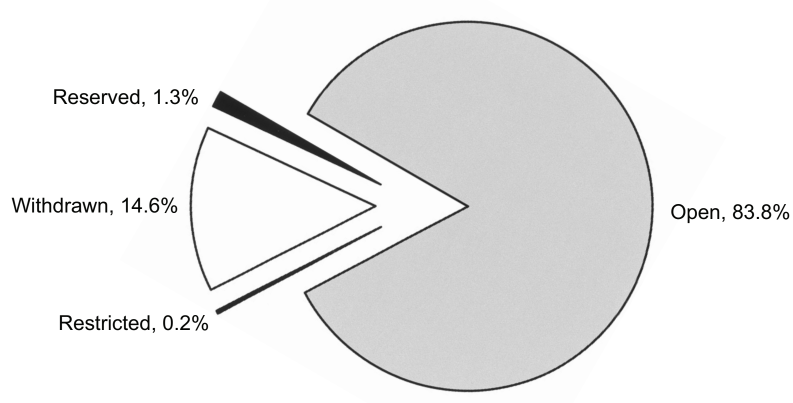


Figure 3-40. Percent of Forest by Management Area Direction for Production and Development of Leasable Minerals.

Mineral Materials (Common Variety)

Mineral materials include the common varieties of sand, gravel, stone, and similar materials. 36 CFR 228 subpart C and FSM 2820 provide direction for management of this resource. A Forest inventory of gravel pits identified about 30 sites of varying character, most of which were either not in use or closed. Sand and gravel deposits in New Hampshire generally are associated with stratified drift deposits from the glacial age, and these are usually found in stream valleys and lowlands. Since most of the Forest is higher elevation, these types of deposits are localized and more limited than off-Forest sites. Construction sand and gravel was New Hampshire's leading nonfuel mineral commodity in 2002, and accounts for 68 percent of its nonfuel mineral production value (USGS, 2002). The numerous sand and gravel operations outside the Forest contribute to these production figures.

As with leasable minerals, removal of mineral materials is not allowed in Wilderness, and is restricted in MAs 7.1 and 9.3. Current management standards and guidelines direct that these resources will be disposed of to others only to the extent that they are not needed by the Forest Service for on-Forest use, and they have been used primarily for Forest projects, with some use by other government agencies. Between 1986 and 1992, twelve sand and gravel permits were processed. In addition, there is a small area on the Androscoggin Ranger District where rights to mineral materials have been reserved through 2016. The Forest's 1996 Annual Monitoring report noted that sand and gravel removal has been effectively managed under Plan guidelines and site specific permitting.

Recreational Rock and Mineral Collecting

Recreational mineral collecting, often referred to as "rock hounding" or "hobby" collecting, is a recreational, rather than commercial, activity. However, it is discussed here since it is a mineral resource, and FSM 2860 provides direction for its management. Currently, recreational mineral collecting is a popular activity on the Forest, and takes several different forms. Gold panning is popular on the west side; smoky quartz collecting from bedrock is prevalent in the area just west of Conway, in the Moat Mountain Range; and purple amethyst is collected in Maine, on Deer Hill, by digging into glacial till.

Current direction for recreational mineral collecting states that, except within the Congressionally-designated Moat Mountain Smoky Quartz Area and such other areas as may be designated in the future, the collection of mineral specimens for personal use shall be allowed. Surface-disturbing activities are not allowed in Wilderness. Fee collection sites and closures are two methods the Forest uses to manage this activity, and there are standards and guidelines that assist in mitigating impacts to water resources, developed recreational areas, and other conflicting resource values. Despite these standards and guidelines, recreational mineral collecting has resulted

in resource damage in several areas, as described in Forest monitoring reports. Forest managers have found that this activity is difficult to monitor without permitting. Furthermore, unlimited and illegal collecting is impacting opportunities for recreational collectors and scientific discovery.

One site at the Deer Hill collecting area is currently managed as a fee collection site. With its remarkable purple amethyst crystals, the site has had steadily increasing use since it opened, as shown in the number of permits sold since 2001 (Figure 3-41). Some violations still occur, such as digging outside the open areas, not following the prescribed practices, and failing to get a permit. Increased monitoring has assisted greatly in reducing this illegal activity. (Figure 3-42)

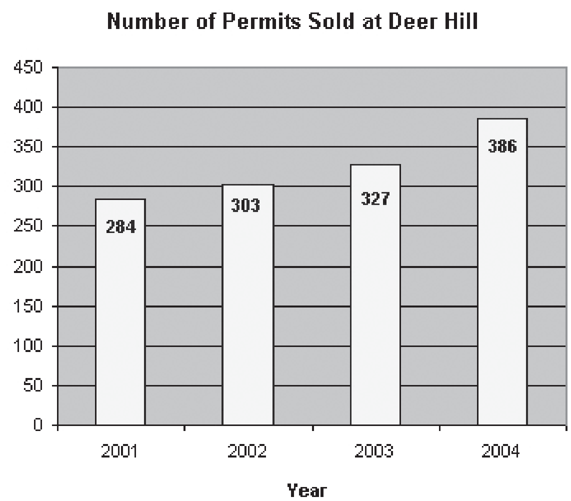


Figure 3-41. Number of Permits Sold at Deer Hill (2001-2003).

Figure 3-42. Minerals Technician Elaine Swett watches young people digging for amethyst at the Deer Hill Permit Area (WMNF photo)

The Moat Mountain Smoky Quartz area was designated to be made available "to mineral collectors at a reasonable fee and under terms and conditions necessary for the conservation of natural resources, multiple use of NFS lands, equitable distribution of recreation privileges, and public safety." This site is managed as a free use site and currently does not require permits. However, monitoring shows resource impacts are occurring, caused largely by users who don't restore sites, who dig unsafely, and who illegally remove public resources from the Forest.

Another method used to manage recreational mineral collecting sites is closure. Pine Hill is a site with remarkable smoky quartz crystals. After allowing limited collection, the site was filled in, restored, and closed in order to protect the resource and address safety concerns.

Abandoned Mine Lands

The Forest has no active leased mines. An area that saw limited production in the past is located at the extreme southwestern corner of the Forest, on the edge of the Grafton pegmatite district. Another is the Rumford-Paris pegmatite area to the east of the Forest. Another site is Ore Hill, an old mine located in a strata-bound zinc-lead massive sulfide deposit in the Ammonoosuc Volcanics. Developed through a series of included shafts, and first opened as a copper mine in the 1840s, mineral activity continued on and off through 1915, when the mine closed. Minerals extracted included zinc, copper, and lead, with some silver as a by-product. It is not known how much ore was extracted, but one estimate referenced in Secord and Brown (1986) suggested 50,000 to 100,000 tons. The Forest Service acquired a portion of Ore Hill mine in 1937, and in 1979, the National Park Service acquired the remainder of the site. The Forest administers the entire site under a 1993 Memorandum of Understanding with the Park Service, in order to protect the Appalachian Trail.

The seven-acre Ore Hill mine site, including waste piles and remnants of foundations and equipment, has been identified as the source of water quality concerns in Ore Hill Brook. Several reclamation projects have been undertaken. A 1962 attempt to restore the site by planting red pine was unsuccessful. Subsequently, tailings piles were recontoured and revegetated, and Ore Hill Brook was relocated around them in 1984. In the late 1990s, additional monitoring indicated water in the area remained polluted with high concentrations of zinc, aluminum, copper, and manganese. Assessment at the site continued until 2000, when the process listing it as a CERCLA site was completed. Currently, site characterization is complete, and cleanup activities have been planned to ensure that the historic mine tailings are appropriately stabilized and reclaimed.

Environmental Effects

Effects Common to All Alternatives

Direct and Indirect Effects

Reserved Minerals

Private mineral rights on National Forest lands would not be affected by any of the alternatives. Tracts with mineral rights reserved or outstanding are not located in any Recommended Wilderness. The exercise of these rights is subject to applicable federal and state laws and regulations. In addition, the specific terms of the deeds by which the surface and subsurface owners acquired their interest can also provide the basis for the Forest Service to administer these rights (FSM 2830.1). An operating plan must be submitted by the reserved or outstanding mineral owner, which includes a plan for restoration or reclamation of disturbed lands. Due to the low potential and poor economic feasibility of the reserved and outstanding mineral rights on the Forest, it is unlikely that any activity would occur during this next planning cycle.

Mineral Materials (Common Variety)

As described in the affected environment, there are only a few sand and gravel operations on the Forest, and these are mostly small pits used by Forest Service and local agencies for road construction and maintenance. Management area standards and guidelines direct where mineral materials can be developed and how sites will be reclaimed after use. The limited use and need for this resource, combined with an adequate off-Forest supply, means there is no difference to the amount of activity for this resource among the alternatives.

Leasable (Commercial) Minerals — Prospecting and Exploration

Prospecting and exploration are allowed on all National Forest lands, regardless of the management area and alternative selected. In some MAs, surface disturbing methods are not allowed. Additional restrictions occur in Wilderness, such prohibiting motorized and mechanical equipment. Some alternatives may have more of these restricted areas, since they allocate more land to Recommended Wilderness. However, this would affect only the methods that could be used, not the exploration and prospecting activities themselves.

Cumulative Effects

There is currently no reserved mineral activity and none is expected in the foreseeable future, therefore there would be no cumulative effects.

There is such a low level of removal of mineral materials within the Forest that no cumulative effects would occur.

While there are prospecting permits on file, no specific plans or activity have been indicated. Exploration or development proposals would be considered by the Forest the same as for any resource activity, requiring that they follow the NEPA process and standards and guidelines. Whether

or not any of these permits would become active over the planning cycle is not known, therefore no cumulative effects are anticipated.

Leasable (Commercial) Minerals — Development and Production (Extraction)

Alternative 1

Direct and Indirect Effects

Management areas can be available to leasing with standard stipulations; available with additional stipulations, such as no surface occupancy; or unavailable or withdrawn from development and production activities. The purpose, desired condition of the land, and associated standards and guidelines for management areas on the Forest determines the spectrum of uses allowed. Table 3-90 shows the management area direction regarding extraction activities.

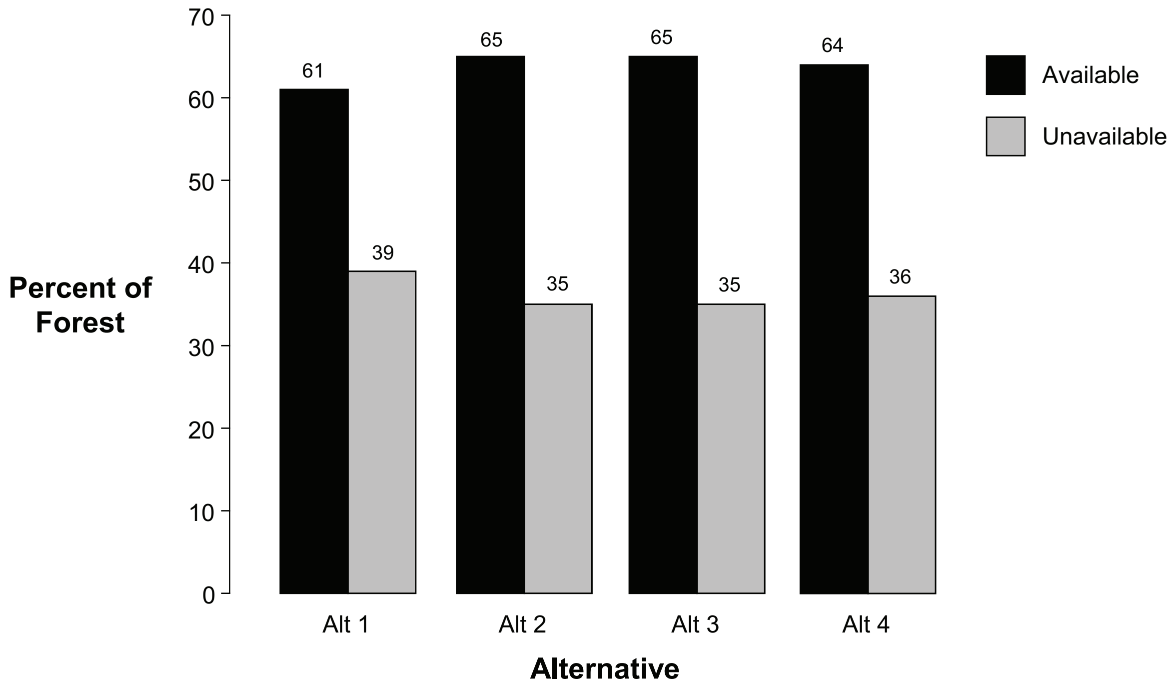
Table 3-90. Management Area Direction for Extraction of Leasable Minerals (all alternatives).

Management Area	Extraction Activities
2.1 General Forest Management 3.1 (Alternative 1 only)	Avalialble to leasing with standard stipulations
6.1 Semi-Primitive Non-motorized Recreation (Snowmobiles) 6.3 Semi-Primitive Motorized Recreation (Snowmobiles) 8.4 Research Natural Areas 8.5 Scenic Areas 9.1 Recommended Wilderness 9.2 Alpine Ski Area Expansion 9.3 Candidate Research Natural Areas	Available to leasing with additional stipulations.
5.1 Wilderness 7.1 Ski Areas 8.6 Wildcat Wild and Scenic River	Extraction activities are withdrawn via legislation.
6.2 Semi-Primitive Non-motorized Recreation 8.1 Alpine Zone 8.3 Appalachian Trail 8.2 Experimental Forests	Administratively unavailable

Figure 3-43 shows the percentage of lands available to leasing or unavailable by alternative. Available means lands that are open with appropriate stipulations; unavailable means withdrawn or administratively unavailable.

Land allocation for Alternative 1 affects the number of acres that are available for extraction, road building, and methods which can be used for extraction activities. In Alternative 1, 61 percent of total Forest lands are available for commercial mineral extraction activities. Currently, 85 percent of the Forest is available for mineral extraction.

Figure 3-43. Management Area Direction for Leasable Mineral Extraction by Alternative.

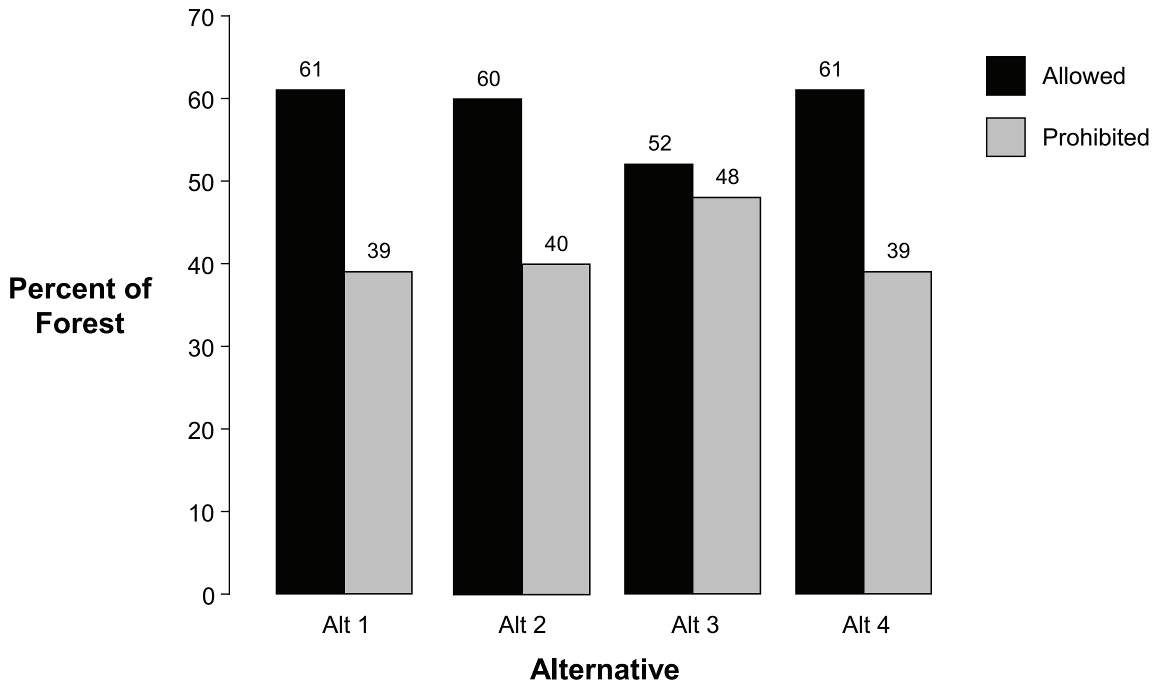


Roads are necessary for extraction of leasable minerals. In general, management areas that allow mineral leasing also allow road building. Table 3-91 summarizes management area direction for roads. As shown in Figure 3-44, road building for mining exploration and extraction purposes does not vary much by alternative.

Table 3-91. Management Area Direction for Roads Related to Mining Activity.

Management Area	Roads
2.1 General forest Management Area 3.1 (Alternative 1) 9.2 Alpine Ski Area Expansion 6.1 Semi primitive winter motorized 7.1 Ski Areas8.2 Experimental Areas 8.5 Scenic Areas	Allowed within S&Gs and other FS directions.
5.1 Wilderness 8.6 Wild and Scenic River 8.1 Alpine zone 6.2 Semi primitive non motorized 6.3 Semi primitive winter motorized 8.3 Appalachian Trail 8.4 Research Natural Areas 9.1 Recommended Wilderness 9.3 Candidate Research Natural Areas	Roads are prohibited.

Figure 3-44. Percent of Forest with Road Building Allowed by Alternative.



Under Alternative 1, 61 percent of total Forest land allows for some form of road building. This is the same as the current condition for roads.

Alternative 2

Direct and Indirect Effects

The effects under Alternative 2 are similar to Alternative 1, except that percentage of total Forest lands available to leasable mining is 65 percent. There are 34,500 acres of Recommended Wilderness in this alternative in the Wild River and Sandwich Range areas. If these are ultimately designated Wilderness by Congress, they would be withdrawn from leasable mineral entry.

The percentage of total Forest land where some form of road building is allowed is 60 percent under this alternative.

Alternative 3

Direct and Indirect Effects

The effects under Alternative 3 are similar to Alternative 2. The percentage of total Forest lands available to leasable mining under this alternative is also 65 percent. There are 97,800 acres of Recommended Wilderness in this alternative in the Wild River, Sandwich Range, Kilkenny, Dartmouth, and Pemigewassett areas. If these are ultimately designated Wilderness by Congress, they would be withdrawn from leasable mineral entry.

The percentage of total Forest land where some form of road building is allowed is 52 percent under this alternative.

Alternative 4

Direct and Indirect Effects

The effects under Alternative 4 are similar to Alternatives 2 and 3. The percentage of total Forest lands available to leasable mining under this alternative is also 64 percent. There are 18,000 acres of Recommended Wilderness in this alternative in the Wild River area. If this acres are ultimately designated Wilderness by Congress, they would be withdrawn from leasable mineral entry.

The percentage of total Forest land where some form of road building is allowed is 61 percent under this alternative.

All Alternatives

Cumulative Effects

One potential cumulative effect related to the leasable mineral activity is the removal of the geologic and mineral resources of interest from the Forest. Since mineral resources are limited, their removal results in less available resources and loss of opportunities. However, as discussed previously, the extractable rock and mineral resources within the White Mountain National Forest are not of high value nor particularly unique within the region. Because of this, the cumulative effects on the mineral and geologic resources is limited to the Forest lands. In addition, it is unlikely that mineral development or extraction activities would occur in the next 15 to 20 years. It is difficult to project demand for these resources beyond this time frame due to changing economic and social conditions. Because of this, the development and extraction of leasable minerals is not expected to result in noticeable loss of this resource on the Forest within the next 15-20 years.

Recreational Rock and Mineral Resources

Alternative 1

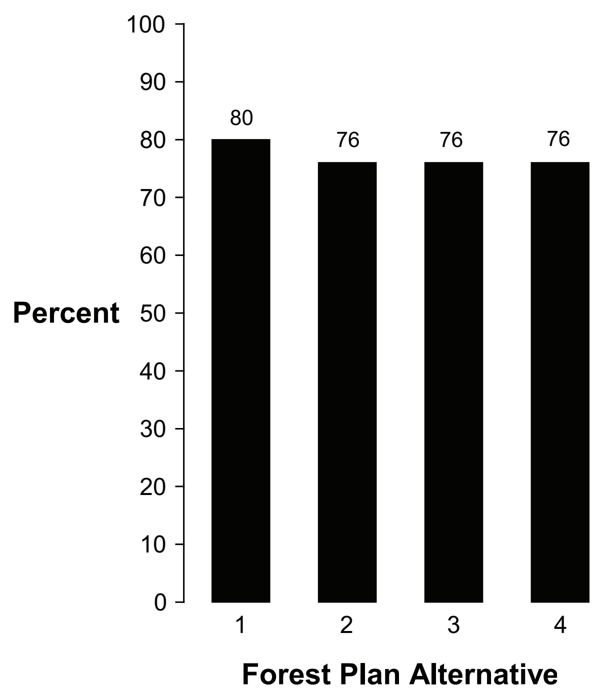
Direct and Indirect Effects

Recreational rock and mineral collecting is affected by the allocation of land to various management areas among the alternatives, and the standards and guidelines of those management areas, when surface disturbing activities are involved. Incidental collecting, which doesn't involve digging or other types of surface disturbance, will be allowed everywhere without a permit. Recreational mineral activities for personal use that involve limited surface disturbance are allowed by permit, provided that the activities comply with Forest standards and guidelines. The management areas where this activity is allowed are shown in Table 3-92. Figure 3-45 summarizes the percentage of the Forest available for this use by alternative. Additional areas may become managed with fee permits, but their location is not known at this time. The designated Moat Mountain Area is a possibility within the planning cycle.

Table 3-92. Management Direction for Recreational Mineral Collecting (all alternatives).

Management Area	Permit
2.1 General forest Management Area 3.1 (Alternative 1) 6.1 Semi primitive winter motorized 6.2 Semi primitive non motorized 6.3 Semi primitive winter motorized	Allowed
5.1 Wilderness 7.1 Ski Areas 8.1 Alpine zone 8.2 Experimental Areas 8.3 Appalachian Trail 8.4 Research Natural Areas 8.5 Scenic Areas 8.6 Wild and Scenic River 9.1 Recommended Wilderness 9.2 Alpine Ski Area Expansion 9.3 Candidate Research Natural Areas	Not allowed

Figure 3-45. Percent of Forest Open to Limited Surface Disturbing Recreational Mineral collecting with a permit.



Under Alternative 1, surface disturbing recreational collecting is prohibited without a permit. With a permit, 78 percent of total Forest lands would be available. Currently, 85 percent of total Forest lands is available for collecting activities without a permit.

Alternative 2

Direct and Indirect Effects

The same effects noted for Alternative 1 apply to Alternative 2, except that under Alternative 2, surface disturbing recreational collecting with a permit would be available on 71 percent of total Forest lands.

Alternative 3

Direct and Indirect Effects

The same effects noted for Alternative 1 apply to Alternative 3, except that under Alternative 3, surface disturbing recreational collecting with a permit would be available on 63 percent of total Forest lands, the smallest percentage of land of all the alternatives.

Alternative 4

Direct and Indirect Effects

The same effects noted for Alternative 1 apply to Alternative 4, except that under Alternative 4, surface disturbing recreational collecting with a permit would be available on 73 percent of total Forest lands.

All Alternatives

Cumulative Effects

Cumulative effects to recreational minerals on the Forest would be the removal of minerals and the loss of the resource to the Forest as a result. As with leasable minerals, the cumulative effects area is all Forest lands. Currently, crystals are being removed from numerous locations on the forest without any tracking or compensation to the public. This has affected prime sites and resources. Improved management of this resource will result in reduced illegal activity and better tracking of use. However, continued removal of this limited resource from the Forest will contribute to a steady decline in the quality and quantity over the planning cycle.

Effects on Non-priced Benefits

There are many reasons for protecting geologic resources, many of which cannot easily have an economic value assigned to them. Geologic resources include rocks and minerals of all types on the WMNF. Aside from the commercial value of rocks and mineral within the WMNF, these rocks and minerals do provide a non-priced benefit to recreational rock and mineral collectors. As described earlier in the EIS, recreational rock and mineral collecting sites are being impacted by destructive collecting practices

including activities for commercial gain rather than personal use. If this practice were allowed to continue, opportunities for rock and mineral collecting across the forest would be greatly diminished. As described in the Revised Plan, each alternative provides the same standards and guidelines to protect these resources and the enjoyment it provides for numerous people.

For the sixth year, Girl Scouts from around New England participated in an archaeological field school sponsored by the Swiftwater Council, Girl Scouts of the USA, and the White Mountain National Forest. The 2005 dig took place at the Smith House/Mead Base. (WMNF photo by Sarah Jordan)

Heritage Resources

Affected Environment

The analysis area for heritage is the entire White Mountain National Forest. To date, approximately nine percent of the land base has been surveyed for prospective heritage sites, with 1,119 sites recorded. Two sites have been listed on The National Register of Historic Places (NRHP), and 24 sites have been Determined Eligible for listing.

Heritage sites have been identified in all areas of the Forest. The land was used first by Native American peoples, beginning after the last glaciation some 10,000 years ago, then by Euro-Americans, from the early exploration and settlement of the late 17th and early 18th centuries to the present.

Native American Environmental History

Information on the ways prehistoric indigenous peoples used the White Mountain region is only just emerging. Though few archaeological investigations have occurred in the mountainous areas comprising the Forest, the existence of Paleo-Indian sites at the base of the northern slopes indicates that people were here at least 10,000 years ago.

Euro-American Environmental History

Euro-American exploration of the White Mountain region dates to the mid-1600s. The first recorded Euro-American ascent of Mt. Washington, by Darby Field and Indian guides, is reported to have occurred in 1642.

Settlement in the interior of what is now New Hampshire increased dramatically after the American Revolution. People began to establish farms and work the land, and in the early 19th century, farming, fishing, and lumbering were the chief sources of income in New Hampshire until they were gradually replaced by manufacturing.

Documentary research and oral history indicate that distinct periods of human occupation and land use in the White Mountains are represented by a variety of heritage site types, representing different historic contexts. Inventoried sites are represented in the following historical themes.

Exploration and Settlement

- Exploration of the mountains (1642-1800s)
- Settlement of the interior of New Hampshire (1642 -1900)

Industry

- Logging, lumbering, and saw mills (ca. late 1600s-present)
- Granite quarrying and stone cutting (1790s-1900)
- Mining (early 1800s-present)

- Mineral springs and bottling plants (1880-ca. 1916)
- Brick making (1800s)

Agriculture
- Mixed agriculture and the family farm (ca. 1800-1940s)
- Hill farms (ca. 1800 -1930s)
- Orchards and cider production (ca. 1800-present)
- Maple sugar and syrup production (ca. 1800-present)
- The sheep craze (1820-1870)

Recreation
- Recreation trail development (1819-present)
- Dispersed recreation (1819-present)
- Developed recreation (1819-present)
- Summer resorts/grand hotel tourism (1840-1940)
- Boarding house tourism (1875-1920)
- Summer home tourism (1880 -present)
- Winter recreation and the ski industry (1890-present)

Transportation
- Footpaths (pre 1600-present)
- Bridle paths (ca. 1830s-1900)
- River navigation (1790-1890)
- Carriage roads (1775-1900)
- Railroads (1842-1960)
- Auto roads and highways (1900-present)

Utilities
- Water supply and distribution (1850-present)

Government
- USFS land management and administrative sites (1911-present)

Environmental Effects

Effects Common to All Alternatives

Unlike other resources, such as vegetation or wildlife, heritage resources are not renewable. Damage or disturbance is generally permanent. Although repairs may be possible in some cases, the historic nature and historic value of the resource is generally compromised once it has been disturbed. Under all alternatives, the Heritage Program will provide support to all of the resource projects, as required by Sections 106 and 110 of The National Historic Preservation Act (NHPA). This includes the identification and

evaluation of appropriate sites for The National Register of Historic Places (NRHP). Opportunities for interpretation of historic resources will be explored.

Non-project related site inventory and site evaluation will occur in all alternatives, since this will provide the data base needed for land managers to develop good management approaches which adequately address heritage values. Project supportive site inventory, evaluations, and monitoring will occur in all alternatives. Site monitoring will occur for potential project impacts as well as for other concerns, such as erosion and vandalism.

Direct and Indirect Effects

Facilities Maintenance Effects — The maintenance, reconstruction, remodeling, and removal of facilities considered historic in nature (Listed or Determined Eligible for listing on the NRHP or on a state register of historic places) are direct effects to the property. In all alternatives, these activities will be conducted in accordance with the Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings, and will comply with the NHPA.

Fire Protection Effects — Wildland fire poses a direct threat to historic structures and surface features. These include total and partial consumption, intense heating, and alteration of artifact materials from heat. It poses an indirect threat to buried artifacts and site features due to heat intensity. The suppression of wildland fires has the potential to affect heritage properties if control activities directly disturb those properties. In all alternatives, activities that reduce fuel loads, such as prescribed burns and salvage sales, are projects that require mitigation measures to comply with the NHPA.

Wildlife and Fisheries Effects — Effects from wildlife and fish habitat management activities are generally limited to the project level. These projects include, but are not limited to, prescribed burns, revegetation, and stream fish structures. Effects that might occur to heritage properties, such as heavy equipment disturbance or water diversion toward a known resource, would be mitigated in accordance with the NHPA for all alternatives.

Land Exchanges Effects — Exchange of federal land for private land has the potential to affect heritage resources, because the legal protection for heritage properties ends once the land ownership becomes private. In all alternatives, this direct effect must be mitigated in accordance with the NHPA before a land exchange takes place. Land that is acquired by the federal government is protected by all laws that normally apply to federally-maintained lands, and such property should be inventoried for heritage resources and managed appropriately. Long-term heritage management needs and responsibilities may affect the conditions of a purchase, and should be considered when determining fair market value.

Effects from Easements and Utility Corridors — The construction activities for utility development, and the establishment of various types of easements, have the potential to both directly and indirectly affect heritage resources.

In all alternatives, these direct and indirect effects will be mitigated in accordance with the NHPA. One indirect effect is the potential for vandalism of a site or theft of artifacts during the execution of projects. Another indirect effect is making public access available to previously inaccessible areas.

Effects from Recreation — The construction of recreation facilities, such as campgrounds, trails, roads, toilets, and parking areas, has the potential to directly affect heritage resources. Under all alternatives, these direct effects will be mitigated before construction begins. Both positive and negative effects can indirectly result from recreation management. Negative impacts include vandalism of sites and theft of artifacts, inadvertent camping directly on sites, and soil erosion. A positive effect is public education about heritage resources.

The effect of organized recreation through the outfitter/guide program also can be both positive and negative. If outfitter/guides are educated regarding heritage resource protection laws and regulations, they will be able to assist the Forest in its heritage resource management responsibilities.

Effects from Wilderness Management — If the management of Wilderness requires the removal of buildings or other features that are historic in nature, this direct effect would be mitigated prior to their removal. Heritage surveys in Wilderness will provide the data required to make informed management decisions regarding heritage sites and landscapes. Cultural resource surveys, inventories, excavations, and monitoring will ensure that direct and indirect effects to heritage resources are addressed appropriately.

Timber Management Effects — Timber management activities, such as skidding logs or developing skid trails, have the potential to directly affect heritage resources, but these would be mitigated prior to beginning project activities. Indirect effects might occur through providing better access to sites due to road construction, and opening up an area to make the site more visible. Mitigation measures in such instances would be developed.

Mineral and Energy Development Effects — The use of heavy machinery in the construction and access to energy and mineral extraction areas, as well as the actual extraction activities, are direct effects that would be mitigated in accordance with the NHPA. Mining history studies will help determine the antiquity of mining actions in the states of New Hampshire and Maine, and will help guide mitigation measures for minerals proposals. Indirect effects of both development and cleanup work include the potential for vandalism of a site, or artifact theft, due to improved public access.

Cumulative Effects

As site impacts increase over time on private land in New England, the overall documentation and management of cultural sites and landscapes on public land will become increasingly important. Efforts to inventory and evaluate the variety of cultural sites will lead to a better understanding of the Forest's environmental history, and will more effectively guide future management decisions.

Over time, the effectiveness of cultural resource mitigation measures would be monitored, and the best measures would be evaluated and expanded upon.

Heritage resources are a non-renewable and a constantly changing resource. This inevitable change results from both natural and human actions. Federal and state legislation exists to provide for the inventory, documentation, evaluation, monitoring, and effective management of the variety of cultural resources and landscapes on federally-managed lands.

There is a slightly increased risk over time for heritage resource damage or loss at areas of higher recreation use. Inventories and mitigation measures will limit the chance for damage or loss.

Effects on Non-priced Benefits

Knowledge gained from studying the cultural sites and landscapes within the National Forest provides factual information about how the land has reacted to all past disturbances, human and non-human. These facts can provide Forest managers with the historical perspective to make defensible land management decisions at present and in the future.

Environmental history of Forest-managed lands and studies of land use history can be supportive of state historic preservation plans and state tourism initiatives.

The historic Fabyan Cabin, a Forest Guard station constructed ca. 1923 of native spruce logs, is still standing. (WMNF photo by Mort Gellman)

WMNF Forest Supervisor Tom Wagner at the 2005 dedication of Gateway Information Center in Lincoln, NH. Part of the White Mountain Attractions facility,the center features interpretive displays and was constructed with the aid of many Forest partners. (WMNF photo)

Social and Economic

Introduction

This section describes the Forest's social and economic environment and the potential social and economic effects of implementing the four Plan revision alternatives. Most of the material used in this section is taken either directly or indirectly from "A Socio-Economic Assessment to Provide a Context for the White Mountain National Forest Plan Revision" (High et al., 2004), referred to as the Socio-Economic Assessment in this section. Another report titled "Economic Impact Evaluation of the White Mountain National Forest Plan Alternatives," also prepared by Resource Systems Group, Inc., 8 March 2004, was also used. These reports were prepared under contract with the US Forest Service expressly to provide the research and analysis necessary for this section of the Environmental Impact Statement.

Legal Framework

The following is a list of important legal and administrative policy areas to be considered when describing social and economic effects of management actions on local communities.

- The **Twenty-Five Percent Fund Act (1908)** requires the Secretary of the Treasury to allocate 25 percent of all fiscal year National Forest receipts to the state (or territory) in which the National Forest is situated. The distributed funds are to be expended as the state or territory legislature may prescribe for the public schools or public roads of the county or counties in which the National Forest is located.
- The **National Environmental Policy Act of 1969 (NEPA)** requires that consequences to the human environment be analyzed and disclosed. The extent to which these environmental factors are analyzed and discussed is related to the nature of public comments received during the public involvement process, from scoping through the preparation of the Final Environmental Impact Statement (FEIS).
- The **Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974** as amended by the **National Forest Management Act (NFMA) of 1976** requires that renewable resource programs be based on a comprehensive assessment of present and anticipated uses. The demand for, and supply of, renewable resources must be determined through an analysis of environmental and economic impacts. Local community impacts, as well as economic cost-efficiency considerations, must be considered when revising a Forest Plan.
- The **Payments in Lieu of Taxes Act (1976)** authorizes compensation to counties in lieu of property taxes that cannot be levied against federal lands within the counties' jurisdiction.
- **Executive Order 12898** requires that planning alternatives be assessed for environmental justice concerns, determining whether or not any of the alternatives disproportionately affect minority and low-income populations.

- The **Secure Rural Schools and Community Self-Determination Act** of 2000 specifies how states and counties will be compensated for impacts associated with visitors to National Forest System lands.

Analysis Area

From a social and economic perspective, the Forest can be evaluated at three geographic levels (Figure 3-46): the Directly Affected Towns, the Forest Region, and the Wider Region. The 53 Directly Affected Towns include 43 towns and 17 unincorporated minor civil divisions that generally have Forest land and activities taking place within their boundaries and that are closely tied to the Forest with businesses or workers engaged in Forest-related activities. The Forest Region is defined by the geographic boundaries of Coos, Carroll, and Grafton Counties in New Hampshire, and Oxford County in Maine. The Forest boundary lies within the four counties, and this region provides a useful delineation for much of the economic analysis, since a great deal of economic data are only available at the county level. The Wider Region includes the four states of Maine, New Hampshire, Vermont, and Massachusetts, which collectively account for the majority of users and visitors to the Forest. The Wider Region is useful when looking at several statewide studies that provide a context for the social components of the Forest Region. These three areas are consistent with the areas defined in the Socio-Economic Assessment, and are explained in greater detail within this effects assessment.

Social

Affected Environment

The social landscape of the White Mountain National Forest is one of a highly visited and treasured outdoor recreation destination that also serves as a working forest, providing goods and services to the public. The history of the Forest is rooted in citizen action that passed the Weeks Act in 1911, giving Congress the ability to purchase lands that became the National Forest in 1918. This grassroots citizen effort was prompted by widespread logging across New England in the late 1800s that raised concerns for the protection of forest lands and navigable water. Recreation use in the White Mountains grew rapidly as the land recovered through the 20th century. People came to the National Forest to backpack, fish, hunt, climb, view wildlife, ski, hike, camp, and engage in motorized recreation.

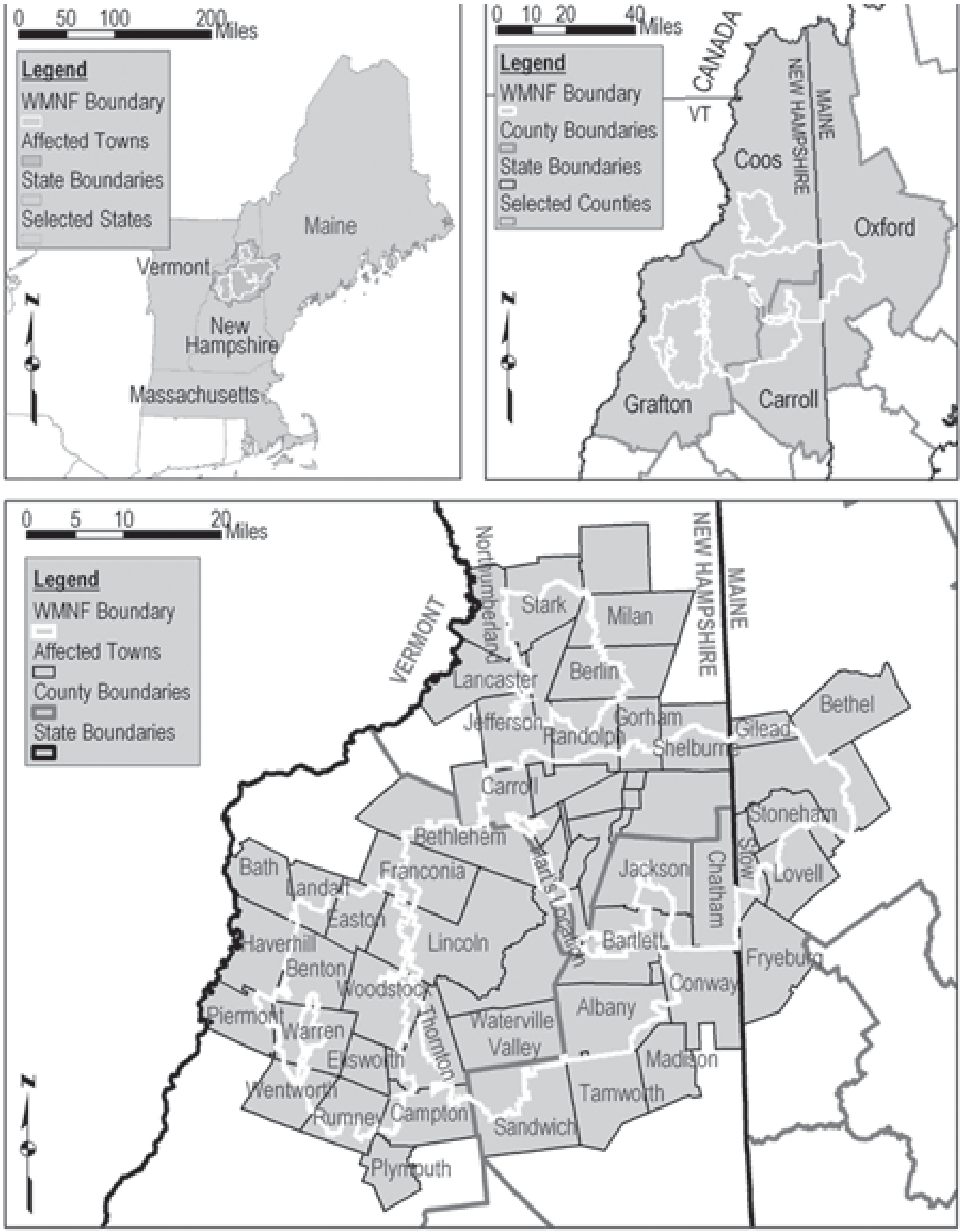
Today, the White Mountain National Forest is the largest holding of public land in New Hampshire, and represents a small but unique share of Maine's public land.

The Affected Social Region

As mentioned above, the Forest's social analysis area focuses on three geographic levels: Directly Affected Towns, the Forest Region, and the Wider Region.

The Affected Towns receive the greatest tangible impact from the presence of the Forest and the management decisions made by the Forest Service.

Figure 3- 46. The three geographic levels of study. Clockwise from left: the Wider Region, the Forest Region, and the Directly Affected Towns.



Data Sources: U.S. Census Bureau; U.S. Forest Service, White Mountain National Forest

They are directly affected in some or all of the following ways:

1) Having Forest land and activities taking place within their boundaries.
2) Being on direct access routes for visitors, Forest workers, and contractors;
3) Having local land use and property values directly impacted by Forest management decisions;
4) Providing municipal services, including road maintenance and emergency services, that support Forest activities;
5) Having businesses and workers engaged in Forest related activities; and
6) Having significant numbers of residents in whose lives the Forest plays an important role in tangible and intangible ways.

Looking beyond the Affected Towns, the Forest Region, and the Wider Region, the White Mountain National Forest provides natural resources and recreation opportunities for a large area of the Northeastern United States and Eastern Canada. Over 46 million Americans and 12 million Canadians live within 400 miles of the Forest, and about 70 million people are within a day's drive of the White Mountains (Figure 3-47).

Population

The total population of the Affected Towns was about 76,600 in 2000. The 53 Affected Towns in New Hampshire, and the 7 Affected Towns in Maine comprise 5.6 percent and 0.6 percent of the total population in each state, respectively, but over 35 percent of the population of the Forest Region.

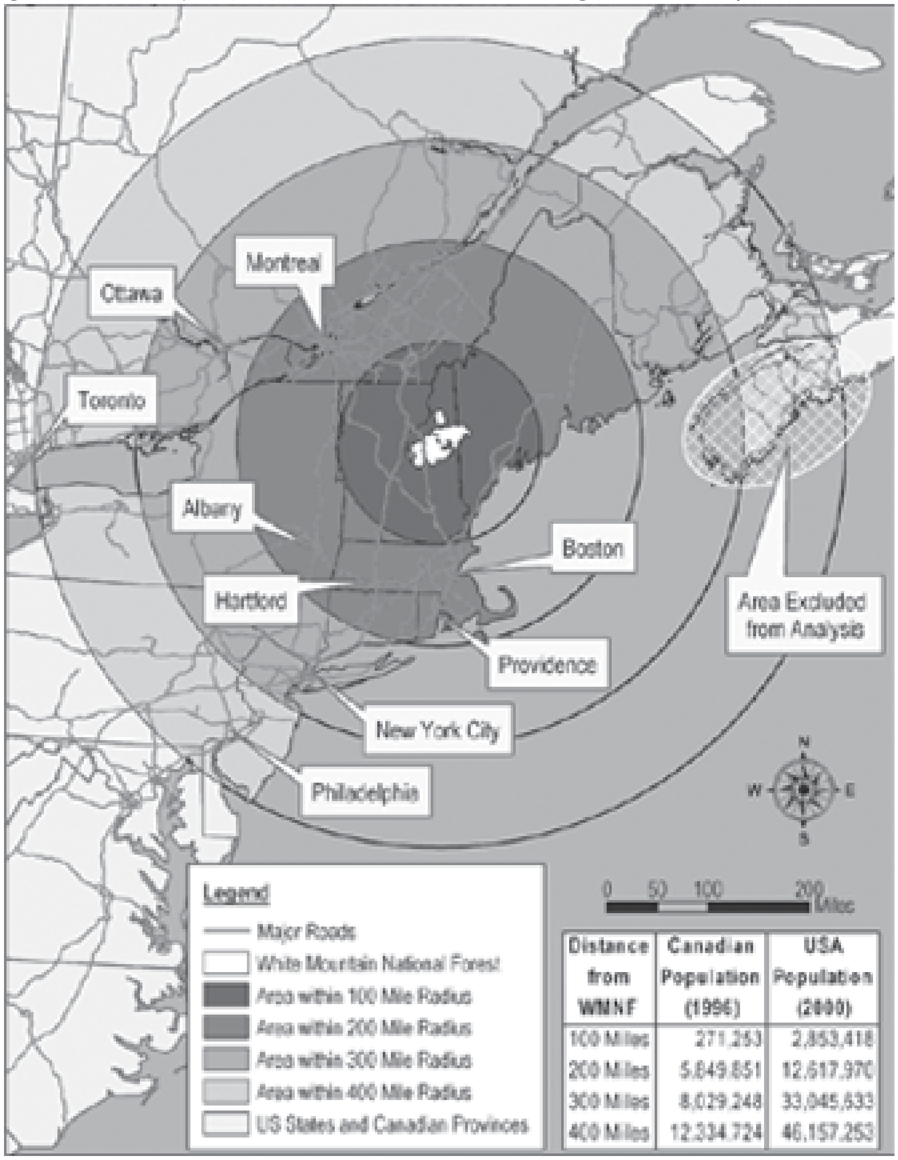
Population Change in the Forest Region

The population of Carroll County, which declined steadily due to the loss of agricultural employment after the West was opened in the middle of the 19th century, rebounded in the 1960s and has since grown rapidly, spurred by economic development, migration to the southern part of New Hampshire, and easier travel to Boston. In the last ten years, Carroll County has grown by twenty-three percent, more than double the average growth rate in New Hampshire. Grafton County, with a static population from the mid 19th century until World War II, has grown dramatically as a result of sustained economic development in the Upper Connecticut River Valley along the corridors of Interstates 91 and 89. Grafton County's ten-year growth rate of nine percent is almost as high as the state average of eleven percent.

Coos County, which grew steadily until World War II, has lost population slowly in most years since that time. In the last ten years it has lost 5 percent of its population, making it the only county in New Hampshire to lose population during the period. Coos County has not benefited from economic development or interstate access to the same degree as Grafton and Carroll Counties.

Population growth in Oxford County in Maine did not increase much until the 1970s, after which it grew, but at a slower pace than Carroll and Grafton

Figure 3-47. Population within various driving distances of the WMNF.



Distance from WMNF	Canadian Population (1996)	USA Population (2000)
100 Miles	271,253	2,853,418
200 Miles	5,849,851	12,617,970
300 Miles	8,029,248	33,045,633
400 Miles	12,334,724	46,157,253

Source: U.S. Bureau of Census, Statistics Canada

Counties. In the years prior to 2000, its growth rate was 4 percent, which is average for all of Maine.

Population Change in the Affected Towns

The overall population growth rate of the Affected Towns has followed the general upward trend for the four-county Forest Region, but in the most recent decade, growth has slowed to 3 percent, below both the New Hampshire and Maine averages. The majority of the towns in Grafton and Carroll Counties have grown in the last ten years, while the majority of towns in Coos and Oxford Counties have not. There is a strong divide north and south of the Notches (Franconia, Crawford, and Pinkham), with towns to the north in Coos County and to the northeast in Oxford having negative or slow growth. There are a few towns whose growth exceeded 25 percent

in the last census decade: Waterville Valley (associated with ski area development), Wentworth, and Carroll.

Projections for future growth are based on models using existing trends, and are less certain. Carroll and Grafton Counties will likely continue to grow relatively rapidly, while Oxford will likely continue its slow growth and Coos will likely continue to lose population.

Migration

Net migration in counties is an important indicator of social and economic conditions. People migrate to counties with strong economies and job opportunities. The two faster growing counties, Carroll and Grafton, have a steady history of net in-migration over a thirty year period. Carroll had no year in which it lost population during that time. Coos County, on the other hand, has lost population in about half the years over that same period. Oxford County has gained population in most years, but its population has not grown as strongly as Grafton or Carroll. Even within the two strongly growing counties, there is evidence of a cyclic pattern, with low or negative net migration for the four counties at the beginning of the 1980s and 1990s.

Population Densities

The Affected Towns and the Forest Region are part of a rural area with relatively low population densities. Within the area, there are notable differences between the almost uninhabited and unincorporated areas at the center of the White Mountain Range and the more populous commercial and industrial towns in the Forest Region. Conway, Berlin, and Plymouth all have densities above 120 people per square mile. The overall density of the Affected Towns is 29 people per square mile, compared with 136 people per square mile in New Hampshire and 40 per square mile in Maine. The much higher population densities of Grafton and Carroll Counties in the southern part of the region reflect the north-south population gradient that characterizes New Hampshire.

Demographic Characteristics

Age and Gender

The age and gender distribution of the Affected Towns, the Forest Region and the Wider Region are similar, reflecting the common characteristics of the communities of this demographically homogenous region. The “baby boom” generation, now in their forties and fifties, is the largest population throughout the area, followed by the “shadow boom” — offspring in their teens and early twenties. The percentage of women in all age classes over 50 is slightly higher.

Population Over 65

The percentage of the population over 65 is a useful measure of the social character of a community because it can indicate likely shifts in activities and needs for additional support systems. Twenty of the Affected Towns have more than 16 percent of their populations over the age of 65. Twelve percent of New Hampshire’s population is over 65, as are 13 percent of

Grafton County's and 19 percent of Coos County's. The age shift in the next ten years, when the baby boom generation begins to retire, will likely affect the demand for recreation, housing, and social services.

Racial and Ethnic Composition

The Forest Region are overwhelmingly comprised of a white population. Minority populations make up less than 2 percent in Carroll, Coos, and Oxford Counties. Grafton County's minority population of more than 4 percent is due in part to Dartmouth College and its teaching hospital, which attracts a more diverse population, including many international students and staff. Table 3-93 contains data for racial and ethnic composition in the Forest Region.

Table 3-93. Racial/Ethnic Composition in the Forest Region in 2000 in Percent (Actual).

State	New Hampshire			Maine
County	**Carroll**	**Coos**	**Grafton**	**Oxford**
White	98.2% (42,890)	98.1% (32,466)	95.8% (778,276)	98.3% (53,797)
Black	0.2% (73)	0.1% (40)	0.5% (435)	0.2% (95)
American Indian, Alaskan, or Aleut	0.3% (122)	0.3% (93)	0.3% (255)	0.3% (151)
Asian	0.4% (167)	0.4% (123)	1.7% (1,414)	0.4% (201)
Pacific Islander	0% (4)	0% (5)	0% (22)	0% (12)
Two Races	0.8% (335)	1% (331)	1.3% (1,026)	0.8% (440)
Other	0.2% (75)	0.2% (53)	0.4% (315)	0.1% (59)
Hispanic	0.5% (209)	0.6% (201)	1.1% (914)	0.5% (292)

Source: US Census

Low Income

The percentage of the population below the federal poverty line is a measure of the level of economic distress within a community. In the Affected Towns, this is 10 percent, close to the statewide average in Maine, Vermont, and Massachusetts, but well above the New Hampshire average of 6.5 percent. Coos County, at 10 percent, and Oxford at 12 percent, contrast with Carroll and Grafton Counties, which average 8 percent and 9 percent, respectively. This statistic is another reflection of the north-south gradient in economic well-being that characterizes New Hampshire. Among the Affected Towns, poverty is more prevalent in some of the larger towns, such as the mill towns of Berlin and Northumberland, as well as Plymouth, which have below poverty line percentages over 16 percent. Plymouth is a university town, which affects these statistics. Albany and Chatham in New Hampshire, and South Oxford and Stoneham in Maine, also have below poverty line percentages above 16 percent.

Housing

Growth in housing, including second and seasonal homes, has been an important driving force in the regional economy. The overall trends for Grafton and Carroll Counties have been upward over the last ten years, especially in the later part of the 1990s, while Coos County remained static. The situation in Oxford County is intermediate between Coos and Grafton and Carroll Counties. Overall, when compared to areas to the south, development in the Forest Region is low and is predicted to continue the trend of recent years.

A striking characteristic of many of the Affected Towns, as well as other communities in the Forest Region, is the very high percentages of seasonal homes, comprising more than half of the homes in some communities. Seasonal homes make up 32 percent of all homes in the Affected Towns, while seven of these communities have more than 50 percent seasonal homes. Waterville Valley, a ski resort community, has over 76 percent seasonal homes.

Seasonal homes are common throughout the Forest Region. Grafton County leads with 43 percent, while over 20 percent of homes in Carroll, Coos, and Oxford are seasonal. These seasonal homes account for high variability in home values, and are a driving force for the economy in many Forest Region communities.

Summary—Demographic and Social Profile

The demographic and social profile of the Affected Towns and the Forest Region is one of a population that is very homogeneous in race and culture, but nevertheless exhibits marked differences in economic and social characteristics. Along many social indicators, there is a marked gradient from the south to the north of the Forest Region that is part of the economic and social geography of New Hampshire and Maine. To the south, in Carroll and Grafton Counties, there is a rapidly growing population with an economy that is expanding quickly in the service sectors with strong tourism and recreation components. These counties have a more educated work force, and are less dependent on traditional manufacturing sectors. In contrast, the two northern counties of Coos and Oxford have slower economic growth and a greater dependence on traditional natural resource-based manufacturing industries.

Community Connections

The communities in and around the Forest Region have historically relied heavily on natural resources and tourism for their livelihoods. Only recently have broader economic patterns been changing the influence of this direct reliance. Farming and forestry were the primary sources of employment in the Forest Region, and northern New England as a whole, through much of the 1800s. Indirectly, the forests, lakes, rivers, and mountains of the region have provided highly valued recreation opportunities to the residents, and these same resources are the main attraction for the eight million people who visit the White Mountain Region each year.

While the availability of forest products affects local industries, just as the kind and amount of permitted recreation affects those whose livelihoods depend on access, the local communities are connected on a much more direct and immeasurable level. The "quality of life" of the region is generally what keeps people living there. Residents enjoy the natural scenic beauty, the healthy lifestyles, access to quiet places, and clean water. The natural resources of the region provide not only the economic base for these communities, but also the lifestyles they choose to live.

Partners

The Forest typically enters into partnerships with federal and state agencies, local communities, non-governmental organizations, and individuals, working in concert to reach a variety of goals in managing the land and providing goods and services to the public. Many partnerships are formalized in Memorandums of Understanding, Challenge Cost Share and Collection Agreements, and Special Use Permits, but many are informal and take the form of volunteer contributions by groups and individuals. The Forest benefits from the numerous relationships with partners at all levels, and partners benefit from the Forest's vast expanse of land for recreation, educational opportunities, and protection of natural resources such as public water supplies and forest products.

Partners support the Forest by providing funding, services, goods, and expertise. Some of the work accomplished with partner support includes:

- Endangered Species Surveys and Management.
- Historic Preservation.
- Safety, Conservation, and Interpretive Programs, Materials, and Events.
- Resource Monitoring.
- Research.
- Trail Maintenance.
- Training.
- Law Enforcement.
- Road Maintenance and Reconstruction.
- Fire Protection.
- Fish and Wildlife Surveys.
- Tourism Services.
- Search and Rescue.

Transportation Network

Visitors and commuters travel to and through the National Forest via major interstate, state, and U.S. highways, including I-91, I-93, NH 16, NH 25, NH 112 (the Kancamagus Highway), NH 118, US 2, and US 302.

1. I-93 and NH 16/US 302 (from Conway to Bartlett) are relatively major conduits of traffic through the Forest.

2. US 302, NH 16 (north of Bartlett), and NH 112 are relatively minor conduits of traffic through the Forest.
3. Significant entrance/exit points to/from the Forest occur in Franconia (I-93), Plymouth (I-93), Conway (US 302/NH 16), Gorham (US 2/NH 16), and Carroll (US 302).
4. The majority of traffic from Maine travels to the Forest via US 302 rather than US 2.

The White Mountains Trail National Scenic Byway loops through the National Forest on segments of NH 16, US 302, US 3, I-93, and NH 112 (the Kancamagus Highway).

Overall, traffic volume in the Forest Region has increased steadily by about 2 percent per year from 1994 to 2002. Average daily traffic, combining commuter and tourist traffic, rose to about 8,300 vehicles per day. Seasonal fluctuations in tourist traffic occur, with the highest averages occurring in July, October, and February.

In addition to major passenger vehicle routes, access to the Forest is gained via many smaller local roads, trails (hiking and motorized), and the network of Forest roads.

Population Demands on the WMNF

Origin of Visitors

Although visitors to the Forest come from all over the United States and Canada, most are from New England. New Hampshire, Maine, and Massachusetts residents comprise roughly 73 percent of visitors, while 14 percent are from the other New England states and New York. Another 11 percent of visitors come from other states, while 2 percent come from Canada and other countries.

Recreation Use

Visitors come to the Forest Region to enjoy the stunning scenery and to pursue recreational and educational opportunities. Developed recreation areas, such as picnic areas, campgrounds, trailheads, scenic overlooks, boat ramps, golf courses, and ski areas, have been created to attract and accommodate visitors.

Fewer than one-third of the developed recreation sites in the Forest Region are located on the Forest. However, many of the off-Forest sites are near the Forest boundaries along the I-93, US 302, US 2, and NH 16 corridors.

The following trends were identified using national, regional, and local surveys and observations. Where known, use is depicted in *visitor days* (a visitor day is equal to a 12-hour period on-site).

Recreational pursuits showing increasing trends:

- The National Survey on Recreation and the Environment (NSRE, 2000) shows strong growth (about 9 percent per year from 1994 to 2001) in day-hiking and backpacking in New England. Trail registries and

surveys indicate an estimated 1,128,000 day-hikers visit the National Forest, and 564,000 people stay in overnight facilities in the backcountry each year.

- Scenic driving, promoted in part by the White Mountains Trail National Scenic Byway that loops through the Forest, is estimated at 91,000 visitor days per year. Scenic driving in New Hampshire is thought to be growing at the general tourism trend of 1.5 percent per year.
- Camping in White Mountain National Forest developed campgrounds occurs at about 265,000 visitor days per year, and shows a 1 percent increase per year.
- Vehicle registration records for Maine and New Hampshire show that all-terrain-vehicle use has tripled in the last ten years, with growth of about 6 percent per year in New Hampshire and 16 percent per year in Maine over the last three years. ATV use in the National Forest is restricted to snowmobile trails in winter only, and use data is not available.
- New Hampshire registrations indicate snowmobile use doubled in the last ten years, but has not increased significantly in the last three years. Snowmobile use in the Forest was estimated at 32,000 visitor days per year in 2002.
- Nordic skiing at permitted areas on the White Mountain National Forest, combined with skiing on general Forest trails and roads, is estimated at 66,000 visits per year. The national trend in Nordic skiing shows an increase of 4.3 percent per year from 1994 to 2001.
- Observations of increasing mountain bike use on the Forest is reflective of the national trend, estimated to be increasing by 36 percent from 1978 to 2000. No Forest or regional use estimates are available.
- Rock and ice climbing appears to be increasing in popularity on the Forest, although there are no reliable estimates of numbers or trends.
- Day use recreation in the Forest was estimated to be 58,000 visitor days in 2002. No trends have been identified.

Recreational pursuits showing no growth:

- Regional trends in hunting, fishing, and alpine skiing are essentially flat, as indicated by state license sales and visitor counts at ski areas operated on the White Mountain National Forest. Hunting is estimated at 112,000 visitor days per year, fishing at 79,000 visitor days per year, and alpine skiing at 920,000 visits per year, based on ski area operators' records.

The White Mountain National Forest attracts recreationists pursuing activities unique to the Forest and region, such as winter traverses of the Presidential Range, off-trail hiking, overnight stays in mountain huts and cabins, wildlife and foliage viewing, spring skiing in Tuckerman Ravine, and hiking the Appalachian Trail. The White Mountain National Forest does not have use estimates for these activities, and therefore cannot evaluate their growth trends.

Educational Use

The White Mountain Region provides educational and exploratory opportunities for tourists, educators, and children. Programs are numerous and varied, and are offered through public and private schools, local towns and chambers of commerce, outfitter/guides, nonprofit conservation organizations, conservation schools, state agencies, and through the Forest Service directly.

Programs vary widely in length and depth. Many are offered just outside the boundary of the Forest; however, the Appalachian Mountain Club (AMC) has a major presence in the National Forest, and offers numerous programs on-Forest. Many school groups come to use the Forest as a setting for both nature study and skill-building in areas such as survival, leadership, and teamwork.

Other educational outreach includes the distribution of safety and resource protection publications, interpretive displays in high-use areas and information centers, and websites managed by the Forest Service and partners.

Economic Use

Discussion of economic uses of the National Forest can be found in the Economic Affected Environment section.

Forest Users

Just over 93 percent of all Forest visitors are White, with the remaining visitors split nearly evenly among people of Hispanic, African American, and Native American descent.

Passive Values

The values people have for public land are also part of the social landscape of the White Mountain National Forest. Many people have passive values for areas of significance to them, meaning that places are valued not for any active or consumptive uses, but because they exist now and can benefit future generations. For example, many people believe that forests, wildlife, and Wilderness have inherent worth in and of themselves, independent of their usefulness to humans, and should therefore be protected.

Land Use and Change in Forest Land

Prior to the arrival of European settlers, forest cover in New England was estimated to be near 95 percent (Sundquist and Stevens, 1999). The rapid expansion of farms across New England caused a long and steady decline in forest cover. The Civil War brought an end to this expansion, and many people abandoned their farms for better land further west. From about the 1870s up until the mid-1980s, forest cover continued to increase on these abandoned farms. The trend of farm-to-forest conversion still occurs, although increasing rates of land development have minimized this in New Hampshire. Development rates have overcome reforestation rates in some areas of southern New England in the last decade, with significant development in southern Maine and southern New Hampshire.

Overall, development in the Forest Region is low and growth is predicted to continue along a similar trajectory to that of recent years. Development has not impacted overall forest cover in Oxford County and Maine as a whole. In New Hampshire, Coos County increased its forest cover (95 percent to 96 percent) over the period from 1973 to 1997, while Carroll County lost 6 percent (92 to 86 percent) and Grafton County lost 2 percent, (90 to 88 percent). Timberland (forest that is physically capable of growing timber and is commercially available for cutting) comprises more than 90 percent of New Hampshire forests, yet has declined by more than 290,000 acres since the previous Forest Plan was adopted in 1986.

Factors such as large economic booms or deep recessions would naturally adjust the development patterns in the short term. Second homes, restaurants, and lodging will likely dominate the development over the next several decades. More uncertain is the expansion of the large regional ski destinations on and off Forest land.

Conserved Lands

There are many tracts of conserved public land in close proximity to the Forest. These tracts are located in both New Hampshire and Maine, and vary widely in size and shape. Examples include state parks, state forests, town forests, conservation easements, land trusts, non-governmental organization lands, and wildlife management areas.

While most conserved tracts are not contiguous, there are some notable parcels of conserved land that connect areas of the White Mountain National Forest, such as Crawford Notch State Park and Mount Moosilauke. The Forest (at about 796,000 acres) accounts for about 68 percent of the approximately 1,143,000 acres of conserved land in the Forest Region (Table 3-94).

Table 3-94. Summary of Conserved Lands in Forest Region.

County	Total County Area (Acres)	Total County Area Conserved (Acres/%)		County Area On WMNF (Acres/%)		Conserved County Area Off WMNF (Acres/%)	
Carroll	635,006	217,951	35%	156,198	25%	61,753	10%
Coos	1,170,838	384,883	33%	231,682	20%	153,201	13%
Grafton	1,120,030	425,632	38%	348,400	31%	77,232	7%
Oxford	1,391,583	123,384	9%	49,564	4%	73,820	5%

Attitudes Toward Land Use Management

Studies completed in recent years shed light on community attitudes toward land use management, and specifically clarified the objectives of people in the Wider Region. Manning et al. (1998) investigated the public's attitudes regarding the management of the White Mountain National Forest and found that respondents tended to agree with statements supporting non-material forest management, such as preserving the remaining undisturbed forests.

Robertson's *Assessment of Outdoor Recreation in New Hampshire — 1997* (Robertson, 1997) provides one of the most thorough examinations of New Hampshire resident attitudes about natural resource management. Robertson found that protecting plants, animals, water recharge areas, and natural regions of New Hampshire ranked among the most important objectives. Providing non-motorized recreational opportunities and preserving historical/archeological areas were also valued objectives. Issues concerning motorized recreation, providing opportunities for a high level of development for recreation, and attracting tourists were among the objectives deemed less important.

These findings are consistent with other work on this topic. Shields and others (2002) explore public opinion as it relates to land management and the performance of the Forest Service in fulfilling the public's land management goals. The following is a list of the objectives deemed most important (in order of importance):

1. Conserving and protecting forests and grasslands that are the source of water resources.
2. Developing volunteer programs to improve forests and grasslands.
3. Protecting ecosystems and wildlife habitats.
4. Informing the public about recreation concerns on forests and grasslands, such as safety, trail etiquette, and respect for wildlife.
5. Informing the public on the potential environmental impacts of all uses associated with forests and grasslands.

Additionally, the study indicated the objectives that received the lowest scores from respondents. These were deemed less important:

- Expanding commercial recreation areas on forests and grasslands.
- Making the permitting process easier for some established uses of forests and grassland, such as grazing, logging, mining, and commercial recreation.
- Developing new paved roads on forests and grasslands for access for cars and recreational vehicles.
- Expanding access for motorized off-highway vehicles on forests and grasslands (snowmobiles or ATVs).
- Developing and maintaining continuous trail systems that cross both public and private land for motorized vehicles such as snowmobiles and ATVs.

Though these issues were cited as the least important, there was high variability among respondents. Many people felt the issues listed here were, in fact, very important, and they believed it was the Forest Service that was responsible for fulfilling these objectives. These concerns are again consistent with public comments on the management of the White Mountain National Forest.

Environmental Effects

The analysis area for social effects is defined as the four-county Forest Region (Grafton, Carroll, and Coos Counties, New Hampshire, and Oxford County, Maine). Most available quantifiable information about social factors and issues comes from the four-county scale, however this discussion at times draws from trends and attitudes identified on a regional or national level.

The social context for assessing the effects of the proposed alternatives lies in what people value about the White Mountain National Forest. Communities around the Forest identified important objectives regarding natural resource management as the desire to maintain the *rural character* and *quality of life* of their communities (Robertson, 1999, 39-41).

- *Rural character* may be defined by development levels and access, and therefore the level of human activity in an area.
- *Quality of life* components identified as "most important" and "very important" include safe drinking water, recreational opportunities, healthy ecological systems, scenic beauty, and the natural and cultural heritage of the region.

Predictions regarding the social effects of the proposed alternatives are based primarily on trends identified in the Socio-Economic Assessment and issues identified in "Social Issues for Forest Plan Revision for the White Mountain National Forest." (Robertson, 1999)

Effects Common to All Alternatives

Overall, the National Forest contributes positively to the rural character and quality of life enjoyed by residents throughout the Forest Region. The legal framework that mandates the protection of natural resources, while providing a balanced mix of economic, recreational, and other uses of the land, forms the foundation of National Forest management. White Mountain National Forest guiding principles further acknowledge that the Forest is vital to the spirit, lifestyles, and livelihoods of local and regional communities. Stated simply, the presence of this large block of public land, managed sensitively for multiple uses, is a major contribution to the rural character and quality of life valued by residents of the Forest Region. The ability to conduct research in the National Forest contributes positively by providing scientific conclusions that can be used to maintain and enhance healthy ecosystems on public and private lands throughout New England and beyond.

Effects on rural character may be measured by activities that change the development levels and access, and therefore the level of human activity in an area. Surveys and changes in land use patterns indicate that the rural character of the Forest Region is impacted by increasing development outside the Forest boundary, and is a concern among residents. Overall, development (as measured in housing starts) in the Forest Region is considered low and is predicted to continue the trends of recent years — increasing in Grafton and Carroll Counties, static in Coos County, and somewhere intermediate in Oxford County.

Forest management alternatives could have some localized impacts on rural character in areas where close proximity and easy access to the National Forest causes development outside the boundary. An example is in areas of ski area development, both on and near the Forest. Overall, however, there are no predicted measurable direct, indirect, or cumulative effects on the level of development outside the Forest boundary.

Within the Forest boundary, rural character would be most affected by Alternative 4, which proposes the highest levels of new recreation development. While this would impact the resources and recreation experience (see Recreation section), there would be no measurable effects on the rural character of the Forest Region as a result. All new development within the Forest boundary is measured and constrained by standards and guidelines, and would occur only to meet very particular goals and objectives.

Population

Historical growth and trends in Forest Region population are not thought to be related to management activities on the White Mountain National Forest. Management goals and objectives and proposed activities would have no notable overall direct, indirect, or cumulative effects on size, densities, or demographics of the populations of the Affected Towns or the Forest Region. Localized population effects could occur in specific communities, and would depend on the management area designations and character of the National Forest lands near the specific communities.

Housing

As with populations, there may be localized effects in specific communities as a result of management area designations and the character of the adjacent National Forest. Development in towns adjacent to Forest-based alpine ski areas — Waterville Valley, Attitash-Bear Peak, Wildcat Mountain, and Loon Mountain — has occurred in the past, and could increase if the ski areas expand. Waterville Valley, Attitash-Bear Peak, and Loon Mountain have potential expansion areas identified (Management Area 9.2.). However, the trend in the use of Forest alpine ski areas is currently flat for both summer and winter seasons, and the future market is uncertain. Effects of ski area expansion on the rural character and quality of life of communities in the Forest Region, if it occurs at all, are expected to be minimal over the course of this planning cycle.

Seasonal home ownership is a tradition among more affluent New Englanders, and will likely continue to be a component of development in the Forest Region over the next decades. The ongoing growth of seasonal home ownership will continue to alter the socio-economic character of the Forest Region communities, the communities' attitudes toward the Forest, and the balance among resource uses. Increasing development to accommodate seasonal home ownership, which could include communities near Forest-based alpine ski areas, is a concern among some residents.

Transportation/Access

In a social context, the transportation network in and around the White Mountain National Forest contributes to the quality of life of the Forest Region by providing commuter corridors and access for recreational, educational, and economic uses within the National Forest. Roads provide the means for people to enjoy the scenic beauty, engage in many recreational activities, and pursue livelihoods and educational enrichment in the Forest. Vehicle access is possible on open Forest roads, while closed Forest roads are available for non-motorized activities such as hiking, cross-country skiing, snowshoeing, horseback riding, and bicycling.

The alternatives propose road work primarily in connection with vegetation management activities, with a proposed 1 mile per year of new road construction, 7 to 11 miles per year of reconstruction, and 160 to 230 miles per decade of roads reopened for access during timber harvest operations. New or reopened roads would be closed when operations are completed. While all alternatives propose some level of new road use for management activities, none would have a measurable direct or indirect effect on the existing social uses by either commuters or visitors.

Socially, the effects of increasing miles of roads constructed or reconstructed would provide additional opportunities for non-motorized road-based recreation (hiking, bicycling, etc.) for a period of time until the road beds revegetated. The cumulative effect would be minimal, because older roads would revegetate as new roads became available.

Environmental Justice

Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations) requires that the alternatives be assessed for "disproportionately high and adverse human health or environmental effects … on minority populations and low-income populations."

Minority Populations

Minority populations comprise less than 6 percent of residents, and about 7 percent of visitors, to the Forest Region. Very little historical information is available on ethnicity patterns in outdoor recreation. The current low participation rates of minorities in outdoor activities has been attributed to concerns of personal safety, the lack of discretionary money, transportation, and inadequate knowledge of recreational sites, though the level that each of these plays in participation is unclear.

Population projections indicate that ethnic and racial minorities will account for 90 percent of the population growth and 50 percent of the overall U.S. population by the year 2050 (Smelser et al., 2001), and as a result, the ethnic profile of outdoor recreation activities, and visitors to the White Mountain National Forest, will likely change.

The trend to increasing visits by minority and low-income populations is notable due to the Forest's close proximity to the Boston metropolitan area and the Forest's active involvement with community-based organizations in the Boston area through the Urban Outreach program. This program

connects the Forest Service with diverse groups sharing common goals in conservation education. These urban outreach efforts will foster long-term relationships with urban constituents to achieve the goals of improved service, enhanced representation of diverse interests, and increased stewardship of natural resources.

Low Income Populations

Ten percent of the Forest Region's population falls below the federal poverty line and can be considered low-income. Higher poverty levels in some towns are attributed to mill closures and student populations. Data regarding income levels of visitors to the White Mountain National Forest are not available.

Effects on Minority or Low-Income Populations

There are no known direct, indirect, or cumulative effects of the alternatives on the resident or visitor minority or low-income populations. The alternatives do not propose management objectives, goals, or activities that would have disproportionately high and adverse impacts on minority or low-income resident populations or visitors.

Conclusion

The Socio-Economic Assessment (High et al., 2004) concludes that the range of proposed alternatives will not have major social impacts on the Forest Region as a whole, but that there could be potential localized impacts, as discussed above. Rather than the Forest Plan alternatives affecting the Forest Region, there is greater potential for regional socio-economic issues to cause changes in the Forest Region which could eventually affect the desired mix of activities on the National Forest. The Socio-Economic Assessment identifies these regional issues as:

- Historic population trends, especially the disparities between counties in the Forest Region.
- Changes in the forest products industry.
- Changes in private forestland ownership.
- Changing needs and recreation demands of an aging population.

Economic

Affected Environment

Economic Impact Analysis Area: The Four County Forest Region

In order to analyze the economic linkages between the White Mountain National Forest and the economy, it is necessary to define an economic area suitable for analysis. For the purposes of this economic analysis, the economic area is defined within Coos, Carroll, and Grafton Counties in New Hampshire, and Oxford County in Maine. The Forest is centrally located within these counties, and they are the only counties directly adjacent to the Forest. It is appropriate to consider the counties together as a single region for analysis purposes, because it would be difficult to attribute specific economic linkages of a particular Forest activity to any one of the four counties. In general, a particular economic activity on the Forest occurs in many of its areas, and cannot be concentrated or attributed to one county. An example is hiking, which occurs throughout the Forest and is not peculiar to one of the four counties.

Most of the towns within the four counties have strong economic ties to the Forest and, in many cases, have significant portions of their land base located within the Forest's geographical boundary. Many of the towns receive direct payments from the federal government in lieu of taxes, and they provide services to the Forest. These towns are also home to many workers and businesses that provide employees and services to the Forest, either directly or indirectly, due to the wide variety of activities that occur on the Forest. Although the importance of these towns as part of the Forest-based economy is clear, they do not form a coherent economic entity that can be analyzed or assessed as a whole. Each town often has stronger economic links to economic hubs in their counties than they do to all of the towns within the Forest Region. For this reason, and because most economic data are only available at the county level, the economic linkages are evaluated here at the Forest Region level.

Regional Employment

Since 1991, and continuing through to 2001, employment trends in the Forest Region have generally been positive. As shown in Figure 3-48, up until the year 2000, increases in employment in non-government services and retail trade were driven in large measure by increases in outdoor recreation, tourism, and second home construction that occurred over the previous 15 years.

A recession began in 2001 that interrupted this trend, and unemployment rates increased (Table 3-95). The loss of jobs was mostly felt in the manufacturing sector, with New Hampshire losing manufacturing jobs at a faster rate than the region and the nation in both 2001 and 2002. New Hampshire's annual unemployment rate rose from 2.8 percent in 2000 to

Figure 3-48. Employment by Sector for the Forest Region (Combined).

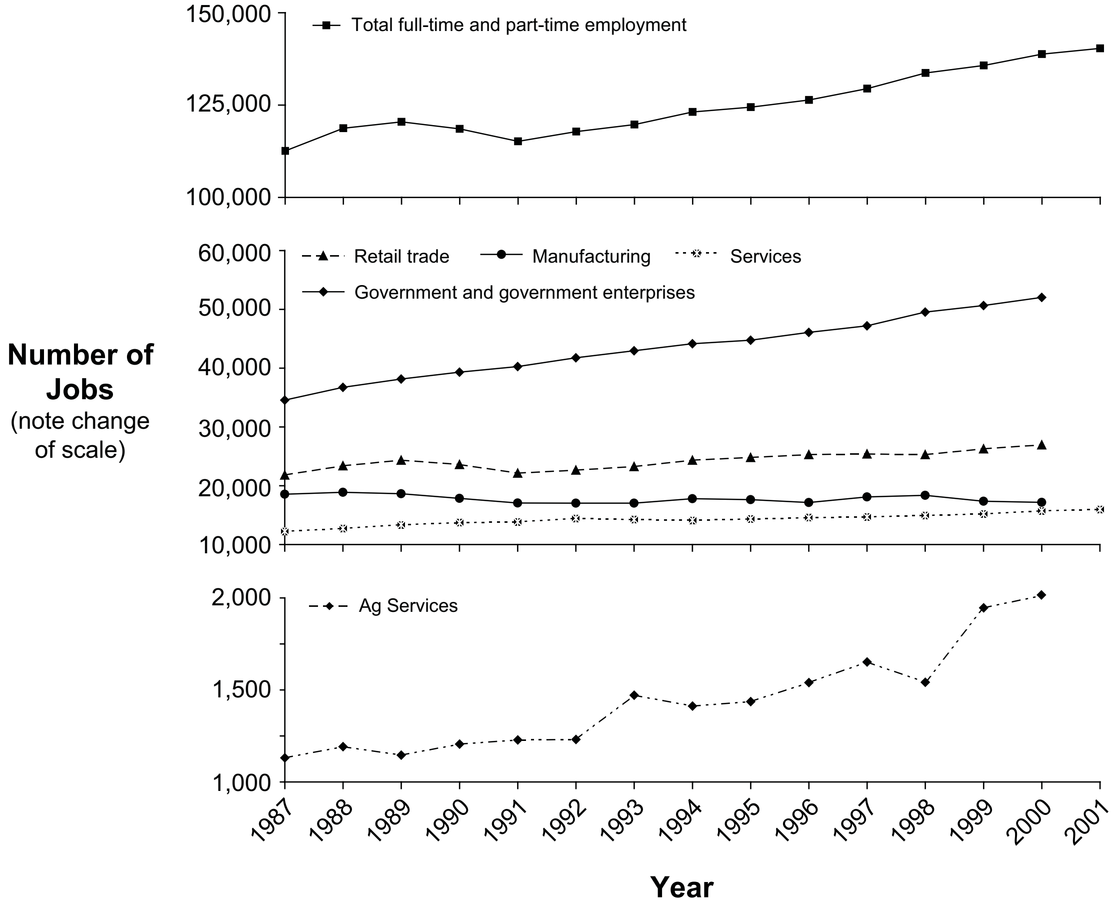


Table 3-95. Percent Unemployment Rates in the Forest Region and States.

	1999	2000	2001	2002	Dec. 2003
Coos County	4.2	4.7	5.4	7.5	5.2
Carroll County	2.5	2.8	3.0	3.5	2.8
Grafton County	1.9	2.1	2.1	2.3	2.0
State of NH	**2.7**	**2.8**	**3.5**	**4.7**	**4.0**
Oxford County	6.7	5.4	6.0	6.6	7.0
State of Maine	**4.1**	**3.5**	**4.0**	**4.4**	**4.9**

Sources: Maine Department of Labor, Division of Labor Market Information Services in cooperation with U.S. Bureau of Labor Statistics and New Hampshire Employment Security, Economic and Labor Market Information Bureau.

4.7 percent in 2002 (Economic and Labor Market Information Bureau, 2004). Maine's unemployment rate also rose over the same period, from 3.5 percent to 4.4 percent. Recently, the region's economy began to show some preliminary signs of improvement. By the end of 2003, New Hampshire's unemployment rate had decreased slightly to 4.0 percent; Maine's had dropped by late summer to 3.9 percent, but then rose to 4.9 percent by the end of 2003. The Forest Region experienced similar changes in unemployment, but with a noticeable difference in scale between the northern counties (Coos and Oxford) and the southern counties (Grafton and Carroll). Unemployment rates were generally higher in the northern part of the region, with Coos County at 5.2 percent and Oxford County, Maine at 7.0 percent, compared to Carroll County at 2.8 percent and Grafton County at 2.0 percent at the end of December 2003. These northern counties have very low population densities, and have been at a relative disadvantage when trying to attract large companies as a source of employment.

Employment projections within the Forest Region are shown in Table 3-96. These employment forecasts point out the relatively low rate of growth in employment in Coos and Oxford Counties, well below their respective state forecasts. Low rates of growth in employment, low population density, and higher than average unemployment rates in these two northern counties distinguish them within the Forest Region as being potentially more sensitive to significant economic changes associated with changes in the management of the Forest.

Table 3-96. Wage and Salary Employment Forecasts 2000-2010

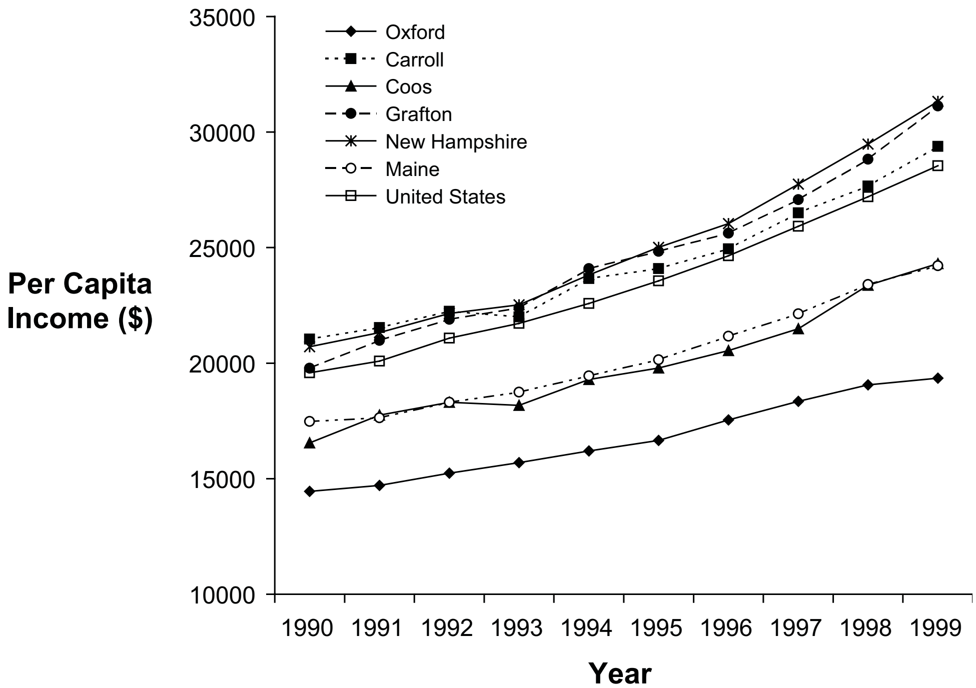
	2000	2010	Change	Rate of Growth
Coos County	13,924	14,983	1,059	7.6%
Carroll County	19,133	22,994	3,861	20.2%
Grafton County	48,906	56,661	7,755	15.9%
State of NH	**603,931**	**713,357**	**109,426**	**18.1%**
Oxford County	25,170	28,514	3,344	13.3%
State of Maine	**795,485**	**945,047**	**149,562**	**18.8%**

Sources: Maine Department of Labor, Division of Labor Market Information Services in cooperation with U.S. Bureau of Labor Statistics and "New Hampshire Employment Projections by Industry and Occupation Base Year 2000 to Projected Year 2010" New Hampshire Employment Security, Economic and Labor Market Information Bureau, February 2003 and County Employment Projections 2000 to 2010, New Hampshire Employment Security, Economic and Labor Market Information Bureau, December 2003.

Regional Income

Annual per capita income in 2001 in New Hampshire was $33,969, compared to Maine at $26,853. Trends in per capita income from 1990 to 1999 (Figure 3-49) indicate that while all four counties of the Forest Region are below their respective state's per capita income levels, Coos County and Oxford County have comparatively much lower per capita income. In 1999, Coos County's per capita income was 22 percent below the average for the State of New Hampshire, and Oxford County was 20 percent below the State of Maine's average.

Figure 3-49. Per Capita Income in the Forest Region



Recreation and Tourism Spending Trends

Recreation and tourism play a vital role in the economy of the Forest Region. The Forest attracted approximately 4.7 million visitors engaged in outdoor recreation on the Forest in 2002 (Table 3-97). This is equivalent to 1.8 million visitor days, and these visitors spent an estimated $65 million in the Region at hundreds of large and small businesses, such as campground managers, AMC Huts, private campgrounds, hotels, restaurants, gasoline stations, and retail outlets and stores.

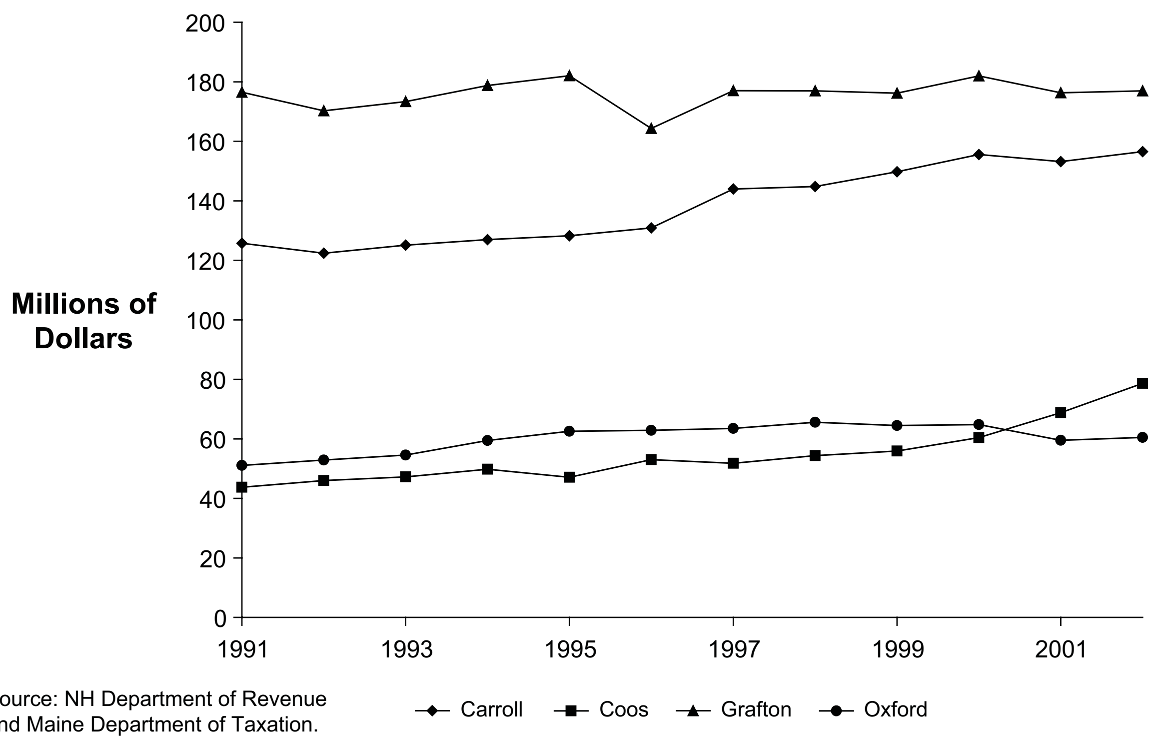
Trends over the past 15 years have shown gradual increases in outdoor recreation, tourism, and second homes. These trends are also supported by data on revenue from rooms and meals tax receipts (Figure 3-50).

Table 3-97. Recreation Visitors to the Forest and Expenditures in the Forest Region (2002).

Recreation Type	Visitor Days	Expenditures per Visitor Day	Total Annual Expenditure
Hiking	728,000	$14.68	10,687,000
Nordic Skiing including Tuckerman	72,000	$32.04	2,307,000
Hunting	112,000	$17.67	1,979,000
Fishing	79,000	$21.71	1,715,000
Snowmobiling	32,000	$81.14	2,596,000
Driving and Viewing*	91,000	$58.30	5,306,000
Road Access Day Use & Camping*	323,000	$29.07	9,390,000
Alpine Ski Area Use*	377,000	$82.54	31,117,000
All Visitors	**1,814,000**	**$35.89**	**65,097,000**

Source: U.S. Forest Service Recreation Data, AMC Surveys, USFWS National Survey, NH Snowmobile Association, Institute for NH Studies. (* Indicates a Developed Recreation Category)

Figure 3-50. Trends in Revenue from Rooms and Meals in the Forest Region ($ Millions)



Source: NH Department of Revenue and Maine Department of Taxation.

For the purposes of this analysis, recreational visitor information is converted into recreational visitor days, defined as a period of at least 12 hours. The expenditures per visitor day include overnight and day visitors, based on their principal recreation activity. The expenditures are only for purchases made in the Forest Region. Spending included both resident and non-resident visitors to the Forest.

Commercial Wood Production

Commercial wood production, including timber harvesting and processing as well as wood products manufacturing, has provided an important and long-lived source of employment for several generations of families in the Forest Region. In many towns, timber harvesting companies, processing mills, and wood products manufacturing plants are either directly or indirectly the largest source of employment. Revenues generated from taxes on timber sales and timber related businesses are an important part of town budgets.

Across the States of New Hampshire and Maine, there are many contributors to the demand for wood products. Wood comes from private, public, and industry owned timberlands to meet national and international demand. In 1989, the Canada-U.S. Free Trade Agreement was initiated, causing tariff-free trading between the two nations. Shortly after, the introduction of the North Atlantic Free Trade Agreement, in 1994, opened the trade doors of Mexico to U.S. and Canadian markets. By 2002, over $440 billion worth of goods were exchanged between Canada and the United States alone. Maine and New Hampshire, both sharing a border with Canada, experienced a tremendous growth in trade. A study completed by *The Trade Partnership for the U.S. Council of the Americas* found that Maine's lumber and wood products accounted for 31 percent of its total state exports to Canada in 1999. In 2001 and 2002, Canada was New Hampshire's largest trading partner, with 2002 sales accounting for $514 million (28 percent) of the state's total exports. Some $55 million of these exports from New Hampshire were forest products (Consulate General of Canada, 2003).

Commercial wood products are derived, either directly or indirectly, from forested timberlands. Maine and New Hampshire have the highest percentage of forested land in the nation. According to a 1997 survey, New Hampshire is the second most forested state, with forests occupying 84 percent of the land (4.8 million acres). Ninety-three percent of this forested land is classified as timberland, i.e., physically capable of growing timber crops and potentially available for harvesting (Thorne and Sundquist, 2001). In Maine, 90 percent of the land is forested and 97 percent of this land is classified as timberland (Griffith and Laustsen, 2001).

The White Mountain National Forest contains many acres of lands that are not suitable for timber harvesting for a variety of reasons. These include lands excluded as a result of law or policy (e.g., designated Wilderness and Research Natural Areas), and other lands containing campgrounds or that are economically impractical, such as mountaintops or side slopes with very thin soils. National Forests are also managed under the guidance of the Multiple Use-Sustained Yield Act of 1960, which creates expectations that these lands will be managed for multiple resource products and benefits and values for the people of the United States. The mix of management necessary to sustain the natural resources and social and economic resources at the local and regional level requires Forest-wide and site-specific decisions that do not always maximize timber volume harvested. Factors that influence

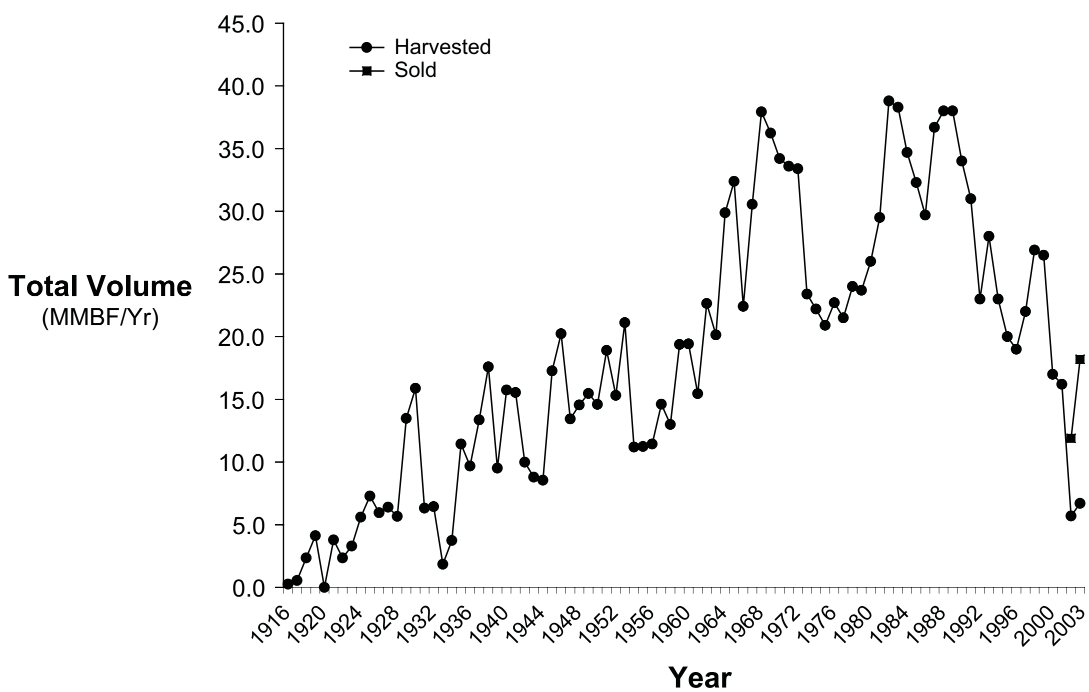
management decisions include, but are not limited to, threatened and endangered species restrictions, recreational use and opportunities, and water resource considerations.

Currently, the Forest has 355,000 acres allocated for general forest management that includes timber management activities out of the total 794,000 acres in the Forest land base. Of these 355,000 acres, approximately 252,000 acres have been evaluated as suitable for commercial harvesting activity.

The difference in allocated versus suitable acres includes acres which are unsuitable due to slope, soil, easement and rights-of-way restrictions, riparian protection areas, and permanent wildlife openings. These unsuitable acres are generally isolated interior areas or linear features that bisect lands allocated for timber management, but are too small, or would not be efficiently managed, in another land allocation category.

Historically, timber harvest levels on the Forest have varied considerably (Figure 3-51). The 1986 Forest Plan calls for a maximum allowable sale quantity (ASQ) of 35 million board feet (MMBF) of timber in the first decade of implementation. As shown in Figure 3-51, actual harvests since 1990 have declined sharply from the planned allowable sale quantity of 35 million board feet. From early 1999 to the end of 2001, timber sales were interrupted while the Forest conducted an analysis of threatened and endangered species. Subsequently, the timber program has rebounded, and in 2003, the Forest sold ten timber sales that will provide a total of 19 million board feet of commercial timber.

Figure 3-51. Total Volume of Wood Harvested on the WMNF from 1915-2003 and Sold 2002-2003. (Source: U.S. Forest Service)



The Forest has been managed with a strong focus on producing high value sawlogs through the removal of low value wood in earlier years. The Forest's high value sawtimber represents a key niche in the region, and has impacts on the local economy. Evidence of this niche can be found in the results of regional inventories conducted in 1995 and 1997, which revealed that high grade 1 or 2 trees on the Forest with greater than a 15 inch diameter breast height (DBH) was 75 percent, compared to 47 percent in New Hampshire and 59 percent in Maine (Table 3-98). By allocating specific areas to timber management over the long term, the Forest can manage these areas to foster and promote the growth of high quality sawlogs.

Table 3-98. Net Inventory Volume of High Value Sawtimber (MMBF) for Trees > 15" DBH.

	Tree Grade 1	Tree Grade 2	All Sawtimber	Grade (1 or 2)
NH Timberland:				
Softwoods	1316.6	1451.7	6374.4	43%
Hardwoods	1081.6	1337.0	4664.8	52%
All	2398.2	2788.7	11039.2	47%
ME Timberland:				
Softwoods	4993.2	1539.2	10081.5	65%
Hardwoods	1465.2	2186.3	7249.8	50%
All	6458.4	3725.5	17331.3	59%
WMNF Timberland:				
Softwoods	380.2	80.7	472.0	98%
Hardwoods	425.3	255.8	1088.7	63%
All	805.5	366.5	1560.7	75%

Source: U.S. Forest Service, 1995 & 1997

The pulpwood market in the Forest Region has experienced significant changes over the last several decades. The northeastern pulpwood market faces ever-increasing pressure from the global paper industry. Increased recycling of wastepaper, improved efficiency of the pulping process, and loss of market share to the southeastern U.S. have contributed to the slow growth of the pulp industry in the Northeast. Within the Forest Region, there is one integrated pulp and paper mill located in Berlin and Gorham, NH that closed its doors in October of 2001. The mills reopened in June, 2002, under the ownership of Nexfor, Inc. of Toronto, Canada, and currently employs about 500 union workers and another 100 salaried workers at the two mills in Berlin and Gorham (Staff Reports, 2004).

Payments to States Contining Federal Lands

The Forest makes payments to New Hampshire and Maine under the 25 Percent Payment-to-States Fund (codified in 16 U.S.C. 500). Twenty five percent of White Mountain National Forest revenues (National Forest Fund) from receipts such as those from timber sales, concessionaire fees, and special use fees (ski areas) have been returned to the states of New Hampshire and Maine. Commercial wood harvests on the Forest are conducted by private companies and individual loggers following a bidding process. The revenue to the Forest from those sales is accounted for as timber receipts, subject to the 25 Percent Payments-to-States Fund. Under this program, the states transfer these funds to counties or towns for the upkeep and maintenance of public schools and roads. This payment is commonly termed the *25-percent payment*.

Another option was added to this program in 2000. The Secure Rural Schools and Community Self-Determination Act of 2000 (Public Law 106-393) was passed on October 30, 2000. It was designed to provide an alternative payment option that would stabilize annual payments to states and counties for six years, beginning in 2001. A new formula for computing annual payments was developed based on averaging the state's three highest 25 Percent Fund payments between 1986 and 1999 to arrive at an alternative compensation allotment termed the *full payment amount*. There is also a provision in the Act to adjust the full payment amount annually to reflect 50 percent of the changes in the consumer price index for rural areas.

The counties and states were afforded the option of continuing with the 25-percent payment or receiving the full payment amount. All three counties containing Forest land in New Hampshire chose the 25-percent payment; Oxford County, Maine, opted for the full payment amount. Recent historical payments to states for these counties are displayed in Table 3-99.

Table 3-99. Payments to States (Fiscal Year 2000-2003).

	FY 00	FY 01	FY 02	FY 03
Carroll County*	$83,870.92	$94,077.26	$46,384.86	$50,615.65
Coos County*	$123,496.12	$138,470.46	$68,968.35	$75,258.99
Grafton County*	$189,814.79	$212,830.53	$104,674.95	$114,222.41
New Hampshire Subtotal*	**$397,181.83**	**$445,379.25**	**$220,030.16**	**$240,100.05**
Oxford County**	$26,916.05	$38,797.87	$39,108.24	$39,577.54
Maine Subtotal**	**$26,916.05**	**$38,797.87**	**$39,108.24**	**$39,577.54**
White Mountain NF Total	**$424,097.88**	**$484,176.12**	**$259,136.40**	**$279,674.59**

*New Hampshire counties elected for **25 percent payments** starting in FY01.
Oxford County, Maine elected for **full payment amount starting in FY01.
Source: U.S. Forest Service ASR-10 Reports, Payments to States from National Forest Receipts, FY00-03.

Payments in Lieu of Taxes

Counties and towns receive Payment in Lieu of Taxes (PILT) to replace tax revenue lost due to the public nature of lands administered by federal agencies (1976 Payments in Lieu of Taxes Act, P. L. 94-565, 31 U.S.C. 6901-6907, as amended). The amount is based on the amount of acreage administered by certain federal agencies, population, a schedule of payments, the Consumer Price Index, other federal payments made in the prior year, and the level of funding allocated by Congress. Payments are generally made to the towns, and in the case of unincorporated towns, the payments are made to the county. These payments are not affected by changes in the Forest Plan. Table 3-100a (New Hampshire) and Table 3-100b (Maine) show the PILT payments made to towns and counties in the Forest economic region in 2003.

Table 3-100a. Payments in Lieu of Taxes (PILT) to Towns – New Hampshire – FY 2003.

NEW HAMPSHIRE			
Town or County	**Payment***	**Total Federal Acres**	**Forest Service Managed Acres**
ALBANY TOWN	$ 55,987	41,155	41,155
BARTLETT TOWN	$ 40,393	29,692	29,692
BENTON TOWN	$ 28,563	23,655	23,655
BERLIN	$ 22,082	16,232	16,232
BETHLEHEM TOWN	$ 41,681	30,639	30,639
CAMPTON TOWN	$ 3,224	2,370	2,370
CARROLL COUNTY**	$2,158.00	1,586	1,586
CARROLL TOWN	$ 21,249	15,620	15,620
CHATHAM TOWN	$ 23,651	28,748	28,748
COOS COUNTY	$184,450.00	135,585	135,585
DOORCHESTER TOWN	$112.00	82	0
EASTON TOWN	$ 17,878	13,142	13,142
ELLSWORTH TOWN	$ 7,914	11,514	11,514
FRANCONIA TOWN	$ 35,448	26,057	26,057
GORHAM TOWN	$ 8,022	5,889	5,824
GRAFTON COUNTY**	$60,562.00	44,518	44,518
HANOVER TOWN	$3,265.00	2,343	0
HARTS LOCATION T	$ 3,366	3,680	3,680
JACKSON TOWN	$ 43,100	31,682	31,682
JEFFERSON TOWN	$ 5,953	4,376	4,376
LANCASTER TOWN	$ 2,136	1,570	1,570

Table 3-100a. Payments in Lieu of Taxes (PILT) to Towns – New Hampshire – FY 2003 (continued),

Town or County	Payment*	Total Federal Acres	Forest Service Managed Acres
LANDAFF TOWN	$ 5,819	4,277	4,277
LINCOLN TOWN	$ 98,920	72,714	72,714
LYME TOWN	$1,987.00	1,437	0
MILAN TOWN	$ 5,791	4,257	4,257
ORFORD TOWN	$1,736.00	1,276	0
RANDOLPH TOWN	$ 17,666	12,986	12,986
RUMNEY TOWN	$ 15,742	11,572	11,572
SANDWICH TOWN	$ 23,016	16,919	16,919
SHELBURNE TOWN	$ 22,275	16,374	14,195
STARK TOWN	$ 25,358	18,640	18,640
TAMWORTH TOWN	$ 308	226	226
THORNTON TOWN	$ 21,258	15,626	15,626
WARREN TOWN	$ 23,666	17,396	16,955
WATERVILLE VALLE	$ 23,378	41,312	41,312
WENTWORTH TOWN	$ 5,208	3,828	3,752
WOODSTOCK TOWN	$ 38,546	28,334	28,334
TOTAL NEW HAMPSHIRE	**$ 941,868**	**737,309**	**729,410**

*Payments include amounts paid for federal lands managed by agencies other than U.S. Forest Service.
**Payments to counties shown are for unincorporated townships and do not reflect the total for the county.
Source: U.S. Department of the Interior, Bureau of Land Management, Payments in Lieu of Taxes, Total Payments and Total Acres by State/County, [Internet: http://www.blm.gov/pilt/, accessed 03/19/2004

Table 3-100b. Payments in Lieu of Taxes (PILT) to Towns – Maine – FY 2003

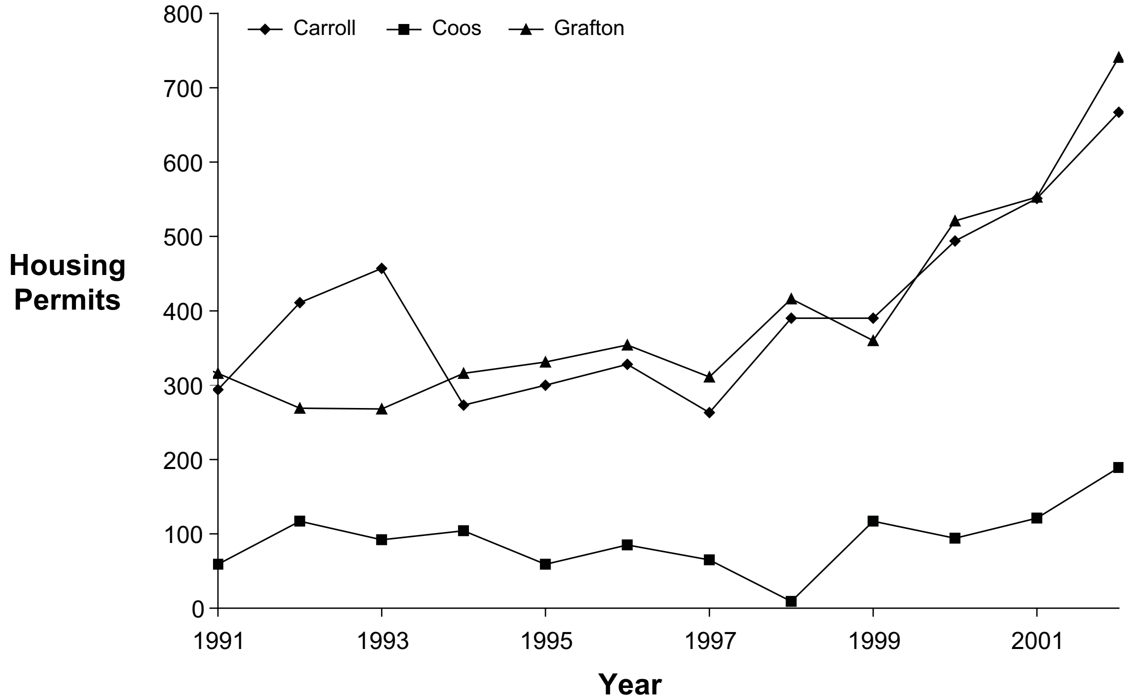
MAINE			
Town or County	**Payment***	**Total Federal Acres**	**Forest Service Managed Acres**
ALFRED TOWN	$ 2,476	1,820	1,820
BETHEL TOWN	$ -	10	10
DAYTON TOWN	$ -	55	55
GILEAD TOWN	$ 1,828	2,200	2,200
HOLLIS TOWN	$ -	24	24
LOVEL TOWN	$ 100	121	121
LYMAN TOWN	$ 2,429	1,785	1,785
OXFORD COUNTY**	$35,314	33,190	30,963
STONEHAM TOWN	$ 10,348	12,455	12,455
STOW TOWN	$ 2,989	3,597	3,597
TOTAL MAINE	**$ 55,484**	**55,257**	**53,030**
TOTAL NH AND ME	**$ 990,252**	**787,428**	**782,440**

*Payments include amounts paid for federal lands managed by agencies other than U.S. Forest Service.
**Payments to counties shown are for unincorporated townships and do not reflect the total for the county.
Source: U.S. Department of the Interior, Bureau of Land Management, Payments in Lieu of Taxes, Total Payments and Total Acres by State/County, [Internet: http://www.blm.gov/pilt/, accessed 03/19/2004

Land Use Trends

The amount of timberland (forest that is physically capable of growing timber and commercially available for cutting) in New Hampshire has undergone at least two discernible changes in recent decades. First, the amount of land that has forest cover has declined by two percent from 1973 to 1997, primarily due to development. (The only other conversion classification would be to farmland, which has been relatively insignificant in recent times.) Second, changes in land ownership have resulted in the conversion of timberland to non-commercial forest. From 1983 to 1997, the amount of non-commercial forestland in New Hampshire increased by 98 percent. These conversions are primarily the result of subdividing wood lots and converting their use to non-commercial purposes, such as housing lots. Through subdivision, the average parcel size for landowners has shrunk from 114 acres in 1948 to 37.5 acres in 1997. While many of these lots retain some degree of forest cover, especially on larger homestead lots, landowners typically no longer consider commercial timber production an appropriate use of the land. Carroll, Grafton, and Coos Counties have recently experienced growth in new housing permits, one of the better indicators of this conversion trend. The number of housing permits for each of these counties is shown in Figure 3-52.

Figure 3-52. Total Housing Permits for Three Counties in New Hampshire (1990-2002)

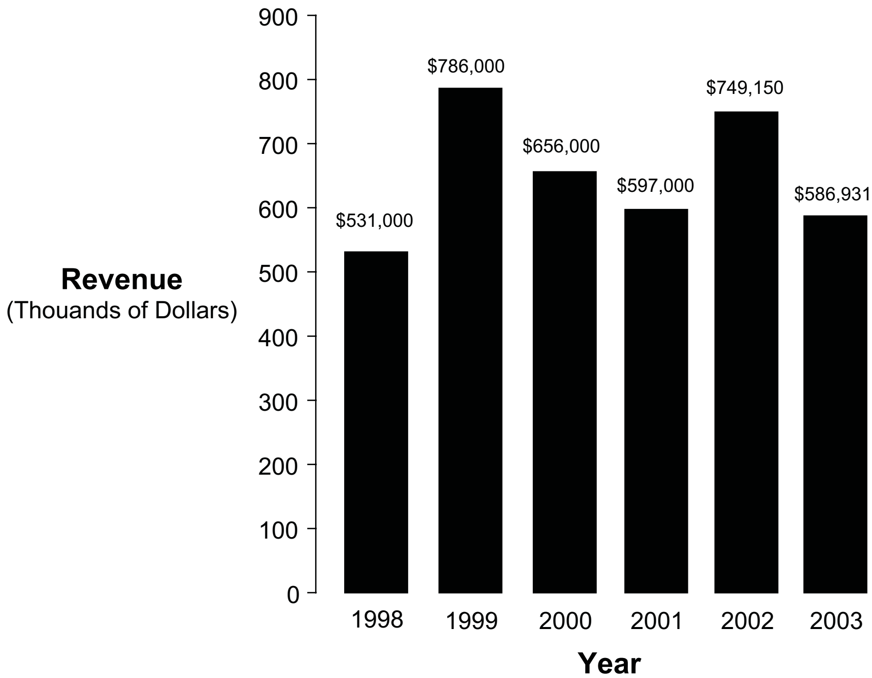


Source: "Current Estimates and Trends in New Hampshire's Housing Supply, Update 2002," New Hampshire Office of Energy and Planning, December 2003.

Recreation Fee Demonstration Program

In May of 1996, the White Mountain National Forest joined other federal agencies to implement the National Recreation Fee Demonstration Program. As a result of efforts to control Federal spending, Forest Service budgets had declined and the recreation portions of those budgets had not kept pace with the increasing number of visitors and the volume of work related to recreation. In an attempt to avert the possibility of further degradation of recreation resources, the Forest Service began charging a parking fee at designated areas (e.g., trailheads, day use areas). The Forest collects these fees, and 95 percent of the revenue is retained by the Forest and used to provide services directly to visitors, including the construction and repair of facilities such as trail bridges, toilets, shelters, repair and maintenance of trails, wildlife habitat enhancements, resource conservation and interpretation, signs, customer service, and program administration. The remaining five percent is sent to the Regional Office, where it is used in other Forests' fee programs or ultimately returned to the WMNF. FY98 to FY03 collections for this program on the White Mountain National Forest are shown in Figure 3-53.

Figure 3-53. Recreation Fee Demonstration Program Revenue (Fiscal Year 1998-2003)



Source: White Mountain National Forest Recreation Fee 2003 Annual Report

By October 2005, the Forest will have fully implemented a slightly altered fee program under the authority of the 2004 Federal Lands Recreation Enhancement Act (REA). This act authorized federal land management agencies to collect fees for recreational use over a 10 year period. The WMNF program will remain essentially same as at present, though fees will no longer be collected at some sites but will begin to be collected at others. The biggest change will be that certain amenities, such as restrooms and permanent trash containers will be present at or near sites where fees are collected. It is not expected that revenues will change appreciably under the new program.

Economic Impact of the Forest Service and Forest Related Activities on the Economy of the Forest Region

As an agency of the federal government, the White Mountain National Forest contributes directly to the region's economy in the course of executing its annual budget. Funds that are appropiated to manage the Forest are used to pay for investments in the Forest to protect, manage, and maintain the various resources under Forest Service jurisdiction. The Forest develops its budget by resource management area in order to accomplish resource objectives. A summarized display of the fiscal year 2002 expenditures by resource management area is provided in Table 3-101.

Table 3-101 FY 2002 WMNF Budget ($1,000).

Recreation	$	4,416
Timber	$	3,018
Soil, water, air	$	1,084
Minerals	$	28
Protection	$	766
Wildlife, Fish	$	1,722
Total	$	11,034

Combining the expenditures of all recreational visitors to the Forest, the direct activities of harvesting timber, and the direct employment and expenditures made by the Forest Service results in additional economic activity within the Forest Region. This creates direct, indirect, and induced effects which are accounted for in the Forest Service IMPLAN model. This can be illustrated using Forest Service timber sales. A direct effect of the sale is its contribution to the employment and income of the loggers that harvest the wood. An indirect effect occurs when local service stations and markets sell fuel, oil, and food to those loggers for their use in the course of harvesting the wood. An induced effect comes from the loggers' household spending on goods and services to support themselves and their families. This flow of money through the economy has a multiplying effect, and these effects are captured and accounted for within the IMPLAN model. The total impacts, including direct, indirect, and induced employment and income for the Forest Region, are shown in Table 3-102.

Table 3-102. Total Employment and Income in the Forest Region from Forest Activities.

Forest Activity	Total Employment	Total Income
Recreation	1,621	$ 31,600,000
Payments to States	10	$ 300,000
Timber	57	$ 2,000,000
Forest Service Expenditures	364	$ 12,600,000
Total	**2,052**	**$ 46,500,000**

Source: U.S. Forest Service IMPLAN Economic Impact Model.

The income and employment data are based on averages from the years 2000 through 2003, and represent current activity levels on the Forest. The timber portion is derived from the 18,500 CCF/year (11.1 MMBF/yr) harvested over this time. This is approximately one-third of the ASQ during this time, and, consequently, the revenue generated from this harvest activity is lower than if it had approached the allowable sale quantity. Revenues to the Forest, expenditures by the Forest, and Payments to States were also taken from this same four year time frame, adjusted to 2002 dollars, and averaged.

It is worth noting that Table 3-102 reflects 2000-2003 data in order to represent the current situation. Looking at the Forest's harvest history since the 1986 Plan was implemented reveals significantly higher figures. In fact, from 1987 (the first year of the current Plan's inception) through 1999 (the last year before timber sales were interrupted to study threatened and endangered species), the Forest averaged 28.2 MMBF/year. Based on this higher figure, employment attributed to revenue generated from timber sales would have been two to three times the 57 jobs in Table 3-107.

The Forest's recreation program shows the largest economic impact, accounting for 79 percent of total employment and 68 percent of total income attributed to Forest activities. This is not surprising, given the large number of visitors that recreate on the Forest. Forest Service expenditures, which includes the budgets for the Forest Service employees and other programs not directly tied to recreation or timber, account for the next highest category, 18 percent of total employment and 27 percent of total income attributed to Forest activities.

Interpreting these results requires a review of some of the assumptions inherent in the IMPLAN model's design. The model relies on the existence of a fixed relationship among economic activities in a region, as measured by economic surveys undertaken by the U.S. Department of Commerce. It is assumed these relationships will remain constant, so that a linear relationship will hold between an input, such as timber harvesting or recreational visits, and a resultant level of income and employment. Further, the model only considers the economic activity within the Forest Region, and is, therefore, sensitive to how much of the linkage in a particular sector occurs in the region. For example, if market forces caused the timber mills within the Forest Region to close, and the timber must subsequently be hauled outside the Forest Region to be processed, the income and employment attributed to this sector would fall to a fraction of the modeled levels, even if the timber harvest remained the same.

With these assumptions in mind, the results of the model in the recreation sector can be a considered a reasonably good predictor of the general direction and magnitude of the economic impacts. It is unlikely that there will be a major structural shift in the recreation sector in the near future. In the timber sector, the linkages to the rest of the wood products industry are less certain. There are inadequate data on the linkages between the timber sector and the wood products sector in the Forest Region. The amount of timber harvested on the Forest and delivered to mills in the region is uncertain and subject to rapid change. Also, the wood products industry in New Hampshire and Maine is declining, and projected to decline further in the next decade (Agiropolus and Bartlett, 2003), while it is undergoing rapid change under pressure from other regions and foreign producers. With this in mind, it is quite possible the vitality of the forest products industry in the Forest Region will be more dependent on the externally driven fortunes of wood products manufacturers than on the levels of harvest that come from the Forest. However, within the industry, the Forest's stated niche of providing high quality specialty sawtimber, where the Forest can be a major supplier, can have a significant effect on the regional market.

Another way to consider the information presented in Table 3-102 is to look instead at which industry sectors are impacted by the Forest activities the table describes. This is shown in Table 3-103.

Table 3-103. Total Employment and Income by Major Industry in the Forest Region from Forest Activities.

Industry Sector Affected	Total Employment	Total Income
Agriculture	20	$ 300,000
Mining	0	$ 0
Construction	27	$ 1,000,000
Manufacturing	61	$ 2,200,000
Transportation, Communication & Utilities	33	$ 1,300,000
Wholesale Trade	27	$ 1,200,000
Retail Trade	483	$ 8,500,000
Finance, Insurance, & Real Estate	37	$ 1,000,000
Services	998	$ 17,900,000
Government (Federal, State, & Local)	359	$ 1,300,000
Miscellaneous	5	$100,000
Total	**2,050**	**$ 46,500,000**

Source: U.S. Forest Service IMPLAN Economic Impact Model.

The two largest sectors affected by Forest activities are the retail trade and services sector, which reflects the very large contribution to the total regional income and employment from recreation and tourism. Also, the government sector, which reflects the activities of the Forest Service and the state and local activity resulting from the direct payment made by the Forest Service. The two sectors most affected by timber harvesting are agriculture, which includes forestry services, and manufacturing, which includes pulp, paper, and saw mills. These two sectors are relatively low as a result of the level of timber harvesting on the Forest during the 2000-2003 time period.

Environmental Effects

Methods of Economic Analysis

The economic impact analysis of the four alternatives has been expressed in terms of total jobs and labor income in the Forest Region. The economic linkages associated with specific activities attributed to the Forest Service, or that take place on the Forest, were estimated using an economic input-output model developed with IMPLAN Professional 2.0 (IMPLAN). The IMPLAN model (MIG, 2000) is used not only by the U.S. Forest Service, but also by other government agencies and private organizations to identify and quantify economic linkages within an area. It can also be used to assess the economic effects of specific activities or changes in levels of activities.

The Forest used an IMPLAN model to analyze labor and income impacts associated with the current environment on the Forest. IMPLAN was used to assess the economic effects of management alternatives that assume different levels of activity on the Forest.

Any visitors to the Forest Region who are not using the Forest, or businesses not involved with the use of land within the Forest, are not included in the model. The analysis is designed to focus on the activities that take place on the Forest or as a direct result of Forest activities. After the IMPLAN model determines the economic linkages between the various activities on the Forest, the coefficients that IMPLAN generates are used, in combination with known or forecasted changes to the activity levels, to determine the effects of those activities on the local economy. The model's output is expressed in terms of regional employment and income resulting from the activity levels described through the model inputs.

In order to estimate the economic effect of a particular activity, for example hiking, the methodology involves first estimating how many visitors will hike on the Forest and then determining how much money the average hiker spends per visit. Expenditure profiles are available from local, regional, and national surveys, and detail how much money a typical hiker will spend on such things as fuel for their vehicle to get to and from the trail, food purchased locally at restaurants or in stores while on the trip, supplies purchased, etc. By applying the expected number of visitors for an activity to that activity's spending profile, and spreading that money according to the multitude of sectors and activities accounted for in the model, it is possible to estimate the direct, indirect, and induced economic effects that a known or projected level of visitors will have on the local economy.

Economic Factors and Assumptions Common to All Alternatives

Recreational Growth Trends

Recreation in the Northeast and recreational visitors to the Forest are expected to continue to increase overall throughout the Forest Plan period. Specifically, hiking, Nordic skiing, driving and viewing, road access day use and camping, OHRV use, and snowmobiling are all expected to increase in the Forest Region. Alpine skiing, fishing, and hunting are not expected to grow significantly. These regional trends provide the foundation to the recreation estimates under each of the four alternatives. All alternatives, therefore, include increases in recreation activities when compared with the current situation. Excluding OHRV use, which is not permitted in the Forest at present, the overall average rate of growth in recreation visitor days is 4 percent per year in the Forest Region. This exceeds the average difference of less than 2 percent in total visitor days between the alternatives over the fifteen year planning period. Therefore, changes in regional recreational trends may have a greater influence over the economic impacts of Forest recreation than the choice of the Plan alternative.

Forest Products Industry Structure

The economic impact of timber sales is based on the IMPLAN model and specific inputs concerning the forest products industry in the Forest Region. Notably, the model assumes that on average the economic linkages between where the timber is harvested and the location and type of product produced remains fairly constant over the time period of the Plan. This predictable relationship is common to all alternatives. The analysis of all alternatives is based on an estimate that 90 percent of the wood is harvested by loggers working in the Forest Region, and 60 percent of the total harvest is processed by mills in the Forest Region. These business relationships change over time and will affect the economic impact analysis for the Region. As these input assumptions are constant across all alternatives, the comparison with respect to timber remains valid. However, the absolute number of jobs and dollars of income created may be less reliable over time. Because of this, direct comparisons with other Forest economic activities, such as recreation, are more difficult. The forest products industry in the Forest Region and throughout New England is undergoing rapid change, and predictions are for continued loss of jobs due to structural changes (Argiropolis and Bartlett, 2003). The factors driving these changes are not affected by the alternatives, yet they may have greater effect on the Forest Region's economy than projected changes in employment under any of the alternatives.

WMNF Management Factors

Under all alternatives, the economic impact model assumes that projected timber harvests will be performed at the upper limit of the allowable sale quantity (ASQ). The model also assumes that the budget for employment levels necessary to execute these alternatives will be fully funded.

State and Local Government Factors

State and local governments, as well as the Forest Service, are expected to continue to make road improvements in and around the Forest. The purpose is to improve safety and is not expected to increase traffic levels or visitation. Therefore, it is assumed that there will not be any additional direct economic impacts from these activities under all alternatives.

Alternative 1

Direct and Indirect Effects

The economic impact from Forest activities for Alternative 1 is shown in Table 3-104. Impacts are expressed in terms of a combined total of the direct, indirect, and induced jobs and labor income from the alternative. Alternative 1 has the highest levels of total employment, total labor income, and increases in Forest Service activities and expenditures that result. The largest difference in economic impact for this alternative is presented by the level of timber harvest, with a ceiling of 35 MMBF/year. Recreation increases are projected in hiking, road access day use and camping, Nordic skiing, snowmobiling, as well as the addition of summer OHRV trails.

This alternative has the highest Forest Service revenue, at $4.2 million/year, and the highest payment to states, counties and towns, at $1.0 million/year. These result primarily because this alternative has the highest timber

Table 3-104. Economic Impacts from Forest Activities under Alternative 1.

Forest Activity	Total Employment	Total Income
Recreation	1,795	$ 35,600,000
Payments to States	30	$ 1,000,000
Timber	268	$ 9,100,000
Forest Service Expenditures	401	$ 14,400,000
Total	**2,494**	**$ 60,100,000**

Source: U.S. Forest Service IMPLAN Economic Impact Model.

revenue, at $3.2 million/year. Even so, jobs and income from recreation exceed those of timber harvest and all other Forest activities combined.

The major economic sectors affected by this alternative are shown in Table 3-105. Impacts in manufacturing are expected to occur mainly in the forest products industries, probably at existing locations. However, structural changes occurring in the forest products industries may result in relocation of jobs. The major impacts in terms of both employment and income are found in the service and retail sectors, such as restaurants, accommodations, and stores, because of the dominant role played by recreation visitors in the regional economy. Table 3-105 also underlines the noticeably different levels in compensation between jobs in different sectors. The jobs in the service and retail sectors average $18,300 in labor income per year, while manufacturing, construction, and government jobs average $37,000 per year. In addition, jobs in manufacturing, government, and construction are more

Table 3-105. Economic Impacts for Sectors Impacted by Forest Activities under Alternative 1.

Industry Sector Affected	Total Employment	Total Income
Agriculture	20	$ 400,000
Mining	0	$ 0
Construction	38	$ 1,400,000
Manufacturing	178	$ 6,500,000
Transportation, Communication & Utilities	45	$ 1,800,000
Wholesale Trade	39	$ 1,800,000
Retail Trade	584	$ 10,400,000
Finance, Insurance, & Real Estate	47	$ 1,300,000
Services	1,108	$ 20,600,000
Government (Federal, State, & Local)	421	$ 15,700,000
Miscellaneous	7	$100,000
Total	**2,494**	**$ 60,100,000**

Source: U.S. Forest Service IMPLAN Economic Impact Model.

likely to include benefits and career advancement opportunities. Jobs in services and retail, resulting from increases in recreation, are more frequently seasonal, part-time, and have limited benefits.

Cumulative Effects

Evaluating the economic cumulative effects involves identifying the incremental impacts of Forest Service actions that add to other past, present, and reasonably foreseeable future actions. It is assumed the Forest Service will continue to manage the Forest to preserve its scenic and natural beauty under all alternatives. Therefore, recreation will continue to be a dominant part of the Forest's impact on the Forest Region economy. Because the differences in recreation management on the Forest are not expected to drive significant changes in the number of visitors between alternatives, there is very little difference between the economic impacts of the alternatives with respect to recreation. There are increases assumed in the number of recreation visitors due to OHRVs, however the increases are small compared to overall number of visitors to the Forest. Simply put, the Forest does not forecast significant changes in the numbers of visitors between the alternatives; therefore, there is little difference between the alternatives in terms of changes in the Forest's impact on employment or income attributed to recreation.

Another economically significant area is the timber program, which does offer some noticeable economic differences between the alternatives. However, these differences are more susceptible to external business decisions within the timber industry than by decisions made in revising the Forest Plan. Notwithstanding, for the sake of this analysis it will be necessary to assume that significant changes in the timber industry will be minimal, and trends in the industry will be more reflective of the levels of employment derived from forecasts for these sectors by the states of New Hampshire and Maine.

Another area that was examined was the potential cumulative effect of the Forest's timber program on private timberland owners. One of the conclusions of the Socio-Economic Assessment was that the levels of employment and income in the forest product industry in the Forest Region, beyond the logging subsector, are likely to be affected more by the externally driven fortunes of wood products manufacturers than by the timber cut on the Forest. However, the Forest has the potential to influence stumpage values, particularly in the high quality sawlog market, and consequently could have an effect on private timberland owners. The Socio-Economic Assessment estimated that if the Forest was harvesting at its allowable sale quantity of 35 MMBF/year, as in Alternative 1, the Forest share of the total value of wood harvested in the three county area of New Hampshire would jump from 5 percent experienced in 2001 to closer to 13 percent, and the Forest's share of the volume would increase from 3 percent to 9 percent (High, et al., 2004). It is unclear what the effect of an increase of high quality sawlogs coming from the Forest would have. It is possible that an increase in supply could depress timber values. If this did occur, the magnitude of the effect should not be dramatic due to the relatively low share of the Forest's

contribution in the market. However, it is also possible the market is elastic enough to absorb this additional supply with no appreciable effect on stumpage values.

The economic activity attributed to the Forest more directly relates to the employment and expenditures of the Forest Service itself. This includes the budget that the Forest Service expends in the course of managing the Forest and the number of people it employs, either directly or indirectly. The Forest Service budget and number employees varies between the alternatives only in response to differences in sizes of programs, most noticeably in response to varying levels of planned timber harvest between the alternatives. Since the Forest Service budget category is dependent on the programs it supports, it is more useful to continue to examine the programs themselves.

Under Alternative 1, the segment of the Forest Region's economy that is attributed to the Forest represents 2,494 jobs (Tables 3-104 and 3-105), which account for 1.8 percent of the total jobs and 1.0 percent of the total labor income within the region. It is important recognize this only considers the impacts of visitors to the Forest, and activities on the Forest such as timber harvesting. It does not account for the attractiveness of the mountains and the Forest as a setting for other economic activity that is located near or within sight of the Forest. For example, there is no attempt to quantify what portion of the sale of a second home located near the Forest is actually attributed to the Forest, or what portion of a golf course's revenue is attributed to the Forest because the mountains are part of the course's scenic backdrop. If this kind of accounting were possible, the number of jobs and income attributed to the Forest would undoubtedly grow significantly.

As mentioned above, the distribution of these 2,494 jobs is heavily weighted toward the retail trade and service sectors. In terms of jobs, from 2000 to 2010 these sectors are forecasted to grow by 24 percent in New Hampshire (NH Economic and Labor Market Information Bureau), and by 16 percent in Maine (Maine Department of Labor). According to the same sources, the overall employment in New Hampshire is projected to grow by 18.1 percent, and in Maine by 9.0 percent over the same time period.

Contrast this with the projected slower growth in the manufacturing sector (which includes pulp, paper, and saw mills) of 3 percent in New Hampshire and a projected 6 percent decline in Maine from 2000 to 2010. This presents the possibility that the highest possible level of timber harvest among the four alternatives, Alternative 1's 35 MMBF/year, has the most potential to mitigate this projected slower growth or decline within the manufacturing sector. While 35 MMBF/year is currently only estimated to account for 9 percent of the three county harvest within New Hampshire, the trends in land use and housing permits which are reducing timberland would lead to the conclusion that the percent of timberland under the management of the Forest Service is likely to grow. Hence, the possibility of the importance associated with the timber harvested on the Forest under this alternative in helping to sustain the wood products portion of the industry sector should grow as well.

The consequences of these effects are twofold. First, recreation will continue to dominate in its economic importance of the Forest, and this dominance will continue to be felt most in the service and retail sectors. The service and retail sector jobs will tend to support an entry level and relatively unskilled workforce which does not contribute as positively to the economic prosperity of the region when compared to jobs associated with the manufacturing sector. Second, if there is a consistently reliable supply of higher quality timber harvested at the 35 MMBF/year level, the importance of the timber coming from the Forest will increase over time. Additionally, Alternative 1 has the highest potential to mitigate the forecasted slow growth or declines in the manufacturing sector of all the Alternatives. However, it is important to remember that the uncertainty of the wood products industry associated with international competition and global markets, means considering these as only potential effects, and with a high degree of uncertainty.

Alternative 2

Direct and Indirect Effects

The economic impact from Forest activities for Alternative 2 is shown in Table 3-106. Impacts are expressed in terms of a combined total of direct, indirect, and induced jobs and labor income from the alternative. Alternative 2 has lower levels of total employment and total labor income than Alternative 1. The largest difference in economic impact for this alternative is the lower ceiling on timber harvest, at 24 MMBF/year. Recreation visitor days projected for road access camping are lower than in Alternative 1, because Alternative 1 allows for higher capacity than Alternative 2, and there is no summer OHRV trail use in Alternative 2.

This alternative has lower Forest Service revenue ($3.4 million/year) and lower payment to states, counties, and towns at $0.8 million. These result primarily from this alternative having the lower timber revenue at $2.3 million. Under this alternative, as with Alternative 1, jobs and income from recreation exceed those of all other Forest activities combined.

Table 3-106. Economic Impacts from Forest Activities under Alternative 2.

Total Forest Activity	Employment	Income
Recreation	1,790	$ 35,400,000
Payments to States	23	$ 800,000
Timber	200	$ 6,700,000
Forest Service Expenditures	378	$ 13,200,000
Total	**2,391**	**$ 56,200,000**

Source: U.S. Forest Service IMPLAN Economic Impact Model.

The major economic sectors affected by this alternative are shown in Table 3-107. Major impacts in terms of employment and income are found in the service and retail sectors as in Alternative 1. In other respects, observations made about Alternative 1 also apply.

Table 3-107. Economic Impacts for Sectors Impacted by Forest Activities under Alternative 2.

Industry Sector Affected	Total Employment	Total Income
Agriculture	26	$ 400,000
Mining	0	$ 0
Construction	35	$ 1,300,000
Manufacturing	144	$ 5,200,000
Transportation, Communication & Utilities	43	$ 1,600,000
Wholesale Trade	37	$ 1,700,000
Retail Trade	571	$ 10,200,000
Finance, Insurance, & Real Estate	44	$ 1,200,000
Services	1,087	$ 20,000,000
Government (Federal, State, & Local)	397	$ 14,500,000
Miscellaneous	7	$100,000
Total	**2,391**	**$ 56,200,000**

Source: U.S. Forest Service IMPLAN Economic Impact Model.

Cumulative Effects

The most significant economic difference between Alternative 1 and 2 is that maximum level of timber harvest drops from 35 MMBF/year in Alternative 1 to 24 MMBF/year in Alternative 2. The cumulative effects will be the same as Alternative 1, with the exception that the potential economic importance associated with the timber harvest will be somewhat less than what is expected in Alternative 1. It is not clear if there are any threshold levels of harvest on the Forest which will serve as catalysts for changes in the timber and wood products industry. Since 24 MMBF/year is above recent harvest levels on the Forest, it is expected that stabilizing the levels at this ASQ will have an improved cumulative effect when compared to current, but less than what is projected under Alternative 1. This alternative has a slightly lower potential to mitigate forecasted job losses in the manufacturing sector than Alternative 1, but better potential than current.

Alternative 3

Direct and Indirect Effects

The economic impact from Forest activities for Alternative 3 is shown in Table 3-108. Impacts are expressed in terms of a combined total of direct, indirect, and induced jobs and labor income from the alternative. Alternative 3 has the lowest levels of total employment and total labor income of all the alternatives, and the lowest levels of Forest Service activities and

Table 3-108. Economic Impacts from Forest Activities under Alternative 3.

Forest Activity	Total Employment	Total Income
Recreation	1,790	$ 35,400,000
Payments to States	16	$ 500,000
Timber	121	$ 4,200,000
Forest Service Expenditures	376	$ 13,200,000
Total	**2,303**	**$ 53,300,00**

Source: U.S. Forest Service IMPLAN Economic Impact Model.

expenditures as a result. The largest difference in economic impact for this alternative is the result of the ceiling for the timber harvest, set at 18 MMBF/year. Recreation visitor days projected for road access camping are also lower than in Alternative 1, and there is no summer OHRV trail use.

This alternative has the lowest Forest Service revenue, at $2.4 million/year, and the lowest payment to states, counties, and towns at $0.5 million/year. These result primarily from the fact that this alternative has the lowest timber revenue, at $1.3 million/year. Under this alternative, as with Alternative 1 and 2, the jobs and income from recreation exceed those of all other Forest activities combined.

The major economic sectors affected by this alternative are shown in Table 3-109. The major impacts in terms of both employment and income are found in the service and retail sectors, as in Alternative 1 and 2. In other respects, the observations made about Alternative 1 also apply.

Table 3-109. Economic Impacts for Sectors Impacted by Forest Activities under Alternative 3.

Industry Sector Affected	Total Employment	Total Income
Agriculture	26	$ 400,000
Mining	0	$ 0
Construction	32	$ 1,200,000
Manufacturing	102	$ 3,800,000
Transportation, Communication & Utilities	40	$ 1,500,000
Wholesale Trade	34	$ 1,600,000
Retail Trade	564	$ 10,000,000
Finance, Insurance, & Real Estate	42	$ 1,100,000
Services	1,070	$ 19,500,000
Government (Federal, State, & Local)	387	$ 14,100,000
Miscellaneous	6	$100,000
Total	**2,303**	**$ 53,300,000**

Source: U.S. Forest Service IMPLAN Economic Impact Model.

Cumulative Effects

This alternative sets the lowest ceiling of the four alternatives' allowable sale quantity, at 18 MMBF/year. While this is slightly higher than the most recent years of actual harvest, it will have the least potential to mitigate the slow growth or possible declines in income and jobs forecasted in the in the industry sector.

Of the additional lands proposed for Wilderness designation, about 16,200 acres would be removed from General Forest Management land (MAs 2.1 and 3.1) that currently permits timber harvesting. The loss of these lands precludes some salable timber as well as developed recreation expansion, another potential source of revenue. The Forest projects that visitation to any newly designated Wilderness areas would not expand appreciably beyond the growth in backcountry camping and hiking expected for other non-Wilderness semi-primitive non-motorized recreation areas. The economic cumulative effects would, therefore, be a case of foregone opportunities for the potential expansion of the timber program and creating more developed recreation sites.

Alternative 4

Direct and Indirect Effects

The economic impact from Forest activities for Alternative 4 is shown in Table 3-110. Impacts are expressed in terms of a combined total of direct, indirect, and induced jobs and labor income from the alternative. Alternative 4 is between Alternative 1 and 2 in levels of total employment and total labor income. In this alternative, the ceiling of timber harvest is set at 30 MMBF/year. Recreation visitor days projected for road access camping are higher than in Alternative 1, but with lower OHRV trail use than forecasted in Alternative 1.

Table 3-110. Economic Impacts from Forest Activities under Alternative 4.

Forest Activity	Employment	Income
Recreation	1,798	$ 35,600,000
Payments to States	24	$ 800,000
Timber	211	$ 7,200,000
Forest Service Expenditures	393	$ 14,000,000
Total	**2,426**	**$ 57,600,000**

Source: U.S. Forest Service IMPLAN Economic Impact Model.

This alternative has intermediate levels of Forest Service revenue, at $3.6 million/year, and payment to states, counties, and towns at $0.8 million/year. These result primarily from this alternative having timber revenue at $2.5 million/year, which is less than Alternative 1. Under this alternative, as with Alternative 1, the jobs and income from recreation exceed those of all other Forest activities combined.

The major economic sectors affected by this alternative are shown in Table 3-111. The major impacts, in terms of both employment and income, are found in the service and retail sectors as in Alternative 1. In other respects, the observations made about Alternative 1 also apply.

Table 3-111. Economic Impacts for Sectors Impacted by Forest Activities under Alternative 4.

Industry Sector Affected	Total Employment	Total Income
Agriculture	26	$ 400,000
Mining	0	$ 0
Construction	36	$ 1,300,000
Manufacturing	149	$ 5,500,000
Transportation, Communication & Utilities	43	$ 1,700,000
Wholesale Trade	37	$ 1,700,000
Retail Trade	578	$ 10,300,000
Finance, Insurance, & Real Estate	45	$ 1,200,000
Services	1,096	$ 20,300,000
Government (Federal, State, & Local)	408	$ 15,200,000
Miscellaneous	7	$100,000
Total	**2,426**	**$ 57,600,000**

Source: U.S. Forest Service IMPLAN Economic Impact Model.

Cumulative Effects

The cumulative effects described in Alternative 1 apply for Alternative 4, with the exception that this alternative has a slightly lower harvest ceiling of 30 MMBF/year and, subsequently, a slightly lower potential to mitigate forecasted slow growth or declines in the manufacturing sector. Nonetheless, this alternative provides a significantly higher potential to mitigate the forecasted slow growth or declines in the manufacturing sector than Alternative 3.

Financial and Economic Efficiency

The financial and economic efficiency analysis provides a mechanism for evaluating the Forest's overall value to the nation after considering all outputs (benefits) less all of the associated Forest Service inputs (costs) on the Forest. The criterion used in this analysis is the Net Present Value (NPV) of all goods and services provided by the Forest. As a point of clarification, NPV can be used interchangeably with Present Net Value (PNV). NPV is the difference between the discounted value (benefits) of all outputs to which monetary values or established market prices are assigned and the total discounted costs of managing the Forest. In other words, costs are subtracted from benefits to yield a net value. These costs and benefits are projected 100

years into the future, and discounted using a 4 percent discount rate. In this case, the discount rate can be considered as an interest rate used to determine the present value of these future cash and value flows on the Forest. A discount rate of 4 percent is commonly used in public policy analysis. All monetary values are expressed in constant dollars.

The NPV estimation is required by the National Forest Management Act (NFMA) (36 CFR 219). The planning regulations require the consideration of economic efficiency when estimating effects of the alternatives and in evaluating alternatives. Benefits for outputs such as timber are estimated using stumpage values of the expected harvest amounts under each of the alternatives. Benefits from recreation and tourism are estimated from expenditure profiles for various recreational activities.

Financial efficiency is different from economic efficiency in that it considers only activities that generate revenues. Financial efficiency considers how well the dollars invested in each alternative produce revenues to the agency (Table 3-112).

Table 3-112. Financial Efficiency of the White Mountain National Forest Alternatives.

Revenues / Costs / NPV*	**Alternatives ($ 1,000)**			
	1	**2**	**3**	**4**
1st Decade Program Revenues	50,893	41,082	30,418	43,114
1st Decade Program Costs	126,050	115,690	115,260	122,660
1st Decade Net Revenues	-75,157	-74,608	-84,842	79,546
Market Cost & Revenue NPV *	**-180,600**	**-177,177**	**-198,722**	**-187,989**

* Net present value (NPV) calculated over a 100 year period using an annual discount rate of 4%.

Economic efficiency adds benefits in excess of cash flows. It considers how well the dollars invested in each alternative produce benefits to society and address some benefits that are not included in the marketplace (actual dollar transactions do not take place). Economic values for several common recreational activities were determined as part of a 1990 Resources Planning Act Program by the Forest Service's Washington Office, and subsequently have been updated to present-day dollars. These values reflect the market clearing price for recreation activities on the Forest. Some outputs and benefits, such as biological diversity and visual quality, do not have assigned monetary values, and therefore are considered as part of the non-priced benefits of the alternatives.

The initial result of the economic efficiency analysis, which combines assigned values with market values, indicates that Alternative 2 is the most efficient of the alternatives. This alternative combines the efficiencies associated with a moderate increase in the timber program. Alternative 4 generates only marginally more revenue from timber than Alternative 2, due to a higher percentage of harvest in lower value stands found in Alternatives 1 and 4. Alternative 2 also does not incur the additional expenses associated with creating the more developed recreation programs found in Alternatives 1 and 4 (Table 3-113).

Table 3-113. Economic Efficiency of the White Mountain National Forest Alternatives.

Assigned Values / Costs / NPV*	Alternatives ($ 1,000)			
	1	2	3	4
Assigned Value NPV	2,456,634	2,462,731	2,464,101	2,467,385
Market Cost & Revenue NPV	-180,600	-177,177	-198,722	-187,989
Economic Net Present Value*	**2,276,034**	**2,285,553**	**2,265,379**	**2,279,396**

*Net present value (NPV) calculated over a 100 year period using an annual discount rate of 4%

Effects on Non-priced Benefits

The Forest provides numerous benefits that are difficult to assign a dollar value to or to estimate their worth to the public. However, after visiting the Forest, most people would agree they include some of the most valuable benefits that the Forest provides the public and the environment. Because these benefits are often based on a person's individual perception and their experiences, any attempt to describe them will usually fall short of addressing them adequately. There are also tangible products and benefits that the Forest provides, such as clean water to supply municpal watersheds that are recognized but are not easily measured on a monetary basis. Notwithstanding, the preceeding sections detail many of these benefits which ultimately need to be included in an economic efficiency analysis. Since an economic efficiency analysis extends the economic perspective to include the costs and benefits to the society-at-large perspective, one should evaluate these benefits that are not prescribed a monetary value. Through careful management, the Forest Service strives to preserve and enhance benefits as part of its mission in serving the public.

Conclusions

The economic impacts analysis of the four alternatives has been expressed in terms of total jobs and labor income in the Forest Region. A summary of the differences between alternatives is shown in Table 3-114.

Table 3-114. Summary of the Economic Impacts of Four Alternatives

	Current		Annual Average – Decade 1			
Economic Indicator	**Area Totals**	**Forest Portion***	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Employment						
Total (jobs)	139,538	2,051	2,494	2,390	2,303	2,426
% of Area Totals	100%	1.5%	1.8%	1.7%	1.7%	1.7%
% Change from Current*	—	—-	21.6%	16.6%	12.3%	18.3%
Labor Income						
Total ($ million)	$5,720.9	$46.5	$60.1	$56.2	$53.3	$57.6
% of Base	100%	0.8%	1.0%	1.0%	0.9%	1.0%
% Change from Current*	—	—	29.2%	20.8%	14.7%	24.0%

*Current reflects 2000-2003 averages for employment, income and timber harvested.

Results indicate that the total economic impact of the Forest on the Forest Region is relatively small, about 0.8 percent in terms of income and about 1.5 percent in terms of jobs. In addition, there are only small differences in overall impacts among the alternatives. Overall, economic impacts from recreation exceed all other economic impacts combined. Furthermore, the presence of the White Mountain National Forest is a major attraction for visitors who use state parks and commercial recreation facilities in the Forest Region. Recreation is expected to continue to grow throughout the Forest Region over the Plan period.

The loss of land dedicated to producing commercial timber, and the increasing number of terminal harvests (trees cut for development that will never revegetate) appears to be a continuing trend off-Forest (Thorne and Sundquist, 2001). This has implications for the Forest in that the economic importance of its land that permits timber management will likely continue to rise. This assumes the demand for wood products increases also, and that the supply is not replaced completely by more remote sources, either nationally or internationally.

There are a number of uncertainties in projecting future impacts in all sectors, with significant uncertainty in the timber sector. This is due to the changing structure of the forest products industry in the New England Region. Differences in economic impacts between alternatives may be smaller than the range of uncertainty that exists in projecting the overall economic impacts of Forest activities over the fifteen year life of the Forest Plan.

The economic impact analysis of the alternatives using the IMPLAN model captures only part of the economic benefits that the Forest brings to the region. Many of these additional benefits are intangible, but nonetheless have well recognized effects. As was described in the non-priced benefits section, the Forest Service, through its management practices, protects water quality, air quality, wildlife, ecosystem diversity, and scenic attractiveness that enhances property values and underpins economic development throughout the Forest Region and beyond. These benefits are common to all alternatives.