Chapter 3 Affected Environment and Environmental Consequences

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3.1 INTRODUCTION TO AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1.1 Chapter Purpose and Organization

Chapter 3 describes the existing physical, biological, social, and economical resources of the environment that may be affected by the alternatives presented in Chapter 2. It also presents the effects that the alternatives may have on those resources. The discussion of affected environment and environmental effects was combined into one chapter to provide a clear picture of what the resources are, and what could happen to them under the different alternatives. The analysis of environmental effects provides the basis for the comparison of alternatives that appears at the end of Chapter 2. This Introduction, Section 3.1, prefaces the context in which the alternatives are analyzed and has seven parts:

Social and Economic Setting – Gives a brief overview of the key social and economic components of the area.

Physical and Biological Setting – Gives a brief overview of the key physical and biological components of the area.

Ecosystem Management – Presents the ecosystem management framework that was used in the development of alternatives and the analysis of resources and issues in Chapter 3. This section also introduces the reader to key components and concepts of the ecosystem management framework.

Laws, Regulations, and Policies – Describes the primary applicable laws, regulations, and policies that provide the legal framework for the various resource areas covered in this chapter.

Analysis – Outlines the different scales and units used in the analysis. Some methods used in the analysis are also summarized.

Relationship between Programmatic and Site Specific Analysis – Describes the difference between the analysis for the revised Forest Plan alternatives and site-specific projects.

Affected Environment and Environmental Consequences Section Organization – The remainder of Chapter 3 is organized by resource, focusing on those resources related to issues described in Chapter 1.

3.1.2 Social and Economic Setting

The Green Mountain National Forest (GMNF) is located in central and southern Vermont in Addison, Bennington, Rutland, Washington, Windham, and Windsor counties. The Forest runs along the spine of the Green Mountains and contains portions of the Taconic Range. It provides the scenic backdrop for much of southern and central Vermont. The area is rural with numerous farms and forest lands intermixed with low-density, rural residential development, and small historical villages, towns, and cities. The area has numerous scenic natural resources such as lakes, rivers, mountains, streams, waterfalls, rock faces, cliffs, and a prominent ridgeline. Area town populations range from approximately 5 to more than 17,000. The City of Rutland is located ten miles from the GMNF, between the North Half and South Half of the Forest, and is the largest community in the area with a population of more than 17,000.

Outdoor recreation opportunities, wildlife habitats, aquatic habitats, natural resource education and enjoyment, forest products, and large expanses of forested landscapes are provided by the GMNF. These benefits are enjoyed by residents and visitors. The over 400,000-acre GMNF is a significant component of the rural communities in which it is located and an important resource to

adjacent communities. Communities with National Forest System (NFS) lands recognize the benefits but also feel the impacts of forest use and loss of local tax revenues. These benefits and impacts make community relationships and desires an important aspect of forest management.

Historical Setting

The lands making up the Green Mountain National Forest have been part of the cultural landscape since the glaciers melted more than 10,000 years ago. Interactions between people and nature have kept mountain ecosystems and landscapes evolving ever since.

Native American people, the "Original Vermonters" (Haviland and Power 1994), were dependent on the bounty of nature. Their relatively small, seasonally mobile populations and adaptive technologies allowed them to have a light touch on the land for several millennia until Abenaki and Mohican ancestors adopted an agricultural lifestyle 2,000 years ago. The Abenaki claimed most of what is now Vermont, while the Mohican considered most of the upper Hudson drainage, or present Bennington County, to be their territory.

In the century following Champlain's 1609 "discovery" of interior New England and Lake Champlain, European explorers, traders, missionaries, and settlers converged on the Green Mountains from the north (French), west (Dutch), and south and east (English). Subsequent generations of settlers shared some of the same values as indigenous Native people, but they also saw the mountains as a source of timber, charcoal, iron ore, gravel, pasture, orchard lands, clean water, water power, and, most recently, recreation opportunities.

The introduction of new diseases, economic systems, military conflicts, religious beliefs, and technologies threw indigenous peoples' societies into turmoil. Ultimately, the Mohican were forcibly moved to reservation life in the late 18th century, enduring several moves over a number of decades before finally arriving on their present Wisconsin reservation in the 1860s. A core Abenaki community has remained in or near Missisquoi, one of their traditional villages (Swanton, VT), and over the last 25 years there has been a renaissance of Abenaki cultural values and tribal pride across the State.

In the lands that are on, or near, what is now the National Forest, French and English exploration and limited homesteading occurred in the 1600s and 1700s. Permanent settlement increased dramatically after the conclusion of the French and Indian War and American Revolution in the late 18th century. In the early 19th century, farming and lumbering were the chief sources of income, and iron mines, mills, and charcoal kilns were well represented in the working landscape. The mid-19th century saw the introduction of the railroad to Vermont, and an agricultural transition from subsistence farming to sheep and then to dairy production, while logging continued to be an important economic pursuit. Between the Civil War and the Great Depression there was widespread abandonment of upland farms, based on a combination of changes in markets, demographics, agricultural technology, and transportation systems. The early 20th century marked an increase in tourism and recreation.

By 1900 the landscape was open, having been logged, mined, roaded, grazed, and/or farmed for over a century. This created a new landscape whose aesthetic reflected an agrarian economy, but masked the affect these land-uses had taken on soils, wildlife habitat, and water quality. In essence, both the ecosystems and landscapes characterizing the Green Mountains had changed from a stable, mature forested watershed to a productive/extractive working landscape.

The creation of the Green Mountain National Forest is a story set in this larger context of late 19th century land-use patterns and the rise of the conservation movement as a response. Key characters in the conservation movement such as Gifford Pinchot, John Muir, and George Perkins Marsh (of Woodstock, VT) had promoted the need for

conservation practices prior to the turn of the century. Their advocacy helped pave the way for a series of federal Acts which created the National Forest System. The 1891 Forest Reserve Act allowed the president to create forest reserves from public domain lands, and the subsequent Forest Management (or "Organic") Act of 1897 established a structure for managing the preserves, stipulating that management promote forest protection, watershed protection, and timber production.

During the first few years of the new century, the increased intensity of floods and forest fires in the eastern US were attributed in part to poor land management practices. This led to the passage of the Weeks Act (1911), which authorized the federal government to purchase land to establish new National Forests (with States' consent), largely as a measure to protect headwaters of navigable streams and to prevent wildfires.

In Vermont, the years during and immediately following World War I saw a continuation of the exodus of young people from upland farms and the consolidation of large tracts of land by lumber and paper companies. By the early 20th century, the State reflected the pattern of farm and village abandonment characteristic of western New England's hill and mountain towns generally. By and large, logging practices on newly consolidated lands were poor, resulting in soil erosion, stream degradation, and forest fires. As a result, the State of Vermont asked the National Forest Reserve Commission in 1925 to evaluate the potential for establishing a national forest.

The perceived need for a national forest was further heightened following the great flood of 1927. This cataclysmic event, made worse by the State's denuded uplands and damaged watersheds, washed away much of Vermont's lower elevation infrastructure, causing $35,000,000 in damages. In response, State politicians lobbied the Commission and received approval to proceed with evaluations in 1928. Surveyors established political boundaries in 1929; likely sellers began to be identified in 1930; and Herbert Hoover signed the proclamation establishing the Green Mountain National Forest in 1932.

Although the creation of the GMNF had its genesis largely in environmental concerns (and protection of the downstream infrastructure), its creation coincided with the Great Depression. As a result, New Deal policies directly benefited the newly formed Forest. Federal money for jobs, capital, and construction flowed to the GMNF, largely in the form of support for the Civilian Conservation Corps (Douglass 1990).

Initial Forest acquisitions were proposed to be 370,000 acres, divided into two Districts, but national economic concerns, as well as local political resistance, reduced the initial purchase to 102,000 acres. This reduction in scope was reversed in 1934, and acquisition of lands from the large Battell estate (held in trust by Middlebury College) began. Thus, the original lands acquired by the GMNF were located on the southern unit (the present Manchester District) and were purchased from the estates of Silas Griffith and Marshall Hapgood (who had offered a significant portion of upland holdings to create a Forest Reserve as early as 1905).

By 1933 two Civilian Conservation Corps (CCC) camps – in Peru and Danby – had been established, and in 1934 another was developed in Rochester. These crews undertook projects on the fledgling Forest that would characterize CCC and Forest Service activities for decades: constructing recreation facilities, trails, roads, buildings, fire towers and water-control dams; fire fighting; logging; and extensive erosion-control tree planting.

Social Setting

The social setting of an area can be described through demographics such as population, education, and housing; community stability; lifestyles; values; and social organization. National Forest System lands are located in 53 towns in six counties. The combined population of the six counties is 296,041 and makes up 49 percent of the State of Vermont's population (US Census 2000). The population has increased by more than 5 percent in the past 10 years, is predominantly white (>96%), just over 50

percent are native born Vermonters, and more than 60 percent live in the same house as they did in 1990 (US Census). Approximately 19 percent of the dwelling units are seasonal homes.

There are a number of post-high school educational institutions in the six counties adjacent to the GMNF, including: Bennington College, Middlebury College, Marlboro College, Castleton State College, and Norwich University. In addition, there are notable institutions of higher learning within an hour of the area including Dartmouth College and the University of Vermont. Approximately 29 percent of those over the age of 25 living in the six counties have a bachelor's degree or higher. Towns are responsible for secondary and primary school education and most towns have their own elementary school.

In Vermont, land use planning has a multi-layered system. Towns, regional commissions, and the State are responsible for creating land use plans that are compatible. Town government is responsible for zoning, but the State also has a Land Use and Development Law (Act 250) that regulates development on projects of a certain size. All regional planning commissions in the area have regional plans, and most of the towns in the area have adopted town plans. Goals and objectives in regional and town plans are a good indication of community values and attitudes. The regional and town plans contain goals and objectives relating to a number of topics including: agriculture and forestry, economic development, education, natural resources, recreation, historic and cultural resources, housing, infrastructure, and transportation.

The focus on town government, planning, education, and culture is born of, and continues to perpetuate, a strong sense of community in Vermont towns. The setting of small villages and towns surrounded by a rural and scenic landscape also contributes to the sense of place that knits local communities together. People care deeply about their communities and the land in which they are located.

Economic Setting

The economic setting of an area can be described through income, employment, types of businesses, property values, and tax burden. The six county area containing NFS lands is economically comparable to the State of Vermont as a whole. The average annual per capita personal income (PPCI) for 1999 for the six counties was $20,604. Windsor County had the highest PPCI, $22,369 and Rutland County had the lowest, $18,874. The PPCI for Vermont in 1999 was $20,625.

In 2000, the dominant occupation in Vermont, comprising 36 percent of all employed, was Management, Professional, and Related jobs. Technical, Sales, and Office jobs was the second dominant category with 25 percent, Construction, Production, Labor, and Transportation was third with 23 percent, Service was fourth with 15 percent, and Farming, Forestry, and Fishing was last with 1 percent of all employed. Addison, Bennington, Rutland, Washington, Windham, and Windsor counties were similar to the State with Management, Professional, and Related occupations being the dominant occupations with 36 percent, Technical, Sales, and Office second with 25 percent, Construction, Production, Labor, and Transportation third with 22 percent, Service fourth with 16 percent, and Farming, Forestry, and Fishing was last with 1 percent of all employed. Employment by industry shows the Service industry to be the leading employer in Vermont and the Mining industry to employ the least. The highest employment by industry in the six counties was also the Service industry with 34 percent of full and part-time employment, and the Mining industry employed the least with less than 1 percent. The 2002 unemployment rate for the six counties was less than 5 percent in all counties with the lowest rate in Windham County (2.7%) and the highest rate in Bennington County (4.6%). The State of Vermont's unemployment rate for 2002 was 3.7 percent.

Housing values in the six counties are comparable to those in the State. The 2000 median house value for Vermont was $111,500. Median housing values in the six counties ranged from a high of $116,200 in Addison County to a low of $97,200 in Rutland County. The percentage of housing units that are for seasonal use is slightly higher in the six counties (18%) than it is for the State of Vermont (15%) which is much higher than the Northeast (4%).

The GMNF contributes to the area's overall economy through employment and program spending. Timber harvests provide economic benefit to local mills and processing facilities, and recreation programs provide benefit to the tourism industry in the area. The economy also benefits from NFS lands through values that are associated with the existence of public lands in an area, such as recreational opportunities, open space, wildlife habitats, clean water, and aesthetics.

3.1.3 Physical and Biological Setting

In a global context, the Green Mountains sit within the temperate deciduous forest biome (global ecological communities), which covers much of eastern North America, western Europe, and eastern Asia. The National Hierarchical Framework of Ecosystem Units (Cleland et al. 1997) classifies and maps ecological units based on associations of different factors. These factors include climate, topography, soils, water, and potential natural communities.

Keys et al. (1995) applied the national ecological framework to the Eastern United States down to the subsection level. The GMNF sits within the Warm Continental Division, with most of the Forest within the Mountain portion of this division. Divisions are represented more locally by broad recognizable ecoregions. The mountains of New England and the GMNF are associated with the Adirondack-New England Mixed Forest-Coniferous Forest-Alpine Meadow Province. This province is divided into sections representing the different large mountain ranges, with the Green Mountains, Taconics, and Berkshires combined into one section. This section is divided into three subsections on the GMNF representing the southern and northern Green Mountains, and the Taconic Mountains (Figure 3.1-1). A small portion of the Forest along the northwestern edge falls within the Champlain and St. Lawrence Valley section in the hierarchy, and represents the transition between the mountainous and non-mountainous regions of the Warm Continental Division.

Landscape Characterization

Land type associations (LTAs) are broad ecological categories that describe landscapes associated with a particular subsection. LTAs reflect differences in geomorphology, surficial geology, elevation, relief, and potential natural vegetation. Each LTA for the GMNF consists of one of the seven general landscape types nested within at least one of the four ecological sub-sections that occur on the Forest (Burbank et al. 1999). For example, the Valley Bottom general landscape forms a separate LTA in each of the four subsections where it occurs. LTAs on the GMNF include 18 unique permutations of seven general landscape types and four ecological subsections that are found on the Forest: Each LTA is characterized by its potential natural vegetation (PNV), which is the assemblage of plants that would form over time, given the prevailing climatic conditions and historical disturbance regimes.

Working farm and forest

Green Mountain National Forest LTAs:

Valley bottom – alluvial or glacio-fluvial substrates associated with rivers, generally below 1,500 feet elevation. PNV consisting mostly of hemlock forests mixed with beech, maples, birches, and oaks. There is very little of this LTA on the Forest, although it occurs in four subsections. This LTA is found in all subsections of the GMNF.

Low mountain/small hill – transitional, low- to moderate-relief landscapes between the Green Mountains and its foothills, and along the perimeter and low slopes of the mountains, generally between 600 and 2,400 feet in elevation. PNV is northern hardwoods, primarily beech, with maples, hemlock, and birches. This LTA is found in all the mountain subsections of the GMNF.

Mountain slope – steep, high-relief terrain along the slopes of major mountains and mountain ranges, generally below 2,400 feet elevation. PNV is a mixture of spruce and beech; maples, hemlocks, and birches are less dominant. This LTA is found in all the mountain subsections of the GMNF.

Upper mountain slope – steep slopes with high relief, shallow soils, and rocky outcrops, above 2,400 feet elevation. This landscape is also characterized as the subalpine zone. PNV consists primarily of spruce and fir; birches are common but beech and maple tend not to be. This LTA is found in all the mountain subsections of the GMNF.

Alpine – thin to non-existent soils and harsh climatic conditions above 3,500 feet elevation. PNV is krummholz (small-stature spruce and fir) and alpine meadow. This LTA is found only in the Northern Green Mountains subsection.

Escarpment – a series of cliffs and steep slopes dividing the Green, Taconic, and Berkshire Mountain Section from the Champlain and St. Lawrence Valley Section in the north, and dividing the Taconic Mountains from the Green Mountains in the south. PNV consists primarily of hemlocks and pines mixed with oaks and northern hardwoods. This is the LTA on the Forest where oak is most likely to be found. This LTA is found only in the Northern and Southern Green Mountains subsections.

Precambrian Plateau – low-relief landscape dominated by resistant, acidic, Precambrian bedrock at elevations around 2,500 feet. PNV includes northern hardwoods and softwoods of spruce, fir, and hemlock intergrading at small scales. Many of the wetlands and high elevation ponds on the GMNF fall within this LTA. This LTA is found only in the Northern and Southern Green Mountains subsections.

Air Resources

The GMNF is located northeast and downwind of the industrialized Ohio River Valley. This industrialized area produces the greatest amount of air pollution in the US. Pollutants also originate in the Green Mountain region and include emissions from motor vehicles, aircraft, railroads, homes, offices industry, and agricultural tilling. The current condition of air quality on the GMNF is described in the Green Mountain and Finger Lakes Air Quality Assessment Package (Sams 2002). As described in this assessment, the Forest has some of the best air quality in the nation (Sams 2002) as evidenced by Vermont meeting the ambient air quality standards for all pollutants regulated by EPA.

Despite this, the Forest experiences moderately high deposition of sulfates, nitrates, and mercury especially at mid-to-higher elevations on the GMNF (Sams 2002). This deposition is of concern because the naturally acidic soils on the Forest have a limited ability to buffer the effects of atmospheric pollutants. The effects of

atmospheric deposition on the GMNF have been studied since the 1980s, initially by the State of Vermont Agency of Natural Resources, and the USDA Forest Service Northeastern Research Station. These agencies continue to study these effects today, much of it coordinated with the Vermont Monitoring Cooperative

Based on monitoring conducted on the GMNF and other sites in the Northeast, air pollutants may pose a risk to forest health (Sams 2002, Tetra Tech 2003). The most important, well-documented impacts are:

- Air-borne particulate matter has decreased visibility on the GMNF by 25-50 percent when compared against estimates of natural visibility (Sams 2002).
- Several high elevation ponds on the Forest are classified as impaired by the State of Vermont due to the effects of atmospheric deposition (Donna 2004).
- Due to mercury contamination in fish, various states, including Vermont, have issued advisories alerting the public to the health risks of consuming too much fish from local waters (Sams 2002).

1927 Glastenbury mountain fire lookout, photo courtesy of David Lacy

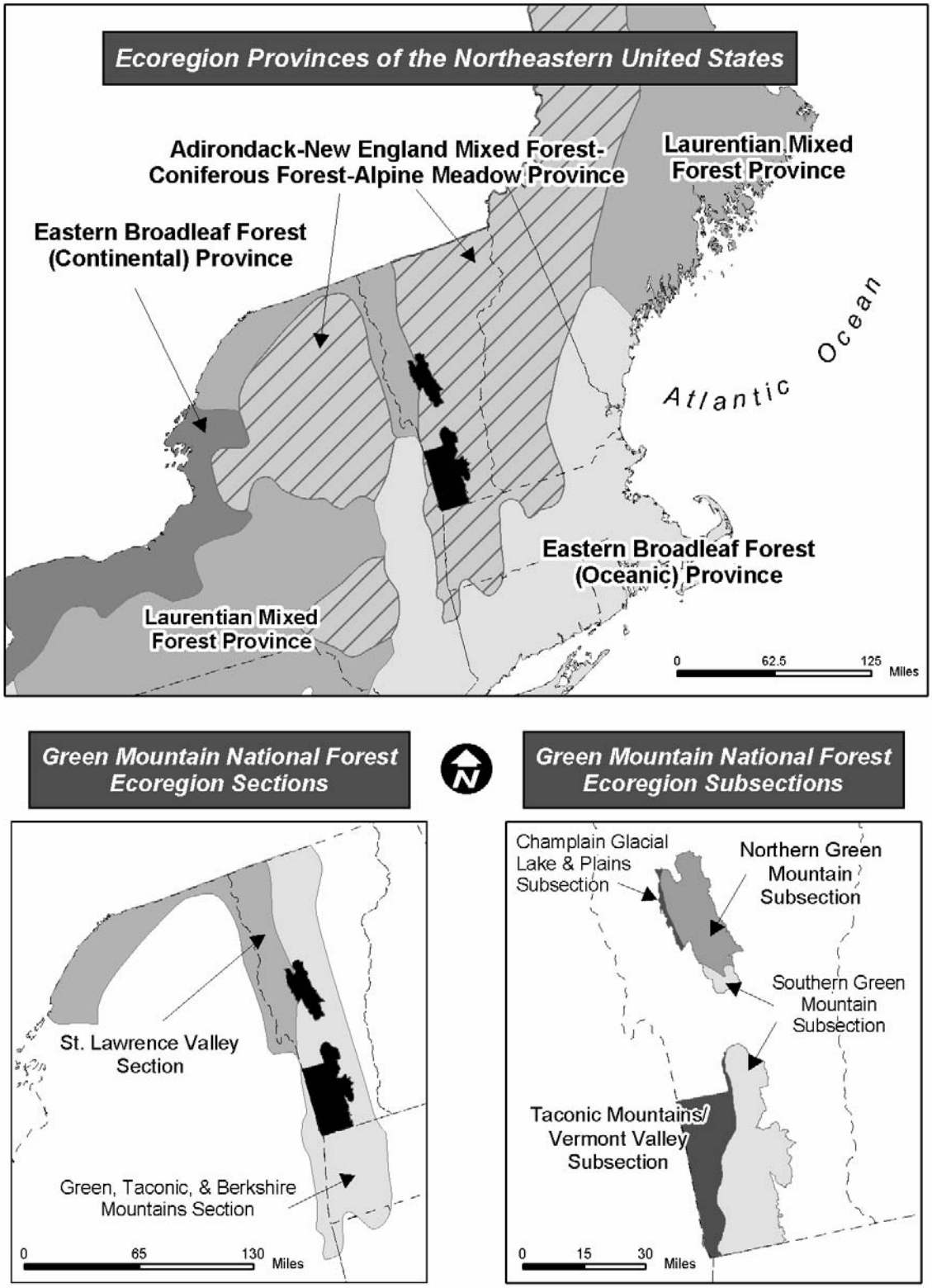

Figure 3.1-1: Ecological Units in the Northeastern United States and the Green Mountain National Forest

Aquatic Resources

The GMNF is draped over the southern and central Green Mountains and the northern Taconic Mountains. About half of the land drains to the east toward the Connecticut River, while the other half drains west toward Lake Champlain and the Hudson River. The Lake Champlain, Hudson, and Connecticut River watersheds are the three major watersheds on the Forest. Within these watersheds, the Proclamation Boundary of the Forest and Appalachian Trail Corridor are together comprised of 63 12-digit (HUC 12) subwatersheds, ranging in size from 10,000 to 50,000 acres. Average annual precipitation is 52 inches on the south half of the Forest and 46 inches on the north half. Estimated water yield for the GMNF is 939,881 acre-feet annually (323,350 ac. ft. on the north half, 616,530 ac. ft. on the south half; Randall 1996).

The Forest includes 900 miles of perennial streams and a large number of intermittent or seasonal streams. Drainage patterns for these streams are generally dendritic and characterized as having moderate to steep gradients with rapidly moving water. There are almost 400 waterbodies on the Forest, around half of which are at least an acre in size, but only 30 of which are at least 10 acres in size. There are also a large number of wetlands of various types and sizes, accounting for approximately 6,400 acres. Wetlands are formed in riparian areas along streams, at the heads of drainages, and in flat or concave landforms like benches and depressions.

Source protection areas and well head protection areas (areas of drinking water sources used by municipalities and/or private individuals) require protection in order to maintain the highest water quality standard. There are 27 such protection areas that are totally or partially within National Forest ownership. There is also one pond that is used for snow-making.

Aquatic habitats on the GMNF include a range of low to high-elevation streams, ponds, lakes, and reservoirs that provide both cold-water and warm-water habitats for a variety of native and introduced fish, macro-invertebrates, and amphibians. High-elevation streams generally support brook trout, slimy sculpin, and blacknose dace. Larger streams at moderate and low elevations commonly support longnose dace, white sucker, creek chub, common shiner, tessellated darter, fallfish, rainbow trout, brown trout, and Atlantic salmon. Most ponds provide cold-water habitat for native brook trout, although little or no natural reproduction occurs there. Grout and Wallingford ponds provide warm-water habitat for species such as smallmouth bass, chain pickerel, yellow perch, and brown bullhead. Large reservoirs on or near the Forest, such as Chittenden, Somerset, and Harriman, support both cold and warm water fisheries.

Terrestrial Resources

The Green Mountain National Forest lies within the highly metamorphosed and mineralized Green Mountains. Deposits of marble, limestone, dolomite, ultramafic and pematitic rocks, and natural gas are known from the Forest (Romito 2004), but usually do not occur in commercial quantities. Gold deposits have been known since the 1850s in Vermont but have always been relatively small, erratically occurring, and economically marginal deposits. Stream and glacial deposits of sand and gravel occur, especially along stream valleys and lowland areas. There are no known large deposits on the Forest and the sand and gravel industry is not a major presence there.

Most soils on the GMNF are formed from acidic, loamy, glacial tills, but about five to ten percent are at least partially formed from calcium-rich parent material. Soils range in pH from 4.0 to 8.0, with a range of 4.5 to 5.5 most common. Soils formed from calcium-rich parent material have pHs toward the high end of the overall range. Slopes range from 0 to 70 percent, with most between 15 and 35 percent. Soil depth to bedrock ranges from 0 to over 60 inches, with dominant condition 30 to 60 inches. In general, soil depth increases as elevation and slope steepness decrease. Soils on ridge tops and side slopes are generally well to moderately well drained, while those on toe slopes, bottomlands, and other concave landscape

positions are generally moderately well drained to poorly drained.

Compared to the rest of New England, GMNF soils are moderate to high in terms of forest productivity. Exceptions are wet, steep, or shallow soil areas, where soil nutrient levels are low. Soil quality on the GMNF has been affected by past land management. Much of the forest was cleared for agricultural uses in the early to mid-1800s, later abandoned (partly due to erosion), reforested, and then logged repeatedly in the early to mid-1900s. Erosion control efforts and conservation measures in the latter half of the twentieth century have improved the quality of the soil. Currently, questions remain regarding the extent to which atmospheric deposition (the result of air pollution) is altering the soil nutrient content and thus soil quality.

Vegetation on the GMNF can be grouped into five major types: northern hardwood forests of beech, birch (yellow and paper birch), and maple (sugar and red maple), and including aspen; softwood forests of red spruce and balsam fir, hemlock, white pine; mixedwood forests that are transitional between northern hardwood and softwood forests and have elements of both; oak forests of primarily red oak, usually mixed with northern hardwoods, pines, or hemlock; and open lands that are mixtures of trees, shrubs, and forbs, representing both uplands and wetlands. Forested conditions are found on 97 percent of the GMNF, with 79 percent classified as northern hardwoods, 10 percent as mixedwoods, 7 percent as softwoods, and 1 percent as oak. Open lands and small stands of aspen and paper birch are maintained to provide wildlife habitat. About half of the forested lands are available for management using timber harvesting under the 1987 Plan. About two-thirds of the Forest is less than 100 years old due to land use history in the area. There are about 700 acres of documented old growth on the Forest. Prior to European settlement, the GMNF had a higher proportion of forest in the mixedwood type and a lower proportion in northern hardwoods than currently. Oaks and softwoods were also slightly more common than they are now.

About 334 wildlife species, 17 fish species, and over 400 vascular plant species inhabit the GMNF. While five federally listed species are associated historically with the GMNF, only two of these species (Indiana bat and bald eagle) are currently known to exist on or near the GMNF. No critical habitat for any federally listed threatened, endangered, or proposed species has been designated on the GMNF. Species of viability concern that may be rare or declining on the GMNF or in the region include 27 animals and 83 plants. The GMNF provides a diversity of habitats for animal and plant species. Habitats that are of particular importance to species in this area include grassy or shrubby openings, young deciduous trees, upland forest of northern hardwoods and conifers, enriched northern hardwood forests, old forest conditions, wetlands, riparian areas, and aquatic habitats. Management Indicator Species (MIS) also address several other wildlife habitat issues, including wintering habitat for white-tailed deer, stands of aspen and birch, and habitat for reclusive species. All of these habitats can be found currently on the GMNF.

3.1.4 Ecosystem Management

Framework

In 1992, the Forest Service adopted ecosystem management as an operating philosophy (Overbay 1992). Ecosystem management is scientifically based land and resource management that integrates ecological capabilities with social values and economic relations to produce, restore, or sustain ecosystem integrity and desired conditions, uses, products, values, and services over the long-term. This means an ecological approach is used to achieve multiple-use management of the national forests and grasslands.

Such an approach helps to accomplish the agency's mission to sustain the health, diversity, and productivity of the nation's National Forests and Grasslands to meet the needs of present and future generations. Through ecological sustainability, National

Forest Management Act (NFMA) goals for maintaining species diversity, viability, and ecological productivity can be addressed. According to the Committee of Scientists (1999) in their recommendations for *Sustaining the People's Lands*, "ecological sustainability means maintaining the composition, structure, and processes of an ecological system". They go on to state that, "sustaining ecological processes so that they operate within their expected bounds of variation is the only way to sustain ecological diversity and productivity for future generations.

Ecological systems are dynamic in nature, with their composition, structure, and processes fluctuating over time. In order to address ecosystem sustainability, these fluctuations need to be understood in the context of natural and historical variation in the landscape. When these fluctuations occur under a relatively stable set of physical and climatic conditions, disturbance regimes, and natural succession processes, such variation can be predictable. In these situations, species associated with these ecosystems can evolve adaptations that allow them to remain resilient and/or resistant to fluctuations. Such fluctuations help to define the range of variation that might be expected in a landscape or for an ecosystem. When fluctuations change suddenly, for example through the introduction of a new or dramatically expanded land use, attributes of an ecosystem's composition, structure, and/or processes can change dramatically, leading to both losses and gains for species associated with these ecosystems. At its worst, fluctuations can become so dramatic and unpredictable as to lead to ecosystem collapse and simplification, with a loss of biological diversity.

In the Green and Taconic Mountains, fluctuations considered part of the expected range of variation include the compositional "tension zones" that are found across the elevation gradient of the mountains from valley to mountain top, as well as the short steep tension zone along the western edge of the GMNF between northern mountainous ecosystems to the east and warmer valley and lake plain forests to the west. There is also a broader regional tension zone between northern and central hardwood forests toward the south end of the Forest. Other fluctuations considered part of the expected range of variation include historical disturbance regimes like wind and ice damage, which tend to occur regularly but in very small patches, but can be catastrophic on occasion. Fire, as a disturbance regime, occurred predominantly along the western edge of the GMNF in a landscape known as the escarpment. Finally, the predominant fluctuation that affects forests of the GMNF is long-term forest succession toward northern hardwood and softwood forests.

Fluctuation in ecological systems that are considered to be outside the expected range of variation include developments and land use practices that are relatively new to the Green and Taconic Mountains, including land ownership and abandonment patterns, the prevalence of roads within river valleys, historical large-scale land clearing over a short period of time, agricultural practices like historical short-term cultivation and grazing in the mountains, and long-term agriculture in the low hills and valleys, introduction of non-native invasive species, and urban and suburban development. Also included are the losses of several species that likely had strong influences on ecosystem development, including species such as passenger pigeon, and perhaps American elm and chestnut.

Due to the current condition of the landscape in terms of these and other human-induced factors that are relatively permanent based on social and economic needs and desires, the ability of the Green and Taconic Mountains to again operate totally within the range of variation that might be expected is limited. In particular, upland openings are maintained outside the expected range of variation, primarily in order to provide habitats for species that are declining across the region as these open habitats decline and become either forested or developed. A guiding principle used in the FEIS and revised Forest Plan for addressing ecological sustainability is recognition that the closer ecological processes operate towards what is perceived to be their

expected bounds of variation, the greater the confidence is that diversity and productivity will be sustained for future generations.

An Introduction to Biodiversity

Ecological sustainability is the key to maintaining species diversity, viability, and ecological productivity, which is a requirement of the agency and part of its mission. This requirement is derived from the National Forest Management Act (NFMA), which 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 the 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 *plant*s, 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 *population*s. The Forest Service is 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 assist the reader in understanding how the Green Mountain National Forest is meeting this direction, this introduction discusses the various aspects of maintaining biological diversity and species viability 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 to contribute to species viability and 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 the Green Mountain region, it includes broad communities, such as northern hardwood forest, as well as isolated communities. 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, are also part of biodiversity.

The challenge in maintaining biodiversity on a National Forest involves two aspects. First, the Forest must determine how best to conserve biological diversity when it includes forest, open, and aquatic communities; common and rare species; and innumerable ecological processes. Second, the Forest Service must determine how to best integrate biodiversity needs with the social and economic aspects of sustainable ecosystem management.

Conservation Approaches

In order to meet the diversity and viability requirements of the NFMA, the GMNF has turned to the literature on conservation of biodiversity. 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 the variety of

ecosystems and their natural processes will also maintain the viability of the species that use those ecosystems.

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. Most often, a fine filter approach is used to address species of concern whose needs are not likely to be addressed by a coarse filter approach. A fine filter approach proposes management for individual species or groups of species. A concern with this approach is that developing separate management approaches for every species occurring in an area individually is often confusing and 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). For those species with very particular habitat needs that cannot be adequately addressed by a species group approach, individualized management strategies are often required.

The GMNF uses a combined coarse filter-fine filter approach to evaluate and manage for species viability. Vegetative composition and age class objectives maintain a representation of common communities, such as upland openings, areas of young deciduous trees, aging forests, and forests dominated by northern hardwoods, softwoods, mixes of hardwoods and softwoods, aspen, and birch, ensuring they are reasonably well-distributed across the Forest. Communities that are naturally restricted but not uncommon, such as hemlock, pines, and oaks along the escarpment and in river valleys, and wetlands, as well as ecological processes such as fire disturbance and forest succession, are conserved through resource goals, standards, guidelines, and management area direction. Maintaining the diversity of communities and processes on the landscape also maintains the diversity and viability of most wildlife and plant species, providing a practical and efficient approach to addressing the thousands of species that are found on a national forest. All of this is the coarse filter.

Goals, standards, guidelines, and management area allocation provide management direction to protect the rarer elements of biodiversity on the Forest, and so constitute 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's coarse filter. These taxa are addressed as species of potential viability concern in this section. Uncommon communities were evaluated separately to determine which ones might not be sufficiently protected by the coarse filter. These are addressed as rare and unique biological features, or as special management areas.

Biological Diversity as Addressed Within the Final Environmental Impact Statement

Maintaining biological diversity is a primary goal of the agency and the GMNF. As a result, the coarse filter-fine filter approach described is an integral part of all alternatives. Goals, standards, guidelines, and management area direction designed to protect communities, processes, and species are largely the same among the alternatives. All five Plan revision major issues (see Chapter 1) cause management activities to vary among alternatives to meet social, economic, or ecological objectives. These differences are seen primarily in the allocation of land to different management areas, each of which varies in emphasis and desired condition of the land. The variation across alternatives in how much of each ecosystem is allocated to what management areas of the GMNF results in different mixes of ecological communities and species on the landscape. Each alternative is then evaluated to determine how it would affect biological diversity and viability on the Forest (direct and indirect effects) and in the surrounding area over the long-term (cumulative effects).

Biodiversity is a broad topic with many pieces. It is covered in many places in this document, by broad resource topic. The Vegetation section discusses two components of biodiversity: terrestrial vegetation and non-native invasive species. The terrestrial

vegetation subsection addresses the basic terrestrial ecology of the Forest, including historical types of vegetation, natural disturbance, past management, and identification of broad forest communities. It describes the current condition for those habitats and evaluates effects of the alternatives on forest composition, age class distribution, and structure. The Non-native Invasive Species subsection focuses on plant species 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 on individual species or groups of species related to habitats that are important to wildlife.

The Areas of Special Significance, particularly in the subsection addressing Research Natural Areas, candidate Research Natural Areas, Special Management Areas, and areas for old growth, specifically addresses the management approach of the revised Forest Plan for rare or exemplary natural communities, as well as the representation of ecosystems within management areas that minimize extractive or disruptive uses. While the types of rare and exemplary natural communities are introduced in the Vegetation section, the analysis of environmental consequences takes place in the Areas of Special Significance section, since these areas are addressed through either goals, standards and guidelines, or by management area allocation as special management areas.

The Water Quality section describes the current condition and potential for alternatives to impact lakes, ponds, wetlands, riparian habitat, and overall hydrology. Habitat for fish is discussed in the Fisheries section. Soil, bedrock, and other surficial materials are described in the Soils section. Air quality is discussed in the Air section.

The Vegetation, Areas of Special Significance, Wildlife, Water Quality, Fisheries, Air, and Soils sections are part of the coarse filter analysis for maintaining biological diversity. They generally deal with the more common aspects of biodiversity.

The effects of alternatives on species considered rare or declining on the GMNF are not likely to be addressed adequately in the coarse filter analysis. Consequently, these species, their associated habitat needs, and alternative effects are discussed in the Threatened and Endangered Species, and Species of Potential Viability Concern sections of this chapter. Threatened, Endangered, and Sensitive species are also addressed in more detail in the Biological Evaluation (Appendix E). Together, these sections and Appendix E of the document address the fine filter component of the biodiversity approach.

3.1.5 Laws, Regulations, and Policies

The following laws, regulations, and policies provide the primary legal framework necessary for Forest Planning and the management of NFS lands. All alternatives have been designed to comply with these laws, regulations, and policies. For additional statutes, regulations, policies, and agreements see revised Forest Plan Appendix E.

Organic Administration Act (1897)
The Organic Administration Act authorized the creation of what is now the National Forest System. The law established forest reserves “to improve and protect the forests within the boundaries, or for the purpose of securing favorable water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States…”

Among other aspects contained in the Organic Act, the Act is the legal authority authorizing designation of Research Natural Areas and classification of lands as special areas.

Twenty-Five Percent Fund Act (1908)

The Twenty-Five Percent Fund Act (1908) requires the Secretary of the Treasury to allocate 25% of all fiscal year national forest receipts to the State (or Territory) where 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 where the national forest is located.

Multiple-Use Sustained-Yield Act (1960)

In the Multiple-Use Sustained Yield Act, the Congress affirmed the application of sustainability to the broad range of resources over which the Forest Service has responsibility. This Act confirms the authority to manage the national forests “for outdoor recreation, range, timber, watershed, and wildlife and fish purposes.”

National Historic Preservation Act (1966)

Sections 106 and 110 of the National Historic Preservation Act (NHPA, P.L. 89-655) provide the framework for federal review and protection of cultural resources, and to ensure that they are considered during federal project planning and execution. The Secretary of the Interior maintains a National Register of Historic Places (NRHP) and sets forth significance criteria for inclusion in the register. Cultural resources may be considered “historic properties” for the purpose of consideration by a federal undertaking if they meet NRHP criteria. Historic properties may be those that are formally placed on the National Register (NR) by the Secretary of the Interior, those that meet the criteria and are determined eligible for inclusion, and those that are yet undiscovered but may meet eligibility criteria.

National Trails System Act (1968)

The National Trails System was created in 1968 by the National Trails System Act (NTSA). The Act established the Appalachian and Pacific Crest National Scenic Trails and authorized a national system of trails to provide additional outdoor recreation opportunities and to promote the preservation of access to the outdoor areas and historic resources of the nation.

Wild and Scenic Rivers Act (1968)

For the segments of rivers that have been determined to be eligible for consideration as National Wild, Scenic, or Recreational Rivers under the Wild and Scenic Rivers Act, the Forest Service is required to provide for the protection of the river values. The Act requires a Forest planning process to conduct an eligibility determination process for potential Wild, Scenic, and Recreational Rivers. The Forest Plan addresses resource protection, development of land and facilities, public use, and other management practices necessary or desirable to maintain the eligibility of the river segments.

National Environmental Policy Act (1970)

The National Environmental Policy Act (NEPA) ensures that environmental information is made available to public officials and citizens before decisions are made and before action is taken. This disclosure helps public officials make decisions based on an understanding of environmental consequences and take actions to protect, restore, and enhance the environment. Essential to this process are accurate scientific analyses, expert agency input, and public involvement, all of which have been part of this revision process. The revised Forest Plan alternatives have been analyzed and the potential effects have been disclosed in this FEIS. The Act also requires environmental analysis and disclosure for site-specific actions and the consequences to the human environment as implemented under the revised Forest Plan.

Clean Water Act (1972)

The Clean Water Act (CWA) provides surface water quality protection in the United States. The statute employs a variety of regulatory and non-regulatory tools to sharply reduce direct pollutant discharges into waterways, non-point source pollution, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."

Endangered Species Act (1973)

The Endangered Species Act (ESA) directs all federal agencies to participate in the protection and conservation of endangered and threatened species of plants and animals. Under the ESA, protection extends to the ecosystems and critical habitats upon which endangered and threatened species depend. The Act requires federal agencies to carry out programs for the conservation of endangered and threatened species in consultation with the US Fish and Wildlife Service.

The ESA also provides for designation of critical habitat for listed species. Critical habitat are those areas that include physical or biological features essential to the conservation of the species and which may require special management considerations or protection. Critical habitat may include areas not occupied by the species at the time of listing but that are essential to the conservation of the species.

Forest and Rangelands Renewable Resources Planning Act (1974)

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.

Federal Noxious Weed Act (1975)

The Federal Noxious Weed Act of 1975 provides for the control and management of plant species that are classified as undesirable, noxious, harmful, exotic, injurious, or poisonous, pursuant to State or federal law. The Act provides specific agency direction for management of undesirable plants on federal lands. This Act does not invalidate any State or local laws regulating noxious weeds. States are encouraged to have parallel legislation and to add species that may only be noxious within their areas.

Federal Land Policy and Management Act (1976)

The Federal Land Policy and Management Act of 1976 requires that public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use. The Act also states that the United States shall receive fair market value of the use of the public lands and their resources unless otherwise provided for by law.

Most linear rights-of-way such as roads and utility lines are authorized under the Federal Land Policy and Management Act.

National Forest Management Act (1976)

The National Forest Management Act (NFMA) requires that National Forest System land be managed for a variety of uses on a sustained basis to ensure in perpetuity a continued supply of goods and services to the American people. The Act regulations also establish analytical and procedural requirements for developing, revising, and amending forest plans (36 CFR 219). The GMNF Forest Plan embodies the provisions of the National Forest Management Act and regulations on forest plan implementation.

Among other important direction, the NFMA requires that:

- The Forest Service manages fish and wildlife habitat to maintain viable populations of plant and animal species in the planning area. The NFMA also stipulates that Forest Plans must provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area.
- The Forest Plan contains monitoring and evaluation requirements that will provide a basis for periodic assessment of the effects on management practices. The monitoring requirements include

selection of management indicator species that will help evaluate whether Forest goals and objectives are being realized.
- The planning process identifies areas for establishment as RNAs.
- The planning process evaluates and considers roadless areas within the National Forest System for recommendation as potential wilderness.
- The planning process estimates and compares the physical, biological, and social effects of implementing each alternative, according to NEPA procedures.
- The Forest Plan contains an estimation of the effects of the expected outputs of marketable and non-marketable goods and services, the impacts on Present Net Value, the receipts to the federal government, the direct benefits to users, the receipt shares to State and local governments, income and employment.

Payments in Lieu of Taxes Act of 1976
The Payments in Lieu of Taxes Act of 1976 authorizes compensation to counties in lieu of property taxes that cannot be levied against federal lands within the counties' jurisdiction.

Clean Air Act (1977 and 1990)
The Clean Air Act is the comprehensive federal law that regulates air emissions from area, stationary, and mobile sources. The Clean Air Act requires the Forest Service to protect the air from pollution emitted inside and outside the borders of NFS lands.

The American Indian Religious Freedom Act (1978)
The American Indian Religious Freedom Act (AIRFA) applies the First Amendment guarantee of religious freedom to Native Americans whose religious practices may involve requirements to access sacred sites on federal property. Under AIRFA, Native Americans must be provided with access and ceremonial use of Native American sacred sites on federal property, and the federal agency must avoid adversely impacting those sites and maintain the confidentiality of sacred site locations.

The Archaeological Resources Protection Act (1979) and the Antiquities Act (1906)
The Antiquities Act of 1906 and the Archaeological Resources Protection Act of 1979 (ARPA) prohibit the unauthorized excavation, removal, damage, alteration, defacement, or the attempt of such acts on federal lands. ARPA provides legal penalties and establishes a permitting system to authorize excavation or removal of archaeological resources by qualified applicants.

The Alaska National Interest Lands Conservation Act (1980)
The Alaska National Interest Lands Conservation Act requires the grant of access to non-federally owned land within the boundaries of a Forest such that its owner may have the reasonable use and enjoyment of that land. These inholdings can occur in any management area across the Forest.

Native American Graves Protection and Repatriation Act (1990)
The Native American Graves Protection and Repatriation Act (NAGPRA) was intended to ensure the protection and the rightful disposition of Native American cultural items (which, under NAGPRA, include human remains, associated funerary objects, unassociated funerary objects, sacred objects, and objects of cultural patrimony) located on federal or Native American lands and in the federal government's possession or control. NAGPRA requires agencies to determine what Native American cultural items are within its possession or located at its facilities and then notify potentially effected tribes concerning possible repatriation. Upon inadvertent discovery and intentional excavation of potential cultural items, it is necessary for the federal agency to identify proper ownership and to ensure the rightful disposition of cultural items.

The Telecommunications Act (1996)

The Telecommunications Act of 1996 requires federal agencies to facilitate the development and placement of telecommunications equipment on buildings and land they manage when placement does not conflict with the agency's mission or current or planned use of the property. An Executive Order issued May 18, 2001, establishes essentially the same requirements regarding alternative energy sources.

Secure Rural Schools and Community Self-Determination Act of 2000

The Secure Rural Schools and Community Self-Determination Act of 2000 (SRSCS) specifies how states and counties will be compensated for impacts associated with visitors to National Forest System lands.

The Healthy Forests Restoration Act (2004)

The Healthy Forests Restoration Act of 2003 provides management tools and authorities to restore forests to healthy conditions. The Act strengthens public participation in developing high-priority forest health projects and reduces the complexity of related environmental analyses.

Executive Order 12898

Executive Order 12898 requires that planning alternatives be assessed for environmental justice concerns to determine whether or not any of the alternatives disproportionately affect minority and/or low-income populations.

Forest Service Directives

Management direction for the GMNF can be found in the Forest Service Directive System, including the Forest Service Manual (FSM) and the Forest Service Handbook (FSH), These directives include applicable laws, regulations, and policies that guide the management of NFS lands.

3.1.6 Analysis

Analysis Units – Spatial and Time Scales

Ecological regions, watersheds, and political boundaries may be used to provide information at appropriate scales for ecosystem mapping, environmental analysis, developing desired future conditions, and monitoring.

Scale is important to understand in terms of both space and time, but scale is often difficult and challenging for resource managers to analyze and communicate. Relationships viewed on a small scale or over a short time period can be very different when viewed over large scales or for a longer time period. For example, the immediate aftermath of a large fire may appear to be highly destructive to a specific site, but the same fire viewed in terms of long-term landscape dynamics may provide many ecological benefits.

Different time scales are used in the effects analysis to provide a temporal context and comparison for the way conditions may change through time as a result of management activities or natural events. Three time frames are used: 1) temporary, 2) short-term, and 3) long-term. Unless otherwise stated, temporary effects are generally expected to last anywhere from 0 to 3 years. Short-term effects can include temporary effects but can last up to 10 to 15 years, or the period of time between Forest Plan revisions. Long-term effects generally last longer than 10 to 15 years, or begin to occur after the first 10 to 15 year planning period.

Available Information and Use of Models

The data and level of analysis in the EIS are commensurate with the importance of the potential effects (40 CFR 1502.15). In the modeling and analysis for Forest Plan revision, the numbers for things such as management areas, road miles, and acres of timber harvest

are all best estimates based on the latest available information.

During the development of assessments for Forest Plan revision, gaps in information were identified, and an interdisciplinary team determined those gaps that were a high priority to fill. Some gaps were filled simply by gathering all relevant literature on the subject for use during various Plan revision stages, while other gaps required more intensive analysis involving such activities as convening expert panels (for example, the species viability evaluation process), or developing models (for example, SPECTRUM).

For the gaps in information that remained, the interdisciplinary team concluded that the missing information may have added precision to estimates or better specified a relationship; however, the basic data and central relationships are already sufficiently well established in science so that additional information was considered unlikely to reverse or nullify understood relationships. Thus, new information would be welcomed and would add precision but is not essential to providing adequate information for the decision maker to make a reasoned choice among the alternatives.

The purpose of modeling is to provide comparative insight into complex questions, not to provide an answer. Decision makers and managers use modeling results along with an understanding of the assumptions used in building the model as a factor in their decisions, but there are many other factors that are considered, many of which are not in the model. The modeling and analysis conducted for the FEIS were intended and designed to indicate relative differences among the alternatives rather than to predict absolute amounts of activities, outputs, or effects.

Analysis Processes

Appendix B of the FEIS provides a discussion of the more complicated analysis processes used in the environmental analysis. These include the timber harvest schedule analysis and the economic analysis. Other analysis processes used in the FEIS are discussed or referenced in the appropriate sections, and are documented in the project file.

3.1.7 Relationship Between Programmatic and Site-Specific Analysis

The revised Forest Plan and Final Environmental Impact Statement (FEIS) are programmatic documents. The FEIS discusses environmental consequences on a broad scale. Over the life of the revised Forest Plan, the selected alternative and accompanying Forest-wide standards and guidelines will set management direction by establishing and affirming rules and policies for the use of natural resources.

Because this document contains a Forest-wide level of analysis, it does not predict what will happen when standards and guidelines are implemented on individual site-specific projects. Nor does it convey the long-term environmental consequences of any site-specific project. These actual effects will depend on the extent of each project, environmental conditions at the site (which vary across the forest), site-specific mitigation measures and their effectiveness.

In preparing this document, focus was on consequences most likely to occur and why. By combining this broad assessment with site specific information, a reader can make a reasonable prediction about the kind of environmental consequences that would result from a specific project. Actual site-specific effects will be disclosed for projects proposed to implement direction in the Plan under a separate NEPA analysis process.

The FEIS does not describe every environmental process or condition on the Green Mountain National Forest because this would be impractical given the complexity of natural systems. The purpose of the FEIS is to provide a survey of the broader environment and social factors that are relevant to programmatic planning.

3.1.8 Affected Environment and Environmental Consequences Section Organization

Each resource section is presented in the following format:

Issue Statement – Describes the Forest planning concerns identified by both the public and Forest Service staff. These statements provide a detailed discussion of the issues derived during public participation in the planning process summarized in Chapter 1.

Issue Indicators – Describes the indicators used to compare the effects of the alternatives associated with the issue.

Analysis Area – Briefly describes the geographic area used for analysis. Analysis areas may vary depending on the resource, issue, or anticipated activities. Within a specific resource or issue, analysis areas may also differ for direct, indirect, and cumulative effects.

Affected Environment – Describes the 1987 Forest Plan direction, proposed changes to that direction common to all alternatives, and the existing (current) conditions of the resources relative to the issues and issue indicators. This section may also include history, development, trends, past disturbances, naturally occurring events, and interactions that have helped shape the existing conditions.

Environmental Consequences – Includes discussion of the direct, indirect, and cumulative effects by alternative for each resource.

Direct and Indirect Effects – Describes the direct and indirect effects that each alternative could have on resources or issues. Direct effects occur at the same time and place as the action. Indirect effects occur later in time or are spatially removed from the action. Although a Forest Plan would guide management for 10 to 15 years, effects may be discussed for both the short-term (throughout the planning period, 10 to15 years) and long-term (greater than 15 years). Direct and indirect effects often overlap and are discussed together.

Cumulative Effects – Describes the cumulative effects by alternative for each resource or issue. Cumulative effects are the incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes the other actions. Cumulative impacts can result from individually minor but collectively significant actions that take place over time.

For the purpose of Chapter 3 Environmental Consequences discussions, Wilderness Study Areas (WSAs) are analyzed as though they are designated Wilderness. Although the WSAs may only become designated wilderness by an act of the Congress, the potential effects are analyzed should designation occur. Environmental effects are disclosed assuming full compliance with the Forest-wide and management area standards and guidelines described in the revised Forest Plan.

Skidder assistance at a timber sale, photo courtesy of Matt Bienkowski

3.2 SOIL

Issue Statement

A concern is the extent to which soil quality will be maintained under the revised Forest Plan. Maintenance of soil quality is an important part of the issue of restoring, protecting, maintaining, and enhancing biological and ecological diversity. There is also concern that acid deposition is adversely impacting soil quality. The issue of erosion in riparian areas is addressed further in the Fisheries (3.7) and Water (3.3) sections of Chapter 3.

Indicator 1 – Acres in Management Area Allocations Most Subject to Ground Disturbing Activities that Decrease Soil Quality

The first indicator to be used in this effects analysis is the number of acres in management area (MA) allocations most subject to ground disturbing activities that decrease soil quality, as compared between alternatives. The MAs most subject to soil disturbance are: Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, the Escarpment, Recreation Special Areas, Moosalamoo Recreation and Education Area, Alpine Ski Areas, and Alpine Ski Area Expansion. All other MAs are subject to low levels of, or no, ground disturbing activities. This indicator is important because the higher the number of acres potentially subject to ground disturbing activities, the greater the potential for soil disturbance and reductions in soil quality. Soil disturbance consists primarily of erosion, rutting, and compaction. It is the most important risk to soil quality that is directly affected by Forest Service land management activities. Soil disturbance results from activities such as: tree harvesting, prescribed burning, recreation development, trail construction, road construction and maintenance, downhill ski trail development, and mineral exploration and extraction.

Indicator 2 – Acres in Management Area Allocations Most Subject to Ground Disturbing Activities, With a High Erosion Hazard

The second indicator is the number of acres in MA allocations most subject to ground disturbing activities that also have a high erosion hazard. These acreages are compared between alternatives. Soil erosion is often a concern with land management activities. The erosion hazard for a soil is the probability that erosion damage and reductions in soil quality may occur as a result of ground disturbing land management activities such as harvesting, prescribed burning, road maintenance, and trail construction. Hazard ratings are based on a combination of Natural Resources Conservation Service erosion hazard ratings (USDA, Natural Resources Conservation Service 1987) and the soil slope. For this analysis, all soils on slopes of 30 percent or more were considered to have a high erosion hazard.

It is important to recognize that a soil with a high erosion hazard will not necessarily become highly eroded when disturbed. Erosion control measures are implemented on each project, and if implemented properly, they are normally effective in keeping erosion to a minimum. Soils with a high erosion hazard require more erosion control measures. The risk of a measure failing due to human error or an unusually high rainfall is also higher.

Indicator 3 – Soil Productivity Losses from Biomass Removal and Acid Deposition

The third indicator to be used in this effects analysis is soil productivity losses from biomass removal and acid deposition. Soil productivity is one aspect of soil quality. It is defined by the Forest Service as the inherent capacity of a soil to support the growth of specified plants, plant communities, or a sequence of plant communities. Soil productivity may be

expressed in terms of volume or weight/unit are/year, percent plant cover, or other measures of biomass accumulation (FSM 2509.18, 2.05; Effective 9/3/91). Concern has grown in the last decade over the loss of productivity from Forest sites due to the removal of trees (biomass) during harvest, and the loss of soil nutrients via leaching in response to atmospheric deposition of sulfur and nitrogen. Both these concerns are addressed in detail in Burt et al. (2005).

Analysis Area

The analysis area for direct, indirect, and cumulative effects includes all federal lands managed by the Green Mountain National Forest (GMNF). This is the area potentially subject to soil disturbance as a result of land management activities implemented under the revised Plan. Note the cumulative effects analysis area does not include privately owned lands adjacent to the Forest. This is because the effects of Forest Service soil disturbing land management practices generally do not extend (in the form of erosion or a landslide) onto privately owned lands. The reverse is also true, in that the effects of soil disturbing activities on privately owned lands generally do not affect soils on the GMNF.

3.2.1 Affected Environment

Introduction

Soil quality, the key issue in this analysis, is defined as the capacity of the soil to function within ecosystem boundaries to sustain biological productivity, maintain or enhance water quality, and support human health and habitation (USDA, Natural Resources Conservation Service Undated, cited in Tetra Tech, Inc. 2003b). For this analysis, it is assumed that to maintain soil quality, the most important and understood soil properties must be protected. Those properties are soil organic matter, aeration (porosity), moisture, and productivity (ability to support plant growth).

A few additional concepts are important to recognize for this analysis. Ground disturbing activities, such as tree harvests, prescribed burns, recreation development, trail construction, road construction and maintenance, downhill ski trail development, and mineral exploration, can reduce soil quality. For example, soil erosion results in loss of organic matter and associated nutrients, in turn reducing soil quality. Other examples are soil compaction and rutting, which can result in decreased soil aeration, moisture availability, productivity, and soil quality. When soil quality is reduced, the soil is less capable of restoring, protecting, maintaining and enhancing above and below-ground biological and ecological diversity.

Soil quality on the GMNF has been affected by past land management. In the early to mid-1800s, much of the Forest was cleared for grazing and other agricultural uses, resulting in widespread erosion. By the late 1800s, grazing and agricultural uses had been abandoned, in part due to decreases in soil productivity. The lands reforested and soil quality improved. In the early to mid-1900s, lands of the GMNF were repeatedly logged. Logging was accompanied by road, railroad, and skid trail construction to remove the timber. These activities again increased erosion and decreased soil quality, but to a lesser extent than past grazing and agriculture. After the GMNF was established in the 1930s, soil quality generally improved. By the 1970s, basic erosion control measures were used, such as locating skid trails on the contour and using water bars on skid trails to control runoff. By the time the 1987 Plan was initiated, more comprehensive conservation measures were used to protect soils from erosion, compaction, and nutrient losses. These conservation measures are the standards and guidelines (S&Gs) in the 1987 Plan.

Soil quality can be maintained or improved in several ways. The most important way is to implement Acceptable Management Practices (AMPs) and Plan S&Gs. AMPs are soil and water conservation measures developed by the State of Vermont to control erosion and sedimentation on logging sites (State of

Vermont Department of Forests, Parks and Recreation 1987). Plan S&Gs provide further soil resource protection to guide a variety of Forest management activities, such as trail construction, road building, and campsite location. The effectiveness of these measures is discussed in the Existing Condition section.

In addition to ground-disturbing activities, two other factors have potential to decrease soil quality on the Forest. First, the removal of soil nutrients held in the leaves, branches, and trunks of trees through harvesting can decrease soil quality. Second, the loss of soil nutrients can occur via leaching (removal) in response to atmospheric deposition of acidic elements, most importantly sulfur and nitrogen.

In regard to atmospheric deposition, acidic compounds from the air occur in both wet form ("acid rain," snow, and fog), or in dry form (particulate matter). Cumulatively, this is known as acid deposition. Research shows that acid deposition can affect soils in several ways including:

- Soil concentrations of sulfur and nitrogen may increase, making the soil more acidic.
- Acid solutions can remove calcium and other bases (such as magnesium) from the soil by leaching. This can trigger plant nutrient deficiencies.
- Soil acidification facilitates movement of dissolved inorganic aluminum into soil water, which can be toxic to organisms.

All of these factors reduce soil quality. According to mapping by the Conference of New England Governors and Eastern Canadian Premiers Forest Mapping Group (2003), areas of the GMNF at high risk for potential reductions in soil quality due to atmospheric deposition are high elevations having acidic, shallow soils, on the southern part of the Forest.

There is uncertainty about the extent to which soil quality is being affected by acid deposition on the GMNF. Conclusive evidence in New England that soil productivity has been affected by acid deposition is lacking (Tetra Tech 2003b), except possibly in high elevation spruce-fir stands (National Science and Technology Council 1998). Research and monitoring is being conducted on the effects of atmospheric deposition on the soil resources on the GMNF to add further understanding to this issue (Burt et al. 2005).

Existing Forest Plan Management Direction

A 1987 Forest Plan goal directs the Forest Service to "stabilize and enrich the soils on the GMNF by fixing sources of erosion, preventing future problems from occurring, and protecting the nutrients which cycle through the Forest ecosystem" (USDA Forest Service 1987). Standards and guidelines in the 1987 Plan were designed to achieve this goal by protecting the soils from erosion, compaction, and nutrient losses.

Proposed Changes in Management Direction Common to All Alternatives

The goal for the soil resource in the revised Plan is similar to the goal in the 1987 Plan, but with increased emphasis on restoration. Goal 3 of the revised Plan states that the Forest Service goal is to "maintain or restore the natural, ecological functions of the soil." Maintaining the soil quality includes protection and restoration of all soil functions to the extent possible, such as sustaining biological diversity, cycling nutrients, providing physical support for vegetation, and filtering pollutants. To achieve this goal two objectives have been identified. The first objective is to minimize the adverse impacts on soils from management activities. The second objective is to restore natural processes and functions on degraded soils. Standards and guidelines (S&Gs) in the revised Plan provide for more comprehensive soil resource protection and restoration than under the 1987 Plan. Examples of S&Gs include: harvesting activities would meet or exceed State of Vermont AMPs, and revegetation would be required of critical bare soils, such as at a newly constructed bridge over a stream

Existing Condition

The current condition of the soil resource on the GMNF is described in the GMNF Soil Assessment (Tetra Tech 2003b). This assessment states that the general health of the soil, including soil quality, is good. Good soil quality means soils on the vast majority of acres on the GMNF are stable (not eroding), have a protective, porous, and nutrient-rich cover of organic matter, and support productive forests.

Soil health and quality has been good over the past 15 years due to two major reasons. The first factor arises from laws and regulations designed to protect the resource. The Forest Service follows State Acceptable Management Practices (AMPs) and Forest Plan Standards and Guidelines (S&Gs). Examples of S&Gs that have protected soil quality include:

- Prescribed fires are conducted without excavated control lines where fuel conditions permit this to be done safely.
- Skidding of trees is not allowed through streams (except at designated crossings).
- Approved structures (usually a bridge, culvert, or a temporary winter poled crossing) are required where machinery crosses stream courses.

AMPs and S&Gs have shown to be effective in keeping the soil impacts at low levels (USDA 1999b, USDA 2000a, USDA 2003c). For this analysis, “low levels” means the following features can rarely be observed: gullies, sheet erosion, sedimentation, rutting, the absence of the soil organic (humus) layer, and large bare and/or compacted soil areas. In addition, overall effects on soil quality and productivity are minor on a landscape scale.

The second major reason soil health and quality has been good over the past 15 years is a general trend on the GMNF toward fewer acres being subjected to land management activities that result in soil disturbance. For example, with the adoption of the 1987 Forest Plan, approximately 50 percent of the GMNF was allocated to MAs where timber harvesting was not allowed. Timber harvesting is the most common land management activity that, by far, results in the most soil disturbance. Another example is the annual volume of timber harvested was generally higher in the 1970s and 1980s than in the 1990s and thereafter. In both of these examples, decreased harvesting activities resulted in less soil disturbance, and consequently, increased soil quality.

Although the general health and quality of the soil is good, there are small, scattered areas where soil quality is not good because erosion, sedimentation, and slope stability are a problem. These areas most commonly are:

- Short segments of roads or trails with gullies or eroding ditch lines due to heavy use
- Poorly designed road/trail areas
- Sites lacking maintenance
- Sites with runoff from unusually high rainfall
- Skid roads with temporary gully erosion or rutting associated with timber harvest and/or high rainfall
- Small landslide areas along steep stream banks, often triggered by high rainfall

These exceptions to good soil quality are uncommon and limited in extent, generally less than 200 feet in length along roads and trails, or less than 0.1 acre in size in areas with no roads or trails. The Forest Service seeks to restore soil quality in these areas through soil improvement projects (Figure 3.2-1). As long as people are utilizing the National Forest, however, improvement project funding is finite, and high rainfall events occur, some exceptions are unavoidable at any point in time.

Figure 3.2-1: A soil improvement project. A large culvert was removed from an old, closed logging road to prevent erosion and sedimentation along a stream.

It is important to note that soils underlying land areas dedicated to permanent roads, parking areas, and buildings are excluded in the discussion of soil quality in the Soil resource Affected Environment (3.2.1) and Environmental Consequences (3.2.2) sections. These land uses have degraded the underlying soils, however they are necessary to provide for management of, and access to, the National Forest.

Soils on most of the GMNF developed in acidic glacial till material (earthen material moved by glacial ice) of sandy loam to loam texture. Soils on ridgetops are normally well to moderately well drained, less than 40 inches deep to bedrock, and have a low erosion hazard. Bedrock outcrops are common on narrow ridgetops but only occasionally occur on broader ridgetops. Most ridgetop soils at high elevations have a thick, erosive organic layer, and are relatively low in productivity.

Sideslope soils occupy most of the GMNF landscape. Soils on mountain sideslopes vary in depth from less than 40 inches deep to more than 5 feet deep. Some sideslope soils have a dense soil layer, generally at a depth of one to three feet below the soil surface. This dense layer is commonly called a hardpan, and it impedes the downward movement of water thorough the soil. Soils with hardpans on sideslopes are normally moderately well to somewhat poorly drained. Soils on sideslopes that lack a hardpan tend to be moderately well to well drained. Sideslope soils are generally moderately productive, producing stands of moderate to high-quality hardwoods. They also have a moderate to high erosion hazard, depending on the slopes steepness.

Soils on toeslopes and valley bottoms are highly variable in texture, and vary in soil drainage from well to poorly drained. Toeslope soils occupy only a small percentage of the GMNF landscape. Toeslope soils formed from acidic tills are usually loamy, soils formed from glacial outwash (glacial material moved by water) are sandy and gravelly, and soils formed from glacio-lacustrine (material deposited in glacial lake beds) are silty or clayey. Toeslope soil productivity is highly variable, depending on the soil texture, drainage, and mineral composition of the glacial material from which the soil formed. The erosion hazard is usually low because the lands are flat to gently sloping.

Ground Disturbance

Most soils on the GMNF are loamy in texture, moderately well to well drained, and occur on moderate to steep slopes. The result is that most soils are moderately to highly erosive and have a moderate risk of compaction and rutting. The risk of compaction from ground disturbance increases on soils with more clay, and decreases on sandy and gravelly soils. The risk of rutting from ground disturbance increases on poorly drained soils and decreases on well-drained soils.

Erosion Hazard

Lands on the GMNF with a slope of 30 percent or greater generally have a high erosion hazard rating. Soils on these slopes cover about 40 percent of the GMNF and are located throughout the Forest on mid-to-upper mountain sideslopes. Soils on these slopes are more erosive because individual soil particles detach from each other more readily and are more subject to down-slope movement. Soil organic matter is usually the first part of the soil to erode. As organic matter and associated plant nutrients are lost, soil quality decreases.

Nutrient Loss

Biomass Removal

According to Grigal (2000), forest harvest removes nutrients in the extracted products. The direct effect of timber harvesting on soil nutrients is the loss of nutrients contained in the harvested biomass (leaves, twigs, branches, bole, roots). At any forest site, only a portion of the total site nutrients reside in the tree biomass, and nutrient content varies from one part of the tree to the next. For example, in a northern hardwood forest in New Hampshire only about five percent of the total calcium nutrient pool was found to be in the above-ground biomass (Likens et al., 1998), and about seven percent of the total nitrogen pool was in above-ground biomass (Hornbeck and Leak 1992). Further, studies at Hubbard Brook Experimental Forest revealed that although bole wood contained more than half of the tree mass, it only contained 11 percent of the tree calcium (Likens et al. 1998). Different intensities and types of timber harvest have different levels of impact on nutrient depletion and soil productivity. For example, conventional bole-only harvests remove fewer nutrients in the tree biomass than whole tree harvests, where the entire above-ground portion of the tree is removed. More frequent harvests (for example, every 40 years as opposed to every 100 years) or more intensive harvests remove more nutrients from a site (Johnson 1997, Federer et al. 1989).

The indirect effects of harvesting on soil nutrient levels include (Hornbeck and Leak 1992, Adams et al. 2000):

- nutrient leaching losses following harvest as a result of accelerated decomposition of organic matter due to increased soil temperature and moisture
- accelerated nitrification
- short-term acidification of the soil solution
- temporary reduction in nutrient uptake by vegetation
- small acceleration in the chemical weathering of inorganic materials in soils and rocks

Acid Deposition

Soil monitoring of long-term changes in soil nutrient levels in response to changes in atmospheric deposition is lacking on the GMNF and rare in New England. Five long-term monitoring sites were established in Vermont in 2002 (two on the GMNF), but several decades are needed to obtain meaningful results. Without this type of information it is difficult to know the exact extent and magnitude of changes in soil nutrient and soil quality levels due to acid deposition. Despite these limitations, it is possible to project the general impacts of atmospheric deposition on soils based on studies conducted in the northeast. Based on these studies it is reasonable to conclude (Bailey 2005, Burt et al. 2005):

- GMNF soils have become more acidic.
- Leaching (loss) of soil nutrients such as calcium and magnesium is occurring on the GMNF as a result of atmospheric deposition. The amount and extent of leaching is highly variable.
- The levels of potentially toxic aluminum and manganese have increased in soils of the GMNF. High levels of these elements can affect the health of vegetation and aquatic organisms.

The forest ecosystems most sensitive to sulfur and nitrogen deposition have been mapped using a model developed in Europe and adapted to the Northeast (Conference of New England Governors and Eastern Canadian Premiers Forest Mapping Group 2003). Forests with high sensitivity have a greater risk of forest decline problems and soil cation depletion. Based on the maps, approximately two-thirds of the GMNF is mapped as having moderate to high sensitivity. These areas occur on the middle to upper elevations, throughout the Forest. Miller (2004) has estimated the calcium losses attributable to sulfur and nitrogen leaching (related to acid deposition) on the GMNF at 18 times greater than projected calcium losses due to timber harvesting.

3.2.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Effects Common to all Alternatives

Soil resource S&Gs and other measures for protecting soil quality are effective when implemented. Under all alternatives it is anticipated that soil resources will be protected and the effects of implementing one alternative over another would be minimal because protection measures would minimize the impacts to soil quality. The opportunity for human error exists when implementing S&Gs and AMPs, which could result in a reduction in soil quality. Therefore, human error is considered in the discussion of direct and indirect effects.

The direct and indirect effects of a variety of land management practices were considered in this analysis. The most common practices having potential detrimental effects on soils are displayed in Table 3.2-1, along with their effects. Note that the soil effects listed are those expected if no soil protection measures, such as S&Gs and AMPs, are implemented. The potential direct effects are erosion, compaction, rutting, and loss of soil nutrients. The potential indirect effects are losses in soil quality and productivity. Most of these effects, if they occur, would last for several years or decades if no restorative actions were taken.

Indicator 1 – Acres in MA Allocations Most Subject to Ground Disturbing Activities

Indicator 1 reveals differences between alternatives in the acreage of MA allocations most subject to ground disturbing activities. Ground disturbing activities have the potential to decrease soil quality to varying degrees. The greater the number of acres of ground disturbing activities, the greater the potential to degrade soil quality. If soil quality is degraded, the soil productivity and biodiversity would also decrease.

Table 3.2-1: Soil Effects of Common FS Activities on the GMNF, without soil protection measures

Activity	Soil Effects
Timber harvest	Landing and skid road construction and use, and over-land travel by skidders can all result in erosion, rutting, compaction, and other losses in soil quality. Removal of trees can also reduce on-site nutrient levels in the short-term. Crossing of wet soils by skidders can cause compaction and rutting.
Road construction and maintenance	Construction can result in erosion, compaction, removal of topsoil, and loss in soil quality. Maintenance can result in erosion and soil displacement.
Recreation development	Construction of new recreation developments can result in erosion, compaction, removal of topsoil, and loss in soil quality.
Trail construction and maintenance	Erosion can occur on trails where the flow of water is uncontrolled. Displacement of soil and loss of soil quality can occur in trail beds.
Prescribed Fire	Erosion can occur on control lines and in burned areas due to loss of organic matter after burns.
Mineral exploration and extraction	Erosion and compaction can result from excavation, road building and use, and construction of facilities. Removal of topsoil, loss in soil productivity, and loss of subsoil material can occur when minerals (such as gravel) are moved off-site.
Downhill ski areas development and maintenance	Erosion and compaction can result from ski run construction, road building and use, and construction of facilities. Losses in soil quality can occur when topsoil or subsoil is highly mixed or moved off site.

Although there is opportunity for soil disturbance within the MAs discussed, only a relatively small portion of each MA would actually be subject to ground disturbing activities in any given alternative. The estimated acreage for various ground disturbing activities is provided in the Forest Plan Proposed and Probable Practices (revised Forest Plan, Appendix D). Although these acres are specific to Alternative E, they are not expected to vary by alternative except those associated with timber harvest activities. The Timber Management section of Chapter 3 (Table 3.13-6) provides the potential acres harvested under each alternative.

Effects Common to all Alternatives

While this indicator reveals sizeable differences between the varied alternatives, the actual overall risk of reduced soil quality would be low for all alternatives. This is because under all alternatives, it is anticipated that the short and long-term effects of implementing one alternative over another would be minimal because standards and guidelines and other protection measures would minimize the impacts to soil quality.

It is important to note that soil conditions on a majority of the Forest (regardless of the alternative) would actually improve over the next planning period. This is because, as displayed in Table 3.2-2, only 50 to 68 percent of GMNF lands (depending on the Alternative) would generally be subject to soil disturbing activities. Equally as important, only a small percentage of lands subject to ground-disturbing activities (based on Table 3.2-2), would actually undergo ground disturbance over the next planning period. For example, timber harvesting would be allowed in Diverse Forest Use, but only a relatively small percent of this management area would actually be subject to harvesting over the next planning period. Another example is that under the 1987 Plan, approximately 45 percent of the GMNF (approximately 162,500 acres) was allocated to management areas allowing harvesting. However, only 20,136 acres were actually harvested from 1987 to 2001, or about 5 percent of the GMNF (USDA 2002c).

Soil quality on lands unaffected by soil disturbance would improve over the planning period because soil processes would proceed unhindered. This soil improvement would equate to soil restoration, since over time the soil ecosystem would move toward a more natural condition. Examples of improvement and restoration processes are the release of soil nutrients (and soil enrichment) through rock weathering, cycling of moisture and nutrients in the ecosystem, and organic matter and nutrient accumulation near the soil surface. This information, combined with the fact that S&Gs would minimize detrimental impacts to soil quality, demonstrates that soil quality would be protected and maintained on a Forest-wide basis, regardless of what alternative is selected. Thus, the goal to maintain or restore the natural, ecological functions of the soil would be met.

Table 3.2-2: Acres in MA Allocations Most Subject to Ground Disturbing Activities

Alternative	Acres
A	198,872 (50%)
B	273,347 (68%)
C	245,930 (61%)
D	226,748 (57%)
E	239,156 (60%)

Source: GMNF GIS Alternative A-E MA Layers. MA Allocations most subject to disturbance are Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Escarpment, Recreation Special Areas, Moosalamoo Recreation and Education Area, Alpine Ski Areas, and Alpine Ski Area Expansion. Notes: Percents in parentheses indicate the percent out of the total GMNF acreage (400,000 acres).

Alternative A

As displayed in Table 3.2-2, Alternative A would have the lowest acreage subject to ground disturbing activities (198,872 acres, or 50% of the GMNF). This indicates that the risk of ground disturbance for Alternative A, the need for erosion control measures, the risk of an erosion control measure failing (due to human error or a very heavy rain), and the risk of reductions in soil quality would be the lowest of any alternative.

Alternative B

Alternative B would have the highest acreage of lands most subject to ground disturbing activities (273,347 acres, or 68% of the GMNF). The risk of ground disturbance, the need for erosion control measures, the risk of an erosion control measure failing (due to human error or a very heavy rain), and the risk of reductions in soil quality would be greatest for Alternative B.

Alternatives C, D, and E

Alternatives C, D, and E would be intermediate in their acreage of ground disturbing activities (ranging from 226,748 to 245,930 acres, or 57

to 61% of the GMNF). The risk of ground disturbance, the need for erosion control measures, the risk of an erosion control measure failing (due to human error or a very heavy rain), and the risk of reductions in soil quality would be greater than Alternative A, but less than Alternative B.

Indicator 2 – Acres in Management Area Allocations Subject to Ground Disturbing Activities, With a High Erosion Hazard

Indicator 2 reveals differences between alternatives in the acreage of lands having a high soil erosion hazard rating in areas most subject to ground disturbing activities (Table 3.2-3). The greater the number of acres of ground disturbing activities on soils with a high erosion hazard, the greater the potential to degrade soil quality.

Effects Common to all Alternatives

Twenty-five to thirty-four percent of the GMNF could be subject to ground-disturbing activities, in areas with a high erosion hazard (Table 3.2-3). However, as explained under Indicator 1, not all acres listed in Table 3.2-3 would actually undergo soil-disturbing activities in the next planning period. Standards and guidelines would also minimize detrimental short and long-term impacts to soil quality. Therefore, the effects of management practices on Forest-wide soil quality would be minor, and soil quality would be maintained.

Alternative A

Alternative A has the lowest acreage (101,336 acres, or 25%) of lands with potential for ground disturbing activities, with a high erosion hazard. The risk of soil quality degradation is lowest for this alternative.

Alternative B

Alternative B has the greatest land acreage (136,201 acres, or 34%) of lands with potential for ground disturbing activities, with a high erosion hazard. This indicates that the risk of soil quality degradation is highest for this alternative.

Alternatives C, D, and E

Alternatives C, D, and E are intermediate in acreage (ranging from 111,576 to 122,831 acres, or 28% to 31%) of lands with potential for ground disturbing activities, with a high erosion hazard. The risk of soil quality degradation for these alternatives is greater than A, but less than B.

Table 3.2-3: Acres With A High Erosion Hazard, in MA Allocations Most Subject to Ground Disturbing Activities

Alternative	Acres
A	101,336 (25%)
B	136,201 (34%)
C	122,831 (31%)
D	111,576 (28%)
E	118,542 (30%)

Source: GMNF GIS Alternative A-E MA Layers MA Allocations most subject to disturbance are Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Escarpment, Recreation Special Areas, Moosalamoo Recreation and Education Area, Alpine Ski Areas, and Alpine Ski Area Expansion.
Notes: Percents in parentheses indicate the percent out of the total GMNF acreage (400,000 acres).

Indicator 3 – Soil Productivity Losses from Biomass Removal and Acid Deposition

Effects Common to all Alternatives

For all alternatives, the loss of soil nutrients from forest sites due to the removal of trees during harvest, a ground disturbing activity, would be minor (Burt et al. 2005). The loss of soil nutrients via leaching in response to atmospheric deposition of sulfur and nitrogen would continue at rates similar to the present for all alternatives. Few ground-disturbing activities, and limited timber harvesting, would occur at the higher elevations of the GMNF.

Biomass Removal

For all alternatives the type and intensity of harvests on the GMNF would include: minimal use of clearcutting; mostly bole-only logging; relatively long rotations; following S&Gs; and

avoidance of harvest on high elevation and/or inherently nutrient poor soils. Given these conditions the nutrient losses due to harvest (biomass removal) would be minor, as would the effects on soil quality and productivity. These conclusions are based on a review of the most applicable scientific literature (Burt et al. 2005), including:

- Based on a study of nutrient removals resulting from harvests at Hubbard Brook Experimental Forest, Johnson (1997) determined that despite large exports of nutrients from the forest ecosystem in harvested biomass, and post harvest stream water losses, whole tree harvesting had little impact on the soil pools of the exchangeable nutrient cations – calcium, magnesium, and potassium. Johnson concluded that because the soil is the principle source of these nutrients, it appears that clear-cutting of this northern hardwood forest did not compromise available soil nutrient reserves. Note that nutrient losses would have been even smaller if bole-only logging, or a partial cut had been used.
- Nutrient losses due to acid deposition were estimated to have exceeded nutrient losses due to timber harvesting by a large margin, based on research at Hubbard Brook, New Hampshire (Gbondo-Tugbawa and Driscoll 2003). This study indicated that historical forest cutting and harvesting has little effect on soil exchangeable nutrient pools.
- Hornbeck and Kochenderfer (2000) reported that leaching of base cations and nitrogen from soils to streams usually reaches a maximum shortly following harvest. In most eastern forests leaching losses are tempered quickly - usually within five years – foliage production and plant uptake recover rapidly.

Acid Deposition

Effects due to acid deposition will be similar for all alternatives. Managers on the GMNF have no direct control or regulatory authority over the amount of deposition coming to the Forest. In addition, no changes in current Forest Service management practices have been recommended by the research community in New England to mitigate potential soil nutrient losses related to acid deposition (Burt et al. 2005). Under all alternatives, the Forest Service will continue to monitor the effects of acid deposition, and base management decisions on the best available scientific information in order to maintain soil quality over the long-term (Burt et al. 2005).

Cumulative Effects

Effects Common to all Alternatives

The cumulative effects on soil quality of implementing any alternative of the revised Plan consists of the effects of ground disturbing activities (including tree harvesting and biomass removal) and acid deposition on NFS lands. The timeframe for this analysis consists of the current planning period (1987 to 2005), the next planning period (extending 10 to 15 years into the future), and beyond the next planning period (the long-term).

The primary land management activities with potential to affect soil quality on the GMNF throughout the time period of this analysis are the same as those considered in the analysis of direct and indirect effects. Similar magnitudes of effects on the soil resources would occur for the long-term. For this reason, effects would continue at low levels, having only minor impacts to soil quality. Soil quality on acres not subject to soil-disturbing activities would actually improve due to ongoing natural processes.

For all alternatives, it is reasonable to expect that over the long-term the potential detrimental effects to soil quality and productivity resulting from management practices (including harvesting) on the GMNF would be minor due to mitigation and protection measures. In

addition, the acres unaffected by management practices would far exceed the acreage affected by management practices. Thus, soil quality on a Forest-wide basis would be maintained for all alternatives, and over much of the Forest would move toward a more natural condition (restoration).

Conversely, as previously stated (Section 3.2.1: Nutrient Loss – Acid Deposition), it is expected that soil quality on the GMNF has, is, and will continue to be affected by acid deposition. Therefore:

- Since the effects of Forest Service management practices (including harvesting) on soil quality would be minor under any alternative of the revised Plan, and
- Since acid deposition is negatively affecting soil quality in important ways, at levels that vary across the landscape,
- The cumulative effects on soil quality, of Forest Service management practices plus acid deposition, are approximately equal to the effect of acid deposition alone.

It is worth noting that air quality is expected to improve over the next 50 years (Sams 2003) and effects to soils are expected to slowly decrease. This decrease in effects may or may not become evident in the next planning period.

The cumulative effects on soil productivity (as defined by the Forest Service), of harvesting plus acid deposition, have also been assessed. Soil productivity is an aspect of soil quality for which the Forest Service has sufficient information to assess the level of effects. Conclusive evidence in New England that soil productivity has been affected by acid deposition is lacking (Burt et al. 2005), except possibly in high elevation spruce-fir stands (National Science and Technology Council 1998). No timber harvest is done on the GMNF in high elevation spruce-fir stands. Annual monitoring projects by the Vermont Department of Forests, Parks, and Recreation found that hardwood forests on the GMNF and throughout the State are generally healthy, with instances of dieback and mortality most often resulting from drought or insect infestations. Acid deposition has not been identified as a major factor responsible for forest decline in Vermont (State of Vermont Department of Forests, Parks, and Recreation 2004). Similar findings have been published by other agencies and organizations doing forest health monitoring (Burt et al. 2005). Long term decreases in biomass production attributable to acid deposition, have not been identified in New England (Burt et al. 2005). Also, species shifts attributable to acid deposition have not been observed on the Forest. Similarly, there have been no observations of a lack of vigorous tree regeneration following harvests on the Forest, which could also be attributable to acid deposition (Burt et al. 2005). Therefore, based on the best available scientific information applicable to the GMNF:

- Nutrient depletion from acid deposition is not of sufficient magnitude to decrease soil productivity and cause tree decline and biomass reductions, on middle to lower elevations on the GMNF.
- As stated previously in this section, the effects of harvesting (biomass removal) on soil productivity are minor.
- Thus, the cumulative effects of acid deposition and harvesting on soil productivity are minor.

If credible new scientific information emerges during the planning period that causes the Forest Service to view these cumulative effects differently, management practices will be adapted based on consultation with researchers at the Northeast Forest Experiment Station.

3.3 WATER

Issue Statement

Concern is focused on the extent to which water quality, riparian area conditions, and watershed health will be maintained and/or restored in the revised Forest Plan. Maintenance of water quality and riparian area conditions is an important part of the issue of restoring, protecting, maintaining, and enhancing biological and ecological diversity.

The related issue of the need to do watershed planning is outside the scope of the Plan revision process, so it is not addressed here. The effects on the fisheries component of riparian areas are addressed in the Fisheries section (3.7) of Chapter 3. Additional information on the effects of erosion, compaction, and nutrient losses in riparian areas is provided in the Soils section (3.2).

For purposes of this analysis, the term "riparian areas" includes all streams, rivers, wetlands, and woodland (vernal) pools. See the Glossary for complete definitions of these terms.

Indicator 1 – Acres in Management Area Allocations Most Subject to Ground Disturbing Activities that Could Impact Water Quality and Riparian Area Conditions

The indicator to be used in this effects analysis is the number of acres in management area (MA) allocations most subject to ground disturbance that could negatively impact water quality and riparian area conditions. This indicator is important because the higher the number of acres subject to ground disturbing activities, the greater the potential for reductions in water quality and damage to riparian areas. Reductions in water quality normally consist of sedimentation (when eroded soil enters a stream) and nutrient enrichment. Damage to riparian areas usually consists of changes in the channel configuration, or reductions in: stream bank stability, stream shading, large woody debris input to the stream, riparian vegetation, or streamside plant or wildlife habitat. Ground disturbance is the result of activities such as tree harvests, prescribed burns, trail construction, recreation development and use, road construction and maintenance, downhill ski trail development and maintenance, and minerals exploration and extraction. The MAs most subject to ground disturbance are: Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, the Escarpment, Recreation Special Areas, Moosalamoo Recreation and Education Area, Alpine Ski Areas, and Alpine Ski Area Expansion. All other MAs are subject to low, or no, levels of ground disturbing activities.

Analysis Area

The analysis area for direct and indirect effects includes all federal lands managed by the Green Mountain National Forest (GMNF). These are the lands where water quality and riparian area conditions are potentially subject to effects resulting from ground disturbing land management activities. The analysis area for cumulative effects consists of GMNF lands and the lands administered by public and private owners within subwatersheds that overlay (partially or fully) federal lands on the GMNF. Forest Service activities in each subwatershed have the potential to affect water quality and riparian conditions throughout the entire subwatershed.

3.3.1 Affected Environment

Introduction

The condition of water resources on the GMNF is described in detail in the *Water Resource Assessment - Green Mountain National Forest* (USDA 2004g). The drainages of major rivers have been mapped by the US Geological Survey at six levels of detail throughout the country. The most detailed levels of mapping,

called the 5th and 6th levels, are discussed here. Units mapped at the 5th level are termed watersheds. Units at the 6th level are termed subwatersheds, as they are subdivisions of watersheds. Fourteen 5th level watersheds touch the GMNF: the Mad River, New Haven, Upper Otter, Lower Otter, Upper White River, Lower White River, Connecticut River, Ottauquechee, Mettawee, Batten Kill, Hoosic, Walloomsac, Deerfield, and West. Approximately seventy 6th level subwatersheds fall fully or partially within the GMNF.

Water quality and riparian area conditions on the GMNF were affected by past land management, as described in the Soils section (3.2). Land clearing in the early-to-mid 1800s led to degradation of water quality and riparian conditions. There was increased sedimentation, runoff, and stream channel instability, as well as decreased stream shading, riparian vegetation, and diversity of riparian wildlife habitats. As lands became reforested in the mid-to-late 1800s, water quality and riparian conditions began to improve. Logging in the early-to-mid 1900s degraded water quality and riparian conditions again, but to a lesser extent. By the 1960s, water quality and riparian area conditions were being restored, and basic erosion and sediment control measures were being used on the GMNF. More comprehensive water and riparian conservation measures were adopted as part of the 1987 Forest Plan in the form of standards and guidelines.

The Forest Service completed a watershed assessment for the Upper White River Watershed on the North Half of the Forest in 2001. The Forest Service identified several watershed health concerns in the assessment, including: many riparian areas lacked forested buffer strips; flow peaks and volumes had increased due to land management; there was a high sediment load in the main stem of the Upper White River; acid deposition decreased the pH of some streams and lakes in the watershed; and there was a lack of large woody debris in the streams. Several recommendations were made to address these concerns, most importantly: work with partnerships to establish forested buffer strips and restore large woody debris to streams, identify actions to encourage geomorphic stability in the White River, decrease river flow volumes and the peak flows, determine the main sources of sediment, and support efforts to reduce acid deposition. These watershed concerns and recommendations are common to many watersheds on the GMNF today (USDA 2004g).

Much of Vermont has experienced increased levels of development to accommodate an increasing human population and changing land uses. Traditional land uses such as family farming and forest management have slowly given way to public demands for more housing, transportation, and recreation infrastructure in suburban and urban areas. The result has been increased sedimentation, storm water, nutrient-rich runoff, and flooding, and other factors that threaten water quality in Vermont waterways (USDA 2004g).

Streams and rivers on the GMNF have been subjected to fewer of these human-imposed changes over time. The extent and magnitude of water resource problems are less than elsewhere in Vermont. Some water resource problems still need to be addressed, however, through Forest Service watershed planning and the implementation of restoration projects. For example, it has been widely recognized that the removal of vegetation from riparian areas, even a century or so ago, has left a conspicuous lack of woody material and debris in GMNF stream channels. The loss of wood has had profound impacts including alterations of existing aquatic habitat quality and quantity, sediment storage and transport, and overall channel pattern, dimension, and profile (USDA 2004g).

Outstanding Resource Waters (ORWs) are waters designated by the State that have exceptional natural, recreational, cultural or scenic values. Water quality of ORWs, and other values for which a waterbody is designated, must be maintained (State of Vermont 2004). There is one ORW, the main stem of the Batten Kill River, which is outside the GMNF, but within a 6th Order Subwatershed that touches the GMNF. This ORW is,

therefore, inside the analysis area for this effects discussion.

The greatest impact to water quality on the GMNF comes from atmospheric pollutants that acidify lakes and streams, reducing the biologic diversity and habitat quality. Ski areas and recreational facilities on National Forest, State, and private lands can also potentially negatively affect watersheds. For example, trail development can cause sedimentation and loss of riparian area vegetation. The Forest Service, however, works to minimize or eliminate these impacts to water quality and biological communities on the GMNF.

Water quality and riparian condition can be maintained or restored in several ways. Some of the most common ways are to: minimize ground-disturbing activities; eliminate sedimentation sources through erosion control measures; locate roads and trails away from streams; and provide healthy riparian areas that shade streams and filter out nutrients and sediment.

Existing Forest Plan Management Direction

Goals in the 1987 Forest Plan direct the Forest Service to meet all federal, State, and local laws governing management of the National Forest, including the Clean Water and Safe Drinking Water Acts. The 1987 Plan also directs the Forest Service, through Forest-wide standards and guidelines, to not allow water quality to be unacceptably compromised by any management activities or public use, and to provide the finest quality water in municipal watersheds. To meet this direction, current management of water and riparian resources on the GMNF is directed at minimizing the negative effects of land management practices, maintaining and improving water quality and riparian conditions, and protecting wetlands, lakes, and ponds.

Proposed Changes in Management Direction Common to All Alternatives

The proposed goal for protection and management of water quality and riparian conditions in the revised Plan continues direction provided in the 1987 Plan while increasing emphasis on riparian area restoration. The revised Forest Plan goal is to “maintain or restore aquatic, riparian, and wetland habitats” (Goal 4). The revised Plan will expand, through Forest-wide objectives, the protection for woodland pools, wetlands, and riparian areas. The Forest Plan will clarify that maintaining or improving water quality includes the protection and restoration of riparian areas, and associated ecological process and functions such as filtering sediments and providing woody debris. The revised Forest Plan also incorporates the State of Vermont Acceptable Management Practices (AMPs) into management activities (Vermont Agency of Natural Resources, Department of Forests, Parks and Recreation 1987).

Existing Condition

Nine watersheds have headwaters located on the GMNF that flow into the Connecticut River, Otter Creek, or Hudson River. Streams typically have steep slopes, narrow streambeds with large boulders, and dense, forested riparian area vegetation. The majority of lakes and ponds on the GMNF are located at mid-to-high elevations, in a mix of coniferous and deciduous forests.

Diverse bedrock types underlie the GMNF. Bedrock ranges from calcium-rich to acidic, producing wide variations in water pH, alkalinity, and biologic aquatic communities. Surficial geologic deposits are also diverse, ranging from glacial till (earthen material moved by glacial ice) to glacial outwash (sediments deposited by moving water) and lacustrine (sediments deposited in lakebeds). These deposits directly influence stream characteristics such as water quality, aquatic diversity, and channel configuration.

There are currently no Outstanding Resource Waters on the GMNF and no rivers in the Wild and Scenic Rivers system. Wild and Scenic Rivers and significant streams are addressed in the Wilderness, Wild and Scenic Rivers, and National Recreation Area section (3.12). All waters at an elevation above 2,500 feet are Class A1 waters, as identified in Vermont's Water Quality Standards. The aquatic biota and habitats of Class A waters must be consistent with waters in their natural condition. All other waters on the GMNF are Class B. In these waters, changes in the aquatic biota and habitats are limited to minimal changes from the reference (natural) condition (USDA 2004g).

The State of Vermont places all wetlands in one of three classes. Class 1 wetlands are exceptional or irreplaceable in their contribution to Vermont's natural heritage. They merit the highest level of protection. Class 2 wetlands are also significant based on an evaluation of their functions, but merit a lower level of protection than Class 1. All other wetlands are Class 3. These wetlands either are not so significant as to merit protection, or they have not been thoroughly evaluated. There are no Class 1 wetlands on the GMNF, but there are dozens of Class 2 and 3 wetlands (USDA 2004g). Wetlands on the GMNF are protected by State and federal wetlands regulations, Forest Service Manual Directives, and standards and guidelines (S&Gs) in the 1987 Plan.

Water and macroinvertebrate monitoring on the GMNF usually indicates high water quality conditions, those exceeding Vermont Water Quality Division water quality standards, and macroinvertebrate communities with moderate to high biologic integrity exist on the Forest. Several streams on the Forest are considered by the State of Vermont to be at reference condition. Reference condition streams are minimally disturbed (comparatively speaking) and have stable channels, good riparian buffers, coarse sediments, large woody debris, and channel geometry features that give structure to the stream (USDA 2004g).

Source Protection Areas and Well Head Protection Areas are land areas that are the source of drinking water for municipalities and/or private use. These areas require protection in order to maintain the highest water quality. Twenty-seven protection areas are totally or partially within the National Forest. The objective in these areas has been to provide the finest quality water that can naturally occur. This objective has been met by minimizing or eliminating ground-disturbing management activities in, or near, these protected areas.

Current management activities on the GMNF typically have minor adverse impacts on water quality and riparian areas as shown in monitoring results and reference stream conditions. In addition, monitoring of timber harvest areas throughout the 1990s showed that standards and guidelines (S&Gs) for soil and water protection were implemented and effective in minimizing soil erosion and resulting stream sedimentation (USDA 2004g, USDA Undated B). Protecting water resources through implementation of AMPs (or similar Best Management Practices) has been shown to be effective throughout the northeast United States (Martin and Hornbeck 1994).

Despite the overall good water quality and compliance with S&Gs, degraded water resource and riparian area conditions exist on some areas of the Forest due to two reasons. First, water quality and aquatic communities have been degraded to varying degrees due to atmospheric deposition of sulfur, nitrogen, and mercury (Stratton 2005; also see the Soil and Air Quality sections (3.2 and 3.4) for more information). This has resulted in acidified waters, compromised aquatic communities, and accumulation of mercury in the sediments of some ponds and lakes. This degradation is most problematic at high elevations on the Forest. Twenty-two lakes, ponds, and streams on the GMNF are listed as impaired by the State of Vermont Water Quality Division, due to acid deposition. One pond on the GMNF, Grout Pond, is listed as impaired due to mercury levels that exceed State standards (USDA 2004g). The number of water bodies impaired due to mercury is expected to increase in the

future as more monitoring is done. GMNF managers have no direct control over the amount of deposition coming to the Forest, and cannot effectively mitigate deposition effects by modifying management practices (Burt et al. 2005 Stratton 2005).

The second reason many water and riparian resources are degraded is due to historic land clearing, road construction and maintenance, and harvesting. Most of this degradation originated 40 to150 years ago. While streams and riparian areas have been largely restored due to natural processes, some degradation still persists today. To reduce this degradation, water quality and riparian restoration efforts have been ongoing since the late 1980s. Each year projects are implemented to stabilize stream banks, protect wetlands, control erosion and sedimentation on uplands, and improve stream and riparian wildlife habitats. Much of this work is done in partnership with watershed organizations (USDA 2004g).

3.3.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Effects Common to all Alternatives

Water and riparian resource S&Gs, AMPs, and other mitigation measures for protecting water and riparian habitat quality are effective when implemented. In all alternatives it is anticipated that water and riparian conditions would be protected and the effects of implementing one alternative over another would be minimal. This would be true over the short-term planning period (10 to 15 years) and beyond. The opportunity for human error exists, however, when implementing S&Gs and AMPs, which could result in detrimental effects to water quality and riparian conditions. Therefore, human error is considered in the discussion of direct and indirect impacts.

Indicator 1 – Acres in Management Area Allocations Most Subject to Ground Disturbing Activities that Could Impact Water Quality and Riparian Areas

Indicator 1 reveals differences between alternatives in the acreage of MA allocations most subject to ground disturbing activities that could negatively impact water quality and riparian areas. Ground disturbing activities have the potential to decrease water quality and riparian areas to varying degrees. The greater the number of acres of ground disturbing activities, the greater the potential for degradation. If water quality and riparian condition are degraded, the forest biodiversity would decrease.

Although there is opportunity for ground disturbance within the MAs discussed, only a relatively small portion of each MA would actually be subject to disturbance activities in any given alternative. The estimated acreage for various ground disturbing activities is provided in the Forest Plan Proposed and Probable Practices (revised Forest Plan, Appendix D). Although these acres are specific to Alternative E, they are not expected to vary by alternative except those associated with timber harvest activities. The Timber Management section of Chapter 3 (Table 3.13-8) provides the potential acres harvested under each alternative.

The direct and indirect effects of several land management practices were considered in this analysis. The most common practices having potential detrimental effects on water quality and riparian areas are displayed in Table 3.3-1, along with their effects. These practices are: timber harvest, road construction and maintenance, recreation development and use, trail construction and maintenance, prescribed fire, mineral exploration and extraction, and downhill ski area development and maintenance.

The potential direct effects include sedimentation, stream nutrient enrichment, changes in local hydrology (such as diversion of surface runoff due to a skid trail), and loss of riparian vegetation including large woody

debris. The potential indirect effects include overall reductions in water quality, changes in stream temperature, degradation of fish habitat, changes in stream channel configuration, and off-site changes in hydrology (such as increased stream flow volume). Most of these effects, if they occur, can last for several years.

Note that the water and riparian effects listed are those expected if no resource protection measures, such as S&Gs and AMPs, are implemented. This would never be the case on the GMNF because AMPS, S&Gs, and other water resource protection measures are implemented on every project. These protection measures minimize the negative impacts to water quality and riparian areas.

Effects Common to all Alternatives

Despite the acreage differences (74,475 acres between the alternatives with the most and least acres potentially subject to ground disturbance), the actual variation between alternatives in the risk to water quality and riparian conditions would be small. Also, the overall risk of reductions in water quality or riparian conditions would be minor for all alternatives. This is because measures such as S&Gs and AMPs to protect water and riparian resources would be implemented with every project, for all alternatives.

If water quality and riparian area conditions are maintained, water resources will support the greatest amount of terrestrial and aquatic diversity. Waters in this condition can also provide the greatest benefits to people including clean water, and opportunities for water-based recreation, such as fishing, boating, and scenic views. When water quality and riparian conditions are maintained over the long-term, the ability of water resources to provide important functions in the forest ecosystem will continue. Some of these functions are: maintaining the ecosystem productivity and biological diversity, maintaining forest hydrologic processes, and providing riparian plant and animal habitats.

It is important to note that riparian conditions and water quality on a majority of the Forest (regardless of the alternative) would actually improve over the next planning period. This is because, as displayed in Table 3.2-2 of the Soils Section, only 50 to 68 percent of GMNF lands (depending on the Alternative) would generally be subject to ground-disturbing activities. Equally as important, only a small percentage of lands subject to ground-disturbing activities (based on Table 3.2-2) would actually undergo disturbance in the next planning period. For example, timber harvesting is allowed in Diverse Forest Use, but only a relatively small percent of this management area would actually be subject to harvesting over the next planning period. Another example is that in the 1987 Plan, approximately 45 percent of the GMNF (or approximately 162,500 acres in 1987) were allocated to management areas allowing harvesting. However, only 20,136 acres were actually harvested from 1987 to 2001, or about 5 percent of the GMNF (USDA 2002c). Riparian areas not subject to disturbance would improve through natural processes. As natural processes proceed, water quality improves through minimized sedimentation, decreased loss of large woody debris, organic inputs to water bodies, stream-side shading, stream bank stability, and aquatic habitat improvement. Additionally, some riparian areas would be improved following implementation of site-specific restoration projects.

Alternative A

As displayed in Table 3.2-2 of the Soils Section, Alternative A would have the lowest acreage subject to ground disturbing activities (198,872 acres, 50% of the GMNF). This indicates that the potential risk of ground disturbance, the need for water quality and riparian protection measures, the risk of a protection measure failing (due to human error or very heavy rain), and the risk of reductions in water quality and riparian condition would be the lowest for Alternative A.

Alternative B

Alternative B would have the highest acreage of lands most subject to ground disturbing activities (273,347 acres, or 68% of GMNF;

Table 3.2-2). The potential risk of ground disturbance, the need for water quality and riparian protection measures, the risk of a protection measure failing (due to human error or very heavy rain), and the risk of reductions in water quality and riparian condition would be the greatest for Alternative B.

Alternatives C, D and E

Alternatives C, D, and E would be intermediate in their acreages of ground disturbing activities (ranging from 226,748 to 245,930 acres, or 57-61% of GMNF; Table 3.2-2). The potential risk of ground disturbance, the need for water quality and riparian protection measures, the risk of an protection measure failing (due to human error or very heavy rain), and the risk of reductions in water quality and riparian condition would be larger than Alternative A, but less than Alternative B.

Cumulative Effects

The cumulative effects on water quality and riparian area conditions of implementing any alternative of the revised Plan consist of the effects of land disturbing, plus the effects of acid deposition. The timeframe for this analysis consists of the current planning period (1987 to 2005), the next planning period (extending 10 to 15 years into the future), and beyond the next planning period (the long-term). The analysis area consists of all GMNF lands and all other lands in subwatersheds that overlay (partially or fully) federal lands on the GMNF.

In general, GMNF lands in the cumulative effects analysis area are at the middle to upper part of watersheds (headwaters). Conversely, privately owned and other public lands in the analysis area tend to be in the lower parts of watersheds. This means that the quality of waters flowing from the GMNF influences water quality on most privately owned lands, while the reverse is usually not true. Riparian management on GMNF lands can also influence the condition of riparian areas on private lands, since private lands are generally downstream. For example, if riparian areas on GMNF land provide shade to streams, have stable stream banks, and offer sufficient organic

Table 3.3-1: Potential Effects of Common FS Activities on Water Quality, Fisheries Habitat, and Riparian Areas, Without Resource Protection Measures

Activity	Potential Effects
Timber harvest	Landing and skid road construction and use, and over-land travel by skidders can cause sedimentation, damage to wetlands, streams, ponds, and woodland pools, degradation of aquatic/fisheries habitats, and reductions in stream shading, increases in water temperature, and large woody debris for streams.
Road construction and maintenance	Construction and maintenance can result in changes to drainage patterns, fish migration barriers, sedimentation, damage to wetlands, streams, ponds, and woodland pools, and degradation of aquatic/fisheries habitats. If road cross drainage is improperly located, sedimentation and habitat degradation can be a long-term problem.
Recreation development and use	Construction of new recreation developments can cause sedimentation, degradation of aquatic/fisheries habitat, and nutrient enrichment of waters.
Trail construction and maintenance	Construction and maintenance can result in degradation of water quality and aquatic habitat, including sedimentation at stream crossings and fish migration barriers.
Prescribed Fire	Sedimentation can result from soil erosion following burns and control lines.
Mineral exploration and extraction	Road and facility construction and use can cause sedimentation, damage to wetlands, streams, ponds, and woodland pools, degradation of aquatic/fisheries habitats, and reductions in stream shading, increases in water temperature, and large woody debris for streams.
Downhill ski areas development and maintenance	Ski run construction, road building and use, and construction of facilities can result in sedimentation, changes to drainage patterns, degradation of aquatic/fisheries habitats, and reductions in stream shading, increases in water temperature, and large woody debris for streams.

inputs and high quality aquatic habitats, this will improve aquatic habitats on privately owned lands lower in the watershed. Riparian area conditions on privately owned lands, however, often have no influence on National Forest lands, since Forest lands are higher up in the watershed.

Over the short-term, water quality and riparian area conditions are anticipated to remain good on the GMNF. Water quality and riparian condition on privately owned lands will sometimes be lower, due primarily to development. Over the long-term, the conditions on National Forest lands are expected to improve.

It is difficult to predict land management trends and impacts on non-NFS lands over the short and long-term. It is reasonable to assume that development will continue, specifically conversion of pasture and wooded lands to home sites and increased home and business construction near towns. This development requires road building and maintenance, access to clean water through wells, and installation of septic and sewage water systems. These development activities can degrade water quality and riparian conditions if not managed properly. There is a general trend in Vermont, however, toward better protection of water quality and riparian areas, a trend that is expected to continue in the future. For example, there has been increased emphasis in recent years on reducing point sources of water pollution through implementation of Total Maximum Daily Load plans, and on reducing non-point pollution through promotion of best management practices around construction sites. This trend toward better water resource management should, at least in part, counterbalance the negative effects of increased development on water resources.

Aside from development pressure, management practices on privately owned forestlands are anticipated to stay the same over the short and long-term. As with the present, some lands will be harvested for wood products, and other lands will be managed for enhancement of wildlife habitat and aesthetic values. For those lands that are harvested, increased emphasis is expected on management practices that minimize the negative impacts to water quality and riparian resources. This reflects an existing general trend in Vermont toward better protection of natural resources, a trend that is expected to continue over the long-term.

The last major land use on privately owned lands in the analysis area is grazing. As mentioned earlier, the long-term trend is toward conversion of some grazing lands to development. Conversion of forested lands to grazing lands is not expected. On lands that remain in pasture over the long-term, increased emphasis is expected to control erosion and sedimentation, establish riparian buffers, and decrease manure wastes within water bodies. The Natural Resource Conservation Service has several programs to aid pastureland owners in working toward the goals of improving water quality and riparian area conditions. Watershed organizations with the goal of improving watershed health are also expected to be more influential over the long-term. These organizations will continue to influence landowners and implement projects to improve the water and riparian resources.

The cumulative effects on water quality and aquatic species, of GMNF forest management activities in combination with the effects of acid deposition, are approximately equal to the effects of acid deposition alone. The rationale for this is:

- The effects of forest management activities on water quality and aquatic species are minor (see Direct and Indirect Effects by Alternative).
- Acid deposition does affect water quality on the GMNF, to varying magnitudes. Effects are greatest at higher elevations (see section 3.3.1.).

3.4 AIR

Issue Statement

Concern is focused on the extent to which management activities on the Green Mountain National Forest (GMNF) would affect local and regional air quality. Maintenance of air quality is an important part of the issue of restoring, protecting, maintaining, and enhancing biological and ecological diversity. Additionally, there continues to be concern about the impacts to forest resources and air quality from air pollution transported to the GMNF from near and distant sources.

Additional discussion on the impacts of air pollution on other resources may be found in respective Chapter 3 sections, such as Soil (3.2), Water (3.3), and Vegetation (3.5).

Indicator 1 – Potential Amount of Particulate Emissions (tons per year) Generated from Prescribed Fire

The indicator to be used in this effects analysis is the potential amount of particulate emissions generated from prescribed fire. Prescribed fire is the management practice conducted by the GMNF that most directly impacts air quality. Prescribed fire is used to maintain wildlife openings and vistas, promote oak reproduction, control pond dike vegetation, promote vigor of blueberries, provide secondary habitat for many wildlife species, and provide forage for wildlife (see Wildland Fire Management section (3.17) for more information on the use of prescribed fire). This indicator will be used to describe and compare the effects of alternatives on air quality because the potential amount of particulate emissions would depend on the level of opportunity for the use of prescribed fire under each alternative's management area allocation.

Analysis Area

The analysis area for direct, indirect, and cumulative effects includes all land managed by the Green Mountain National Forest, and air quality "sensitive areas" within approximately 62 miles (100 km) of the Forest. Sensitive areas are those not meeting air quality standards or certain wilderness areas protected under the Clean Air Act. This distance was chosen to correspond to other air quality permitting criteria and is the area where smoke from prescribed fire could potentially affect air quality.

3.4.1 Affected Environment

Introduction

Statutes and regulations require federal land managers to protect air, land, and water from the effects of air pollutants originating from federal lands (Clean Air Act 1990, Organic Act 1897, Wilderness Act 1964). In addition, the Clean Air Act amendments (1977 and 1990) direct federal land managers to protect the air, land, and water resources under their jurisdiction from the impacts of air pollution originating outside of federal lands.

The Forest Service must minimize the impact of management activities on Forest resources, as well as the contribution of GMNF management activities to general air pollution. To fulfill this responsibility, the Forest Service must understand the impacts of pollution originating on National Forest System land, as well as the impacts of pollution from sources outside the Forest.

Local sources of air pollution include highway vehicles, fuel combustion, off-highway vehicles, dry cleaners, industry, and waste disposal (US EPA 2004a). Activities within the GMNF, such as road construction/maintenance, mineral development, summer off-road vehicles, and timber harvesting, all have potential impacts on

local air quality. These activities, however, are not expected to increase significantly in the future on the GMNF due to Forest Service management.

Recreational use of snowmobiles and summer off-road vehicles do contribute to air pollution loadings in Vermont. The EPA category of "off-highway vehicles" (which includes, but is not limited to, snowmobiles and off-road vehicles) for Vermont indicates these vehicles are the third largest source of certain regulated pollutants generated within the state (US EPA 2004a).

More distant sources include industry in the Ohio River Valley and other parts of the Midwest United States. This is important since the GMNF is northeast and upwind of this industrialized area which produces approximately half of the nation's nitrogen oxide and sulfur dioxide point source pollution (Driscoll et al. 2001, Sams 2002). Once emitted into the atmosphere, nitrogen oxides are ultimately converted to nitrates and sulfur dioxides are converted to sulfates which can then impact soil, water, vegetation and visibility.

Regional Haze

The Regional Haze Regulations require States and tribes to make reasonable progress over a period of decades toward restoring natural visibility conditions in major national parks and wilderness areas designated by the Congress in the Clean Air Act as "Class I" areas. Class I areas are afforded the greatest protection from air pollution impacts. National wilderness areas greater than 5,000 acres in size and national parks greater than 6,000 acres in size were designated Class I if they existed when the 1977 Clean Air Act amendments were passed. All other national parks and wilderness areas, as well as the remainder of the United States, were designated Class II areas.

The Lye Brook Wilderness (15,503 acres) located on the south half of the GMNF, is the only Class I area on the GMNF. As a Class I area, air quality related values (AQRVs), including visibility, are to be protected from air pollution impacts. As the Federal Land Manager for the Lye Brook Wilderness, the Forest Service has the direct responsibility to protect the AQRVs by considering the impacts of proposed major emitting facilities on these AQRVs (Clean Air Act, 42 U.S.C 7475(d)(2)(B)).

Additionally, because pollutants that cause haze are emitted over wide areas and are transported by winds over long distances, the United States Environmental Protection Agency (EPA) promulgated the Regional Haze Regulations (US EPA 1999). These regulations promote states, tribes and federal land managers working together in regional programs (Regional Planning Organizations (RPO)) to improve visibility in parks and wilderness areas. The GMNF is a partner in the Mid-Atlantic/Northeast Visibility Union (MANE-VU), the RPO considering all sources and their emissions which impact visibility at Lye Brook Wilderness.

The State of Vermont will need to develop a State Implementation Plan (SIP) for Regional Haze by 2008. In developing the SIP, all sources of air pollution (major, minor, local and distant) affecting Lye Brook Wilderness will needed to be considered for their contribution to visibility impairment and the potential reduction in emissions which could occur from that source. Reductions are meant to move visibility towards more natural conditions by 2064. State of the science emissions inventories and modeling is currently being conducted by the MANE-VU RPO in order to provide information and data to the New England states as they develop their SIPs.

Ozone

Regional air pollutants are inextricably related, and there is an interrelationship between ozone, fine particles, and regional haze. Ozone levels can occasionally reach high levels anywhere in the northeastern United States. Only southern California and some areas near the southern Appalachians experience greater and/or more frequent concentrations than the northeast United States of rural, ground-level ozone. This can be attributed to higher

temperatures and longer, more severe, periods of stagnant weather conditions (Sams 2002).

Atmospheric Deposition

Atmospheric deposition refers to chemicals that are carried in the air and deposited on the land or water via precipitation ("wet" deposition) or gases and particles ("dry" deposition). Sulfur dioxide (SO2) and nitrogen oxides (NOx) are the primary causes of atmospheric deposition producing acidic water, gases, and particles that can affect water quality, soil productivity, and other forest resources.

Sulfur dioxide and nitrogen oxides primarily come from fossil fuel combustion. 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 dominant sources for sulfur and nitrogen oxide emissions, traveling downwind to the northeastern US (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 and soil quality by lowering pH levels (increasing acidity), decreasing buffering capacity, and increasing aluminum concentrations.

Another 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 accumulated through the aquatic food chain. In Vermont, fish consumption advisories due to mercury are in effect for all surface waters (Sams 2002). See the Water section (3.3) for more information on the impacts of mercury deposition.

Existing Forest Plan Management Direction

The 1987 Forest Plan goals directed the Forest Service to meet all federal and State laws for air resource protection. The 1987 Plan also set a goal to learn more about the effects of air pollution on the forest ecosystem, and to adjust management to buffer any ill effects.

Proposed Changes in Management Direction Common to All Alternatives

The revised Forest Plan will continue management direction provided in the 1987 Plan, while incorporating a revised goal (Goal 5) and objectives to maintain or improve air quality on the GMNF. This goal was changed to be more proactive in protecting air quality and air quality related values. Additionally, the revised Plan includes standards and guidelines stating that all prescribed burning should implement best available smoke management techniques in order to minimize emissions and reduce smoke.

Existing Condition

Local Air Quality – Emissions and Concentrations

Emissions of particulate matter smaller than 2.5 microns in diameter (PM-2.5) impact visibility and human health. The amount of particulate matter a source emits is typically measured in tons per year. Sources which produce PM-2.5 include diesel cars, trucks and buses, power plants, industry, and many other sources including prescribed burning. Approximately 80 percent of the pollutants emitted from wildland fire and prescribed fire are PM-2.5. In Vermont, all counties, except Chittenden County, produce less than 2,500 tons per year of PM-2.5. Chittenden County produces between 2,500 – 4,500 tons per year of PM-2.5 (US EPA 2004b). Across Vermont, however, PM-2.5 emissions are relatively low compared to other more industrialized places in the country. For example, several New York counties generate more than 4,500 tons per year of PM-2.5 (US EPA 2004b).

The amount of particulate matter in the air which could impact human health is measured as a concentration, such as the amount of mass of particulate per unit volume of air. This concentration is typically expressed in

micrograms per cubic meter (μg/m^3). The EPA established National Ambient Air Quality Standards (NAAQS) for PM-2.5 for both a 24-hour period and an annual period. Although there are technicalities in how concentrations are measured and compared to the NAAQS, in general, concentrations must not exceed 65 μg/m^3 when averaged over 24 hours and must not exceed 15 μg/m^3 when averaged annually. This standard is meant to protect the groups at greatest risk to air pollution impacts: the elderly, individuals with cardiopulmonary diseases such as asthma, and children.

Air quality monitoring data from 1999 to 2003 collected by the Vermont Air Pollution Control Division indicates that Vermont complies with both the 24-hour and annual PM-2.5 standard (State of Vermont 2004b). Monitors are, or have been, located in Vermont in Barre, Bennington, Burlington, Rutland, and Underhill. These monitors represent upwind and downwind monitoring data near to, and on, the Forest. Individual sites vary but all 24-hour average concentrations are between 15 and 40 μg/m^3, and all annual average concentrations are between 6 and 12 μg/m^3 (Vermont 2004b). In addition to monitoring conducted by the State, the Forest Service has monitored air quality since 1991 at Mt. Equinox, on the South Half of the Forest, to determine visibility impacts to the Lye Brook Wilderness. Annual PM-2.5 concentrations at the Mt. Equinox site have averaged between 5 and 8 μg/m^3 since 1991 (Vermont 2004b).

In sum, the Vermont Air Pollution Control Division (APCD) of the Department of Environmental Conservation (DEC) implements state and federal Clean Air Acts, “monitors air quality and air pollution sources, proposes regulations to improve existing air quality, ensures compliance with the regulations, and issues permits to control pollution from sources of air contaminants across the state” (VAPCD, 2006). As such, they are the regulatory authority ensuring that ambient air quality standards, designed to protect human health, are met. As of February 2006, the State of Vermont meets federal and State ambient air quality standards not only for particulates but for all ambient air quality standards (carbon monoxide, lead, nitrogen dioxide, ozone and sulfur oxides).

Regional Haze

Emissions from prescribed fire, and all other local and distant sources, contribute to regional haze. Natural visibility, that is visibility unimpaired by emissions produced by humans, at Lye Brook would be approximately 162 miles on the best days, 111 miles on an average day, and 75 miles on the worst days (US EPA 2003, Copeland 2004). Current visibility at Lye Brook is about 120 miles on the best days, 60 miles on an average day, and 24 miles on the worst days (Visibility Information Exchange Web System 2004).

In the eastern United States, sulfates currently cause over 70 percent of the reduction in visibility. Under natural conditions, sulfates would cause about 10 percent of the visibility reduction (Malm 1999).

Ozone

Prescribed fires emit small quantities of nitrogen oxides which are precursors to ozone formation. The National Ambient Air Quality Standard for ozone is 0.08 parts per million averaged over 8 hours and 0.12 parts per million averaged over 1 hour. Ozone monitors in Vermont, located in Bennington and Underhill, show that Vermont currently meets 1-hour and 8-hour ozone standards. However, concentrations are at or near the 8-hour standard (Vermont 2004a and 2004c). If the standard were to be exceeded and deemed violated, the State of Vermont would have to develop a control strategy to bring the State’s air quality back into compliance with the standard.

Ozone also impacts plant species sometimes at concentrations or exposures less that established by EPA to protect individuals. Sensitive species include blackberry, black cherry, milkweed, yellow poplar, and white ash. Data from the USDA Forest Service Ozone BioMonitoring Project indicate low to moderate ozone exposure for most of Vermont. Elevations greater than 3,500 feet, however,

appear to be at higher risk than areas at lower elevations (Sams 2002). Currently pin cherry, blackberry, and black cherry are being monitored in the Lye Brook Wilderness for ozone effects (Vermont Monitoring Cooperative 2004).

Atmospheric Deposition

The Vermont Acid Precipitation Monitoring Program operates monitoring stations located at Underhill and Mt. Mansfield in northern Vermont. Data summaries for these stations from 1980 to 1999 demonstrate that the majority of precipitation in Vermont is acidic. Statewide, forty-three of all precipitation events occur between the pH of 4.1 and 4.6. Ninety-four percent of statewide precipitation events have a pH of less than 5.6, the theoretical pH of unpolluted rain. The data also indicated lower pH values can be expected more often on the west side of the Green Mountains than the east side, or the other parts of the State, due to storm fronts moving from west to east. Further, data indicates the pH of precipitation is lower in the summer than in the winter (Pembrook 1999).

According to maps developed by the National Acid Deposition Program (NADP), sulfate deposition is 9 to 15 kilograms per hectare per year and nitrate deposition is 12 to 14 kilograms per hectare per year for Vermont. Unlike ambient air quality, there are no national "deposition" standards to compare these numbers against. When compared against other parts of the country, however, these amounts are considered low to moderate. Still, acid deposition is a concern to the Green Mountain National Forest because of the Forest's thin acidic soils as evidenced by parts of Vermont already documented as having acid-saturated soils and watersheds with low acid neutralizing capacity (Sams 2002). This is further supported by the 2003 Acid Rain Program Progress Report. It documents that nationally sulfur dioxide and nitrogen oxide emissions were significantly reduced from 1980 levels as well as sulfate deposition. Even so, in New England 5.5 percent of lakes are still acidic, improved only 1 percent from the early 1990s (US EPA 2004a).

See Soil (3.2), Water (3.3) and Vegetation (3.5) sections for more information on atmospheric deposition.

Prescribed Fire Use

The use of prescribed fire on the GMNF is the primary source of particulate matter emissions that could impact air quality and would be the pollutant of most concern to public health and visibility. While fire also produces ozone, "there is little monitoring or research data that directly link fire emissions with ground-level ozone concentrations" (Sandberg et al. 2002). Fire also produces carbon monoxide, but because fires on the GMNF are generally spatially and temporally dispersed, carbon monoxide is rapidly diluted at short distances from a burning area, and thus poses little or no risk to public health (Sandberg and Dost 1990).

Since 1989, the GMNF has burned between 100 and 500 acres per year. Figure 3.4-1 compares emissions generated in three counties covering the majority of the GMNF and the typical amount of particulate matter emissions generated from historical levels of prescribed fire conducted on the GMNF. The amount of emissions from prescribed fire at these levels is 17 tons per year, compared to the other three counties that range from approximately 1,000 to 2,000 tons per year.

3.4.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Indicator 1 – Potential Amount of Particulate Emissions (tons per year) Generated from Prescribed Fire

Effects Common to All Alternatives

The direct and indirect effects would be minor for all alternatives. Although GMNF management activities, such as road construction/maintenance, mineral development, and timber harvesting, can

generate air pollution, effects from these activities are anticipated to be minimal over the short and long-term under all alternatives.

Local and regional recreation studies indicate participation in snowmobiling is expected to increase on the Forest (see Recreation Opportunities and Forest Settings section 3.10.1). At the same time, new national snowmobile emissions standards are being implemented which EPA expects will substantially decrease emissions from this source (US EPA 2002). This is further supported by work conducted by the MANE-VU RPO which projects snowmobile emissions in Vermont mostly decreasing in 2018 from 2002 levels for carbon monoxide, ammonium, particulates, sulfur dioxide, and volatile organic compounds. Nitrogen oxide emissions, however, are projected to increase from approximately 30 tons per year in 2002 to approximately 165 tons per year in 2018 (Schuster 2005, MANE-VU 2006). In sum, Vermont currently meets all ambient air quality standards and future snowmobile emissions are projected to mostly decrease. Therefore it is expected that future snowmobile emissions would meet ambient air quality standards.

The greatest potential impact to air quality due to GMNF management activities is the use of prescribed fire (see Wildland Fire Management (3.17) section for further information). The primary direct and indirect effects of prescribed fire are increased particulate emissions and decreased visibility. These effects are temporary, lasting only a few hours to a day. Burning is typically done in the spring when weather and fuel conditions are conducive to meeting management objectives. Weather and fuel conditions, however, vary from year to year so it is difficult to estimate the exact amount of burning that would be conducted in any one year or the exact amount of emissions potentially produced from that burning.

The potential impacts from prescribed burns are not expected to vary by alternative due to the small acreage differences in management area allocations allowing prescribed fire. Under all alternatives, prescribed fire is expected to have minimal impacts to local and regional air quality.

For the purpose of this analysis, it is estimated that the maximum amount of burning that could occur annually would not exceed three times the maximum historic annual level of 500 acres. This scenario represents the most acres (1,500) that likely could be burned if all conditions conducive to burning occurred at the same time; timing that rarely happens. Figure 3.4-1 compares emission amounts from this level of prescribed burning to overall amounts in surrounding counties. These estimates indicate that tripling the historic maximum number of acres burned would increase emissions to 50 tons per year. This amount is minimal compared to other amounts that range from approximately 1,000 to 2,000 tons per year.

The amount of emissions produced from prescribed burning does not necessarily correlate to increased particulate concentrations. Prescribed fire is a temporary source and would only be implemented using best smoke management practices which consider existing and forecasted air quality and weather. Best management practices include such things as burning with winds that carry smoke away from populated areas; not burning during any stage of an air pollution episode; and ensuring that burning does not adversely impact ambient air quality standards. The direct and indirect effects from prescribed burning, under all alternatives, would have minimal short and long-term impacts to air quality and visibility.

Cumulative Effects

Effects Common to All Alternatives

The cumulative effects consists of the effects of prescribed fire on GMNF air quality, on any given day over the life of the revised Forest Plan (short-term), in combination with the effects of all other air pollutants (from a variety of sources including those in the Ohio River Valley) during the same time period. The analysis will determine to what degree prescribed fire would affect GMNF air quality over the short and long-term.

The potential amount of emissions produced from the GMNF, even if prescribed burning

were increased to 1,500 acres a year, would be small compared to other existing pollution sources outside the control of the Forest Service. It is unlikely this amount of burning would have major impacts to air quality over the short-term. Further, in order to minimize local air quality impacts to human health and visibility, the Forest Service would work with adjacent landowners to coordinate burning and use best available smoke management techniques, such as staying aware of local and forecasted air quality and weather in order to minimize smoke impacts.

Local and regional recreation studies indicate participation in snowmobiling is expected to increase statewide as well as on the Forest. As is the current situation, however, snowmobiling season is outside the typical prescribed burning season of spring and fall. Additionally, the EPA is initiating new emission standards for snowmobiles (and other recreational and off-highway vehicles) which they expect will substantially decrease emissions from these sources (US EPA 2002). Hence, cumulative impacts of prescribed burning and snowmobiling are not expected to exceed the ambient air quality standards. The Forest Service will continue to work with the State of Vermont to ensure that cumulative impacts of agency activities, or permitted activities, continue to meet ambient air quality standards in the short and long-term.

Ozone, Regional Haze, and Atmospheric Deposition

High ozone concentrations are most typical in summer due to high temperatures and stagnant weather. Because of the seasonality of prescribed burning on the Forest (primarily spring), and the small amount of emissions produced, prescribed burning is unlikely to contribute to ozone problems.

The quality of the air that passes over the Forest is largely determined by where the air originates. Outside influences have the greatest effect on GMNF resources, and are cumulative in nature. Emissions produced from GMNF management actions will be negligible compared to emissions generated off-Forest lands. Future levels of these pollutants depend on regulations and national policy. None of the proposed alternatives changes this situation. Additionally, the Forest Service is a partner in the MANE-VU RPO, supporting the States and tribes as they implement rules and policy aimed at restoring visibility in places like the Lye Brook Wilderness.

Finally, the revised Forest Plan direction includes maintaining or improving air quality so additional monitoring will be initiated as necessary to detect impacts from air quality due to changes in air pollution sources or other factors.

It is likely that with current and proposed rules and regulations, air quality across the country will continue to improve over the next 15 years (US EPA 2004a). The GMNF will need to be continually involved in regional, local, and national air quality groups engaged in research, monitoring, education and policy making. Further, the GMNF will be diligent in working within the context of current and proposed air quality rules to in order to protect and restore forest ecosystems impacted by air pollution.

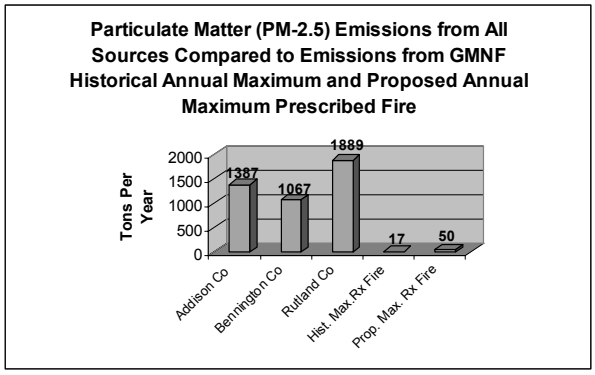

Figure 3.4-1: Particulate matter (PM-2.5) emissions from all sources in Addison, Bennington and Rutland counties compared to historical annual maximum (500 acres) and proposed annual maximum (1500 acres) prescribed fire on the GMNF. Chart was generated using the EPA's AirData Website: www.epa.gov/air/data/index.html (AIRS) and the prescribed fire emissions calculator available at: http://fire.r9.fws.gov/ifcc/smoke/calculate_emissions.htm. Prescribed fire emissions were calculated based on the combustion and emission factor assumptions from the Fire Emissions Project of the Grand Canyon Visibility Transport Commission.

3.5 VEGETATION

Introduction

Terrestrial vegetation includes trees, shrubs, and herbaceous plants, such as grasses, sedges, orchids, or ferns. In combination with the physical environment and ecological processes, vegetation forms the ecosystems present on the Green Mountain National Forest (GMNF), including forests, thickets, meadows, wetlands, riparian zones, and alpine or rocky habitats. The Forest Service is responsible for managing all types of vegetation to meet desired future conditions as specified in the goals, objectives, and management areas (MAs) of the revised Plan.

This section provides a broad overview of the types of vegetation that historically occurred, and presently occurs, on the GMNF, and the effects on this vegetation that are predicted to occur as a result of the revised Forest Plan alternatives described in Chapter 2. It also provides part of the coarse-filter analysis for biodiversity discussed in the Ecosystem Management Introduction section (3.1.4) of this chapter.

Additional analysis of terrestrial vegetation can be found in other sections of this chapter. The Wildlife and Wildlife Habitat section (3.6) discusses vegetation composition in terms of wildlife habitat needs. Because the Wildlife section includes discussion on open habitats, such as meadows and thickets, these habitats will not be addressed in detail in this section.

The Timber Management section (3.13) analyzes some of the same subjects as the Major Forest Communities subsection, but with a focus on wood products supplied by the Forest, demand for these products, and silvicultural systems and harvest methods used on the Forest.

The Areas of Special Significance section (3.11) provides a coarse-filter analysis of biodiversity conservation considering natural communities at large and small scales.

Specific habitat requirements for species of viability concern are analyzed in the Biological Evaluation (BE; Appendix E) and the Species of Viability Concern section (3.9) of this chapter.

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

- Major Forest Communities (Subsection 3.5.1)
- Forest Health (Subsection 3.5.2)
- Non-Native Invasive Species (Subsection 3.5.3)

Major Forest Communities

The Major Forest Communities subsection discusses the ecological context for vegetation on the GMNF, including natural tendencies for vegetation, natural disturbance patterns, and a history of land uses that have affected current vegetation. It then continues with a description of the six major forest communities, including: 1) northern hardwood forests; 2) softwood forests; 3) mixedwood forests (mix of hardwoods and softwoods); 4) oak and oak-pine forests 5) aspen-paper birch forests; and 6) non-forested habitats. These major forest communities are analyzed using indicators related to abundance, age class distribution, and structure. Discussion of non-forested habitat is restricted to abundance.

The Major Forest Communities subsection also provides an overview of the types of communities considered uncommon or rare on the GMNF. These natural communities are by definition not well distributed or common, and organisms associated with these communities may be at more risk if the composition, structure, or functioning of these communities are disrupted. Most of these natural communities are small in scale and are found embedded within the major forest communities. The BE addresses the effects of the revised Forest Plan and alternatives on these uncommon or rare communities in terms of their habitat value for TES species. The Areas of Special Significance section (3.11) addresses the effects of the revised Plan on these

communities in terms of their distribution and representation in protected areas. The effects analyses in the Areas of Special Significance section and the BE will not be repeated in this section.

Forest Health

The Forest Health subsection discusses the threats to forest vegetation from native and non-native insects and diseases.

Non-Native Invasive Species

The Non-Native Invasive Species subsection discusses the threats to the natural vegetation of the GMNF that come from some non-native plants that can invade and alter local terrestrial and aquatic ecosystems.

3.5.1 Major Forest Communities

Issue Statement

Public concern with major forest communities is focused on what tree species and forest ages will provide adequate forest structure and biodiversity while providing for products and opportunities for the social and economic needs of people. Social and economic effects are discussed in the Social and Economic Factors section (3.21) of this chapter.

Indicator 1 – Amount of Each Major Forest Community (Composition and Abundance)

The first indicator to be used in this effects analysis is the amount of each major forest community expected to occur under each alternative. The major forest communities are broadly defined groupings of tree species used to classify lands on the GMNF during field inventories. These communities indicate the dominant tree species present, but may not always reflect all of the species present in a forested stand. The proportion of each forest community projected under each alternative will be compared to existing conditions and vegetative composition objectives, and will be discussed in the context of historical conditions.

This indicator highlights the differences among alternatives because they will produce varying amounts and distributions of major forest communities over time. The amount and distribution of forest communities may have direct and indirect implications on available wildlife habitat, biological diversity, scenic quality, forest products, and recreational opportunities.

Indicator 2 – Percentage of Each Major Forest Community in Various Age Categories (Age Class Distribution)

The second indicator to be used in this effects analysis is the percentage of each major forest community expected to occur in various age categories under each alternative. The proportion in each age category projected under each alternative will be compared to existing conditions and age class objectives, and will be discussed in the context of historical conditions. This indicator highlights the differences among alternatives because each alternative could produce varying amounts and distributions of major forest community ages over time. The amount and distribution of forest communities in different growth stages may have direct and indirect implications on biological diversity, old growth development, scenic quality, available wildlife habitat, forest products, and recreational opportunities.

Indicator 3 – Acres of Timber Harvest Treatments (Forest Structure)

The third indicator to be used in this effects analysis is the acres of timber harvest treatments utilizing varied cutting methods, which influence the within-stand structure and complexity of the understory, midstory, and overstory layers. Other forest management treatments, such as non-commercial methods, planting, and prescribed fire, will be discussed in more general terms. The maximum acres of

timber harvest treatments will be projected under each alternative. Additionally, the amounts of untreated stands will also be projected. These amounts will be compared among alternatives and to what has been implemented over the past fifteen years.

This indicator highlights the differences among alternatives because the mix and amounts of treatments proposed within each alternative will result in varying degrees of within-stand complexity of forest structure over time. Forest structure may also have implications for both native plant community and wildlife habitat quality.

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the GMNF. The analysis area for cumulative effects includes all lands administered by the GMNF and other owners, both public and private, within the ecological sections in which the GMNF resides, primarily the Green, Taconic, and Berkshire Mountain Section. This area encompasses the entire GMNF plus surrounding areas with similar environmental and biological traits, and so is connected to the GMNF by ecological processes and movements of species. These connections and relationships make ecological sections a reasonable context within which to analyze cumulative effects.

3.5.1.1 Affected Environment

Introduction

The composition, age, and structure of the major forest communities present today on the GMNF are the result of interactions between biological and physical environments and the history of disturbances and land uses. Each major forest community has a range of variability in these characteristics associated with the disturbances that affect it. The range of natural variability (RNV) describes the variability in composition, structure, and dynamics of ecosystems before major European settlement. The RNV, first introduced in Section 3.1.4, provides the setting for the discussion in this subsection. Specifically, this subsection introduces the ecological context for the major forest communities to be discussed throughout this chapter, including information on how these communities are defined and organized ecologically, their variation in association with natural disturbances, and how they changed with the historical land uses introduced by European settlers in the 18th and 19th centuries.

Ecological Units

Ecological units are units of land that share features of climate, geology, topography, soils, and natural communities. They integrate knowledge of ecological processes and provide predictions of ecological potential. Several approaches have been developed for mapping ecological units. The approach developed by the Forest Service is known as the National Hierarchical Framework of Ecological Units (Cleland et al. 1997). The scales associated with this hierarchy are described in the Introduction to Chapter 3. The scales most important to this discussion are those at the Subsection level and below.

The Forest is comprised of three primary subsections, the Northern Green Mountains, Southern Green Mountains, and the Taconic Mountains (Keys et al. 1995). A fourth subsection, the Champlain Glacial Lake and Marine Plains Subsection, is associated with a very small portion of the Forest on the edge of the Champlain Valley.

The GMNF is further divided into seven general landscapes, each of which is found in at least one of the subsections on the Forest. The combination of subsections and landscapes result in a total of 18 unique combinations known as land type associations (LTAs).

LTAs are broad ecological categories that reflect differences in geomorphology, surficial geology, elevation, relief, and potential natural vegetation. Potential natural vegetation is defined as the assemblage of plants that would

form over time within the prevailing climatic and historical disturbance regimes. The spatial and compositional patterns of vegetation in New England, prior to European settlement during the 17th and18th centuries, were documented by Cogbill et al.'s (2002) review of historical town surveys. This review provides baseline data for what potential natural vegetation would exist with minimal human influence, and contributes to the LTA classification.

Valley Bottom LTA

The Valley Bottom LTA is generally below 1,500 feet, on alluvial or glacio-fluvial substrates associated with rivers, with potential natural vegetation consisting mostly of hemlock forests mixed with beech, maples, birches, and oaks. There is very little of this LTA on the GMNF, although it occurs in all four subsections.

Low Mountain/Small Hill LTA

The Low Mountain/Small Hill LTA represents low to moderate relief landscapes that are transitional between the Green Mountains and associated foothills, low slopes, and edges, generally between 600 feet and 2,400 feet in elevation, with potential natural vegetation of northern hardwoods, primarily beech, with maples, hemlock, and birches. This LTA is found in all the mountain subsections of the GMNF.

Mountain Slope LTA

The Mountain Slope LTA occurs along the slopes of major mountains and mountain ranges on the Forest, is generally steep, with high relief, generally below 2,400 feet in elevation, with potential natural vegetation consisting of a mixture of spruce and beech with maples, hemlocks, and birches less dominant. This LTA is found in all the mountain subsections of the GMNF.

Upper Mountain Slope/Mountain Top LTA

The Upper Mountain Slope/Mountain Top LTA typically occurs above 2,400 feet in elevation, and represents what is commonly considered the subalpine zone. It is a landscape of high relief, shallow soils with rocky outcrops, and steep slopes, with potential natural vegetation consisting primarily of spruce and fir, with birches common and beech and maple less dominant. This LTA is found in all the mountain subsections of the GMNF.

Alpine LTA

The Alpine LTA occurs above 3,500 feet in elevation on thin to non-existent soils under harsh climatic conditions, with potential natural vegetation consisting of krummholz (small stature spruce and fir) and alpine meadow. This LTA is found only in the Northern Green Mountains subsection.

Escarpment LTA

The Escarpment LTA represents a series of geological formations that form a line of cliffs and steep slopes dividing the Green, Taconic, and Berkshire Mountain Section from the Champlain and St. Lawrence Valley Section to the north, and the Taconic Mountains from Green Mountains in the south. Potential natural vegetation is primarily hemlocks and pines mixed with oaks and northern hardwoods. This is the LTA on the Forest where oak is most likely to be found. This LTA is found only in the Northern and Southern Green Mountains subsections.

Precambrian Plateau LTA

Finally, the Precambrian Plateau LTA represents a low relief landscape dominated by resistant, acidic, Precambrian bedrock at an elevation of around 2,500 feet, where potential natural vegetation of northern hardwoods and softwoods of spruce, fir, and hemlock intermix at very small scales. Many of the Forest's wetlands and high elevation ponds fall within this LTA. This LTA is found only in the Northern and Southern Green Mountains subsections.

Ecological Land Types and Ecological Land Unit Groups

Each LTA is comprised of smaller scale ecosystems that are often recognized during project planning and field inventories. This smaller scale is most often the scale at which the less common forest communities, including the oak and aspen-birch types, are recognized, as they do not occur either with enough frequency or over a large enough contiguous area to be recognized at a landscape scale. These ecosystems have been mapped as forest types to represent current composition. They have also been mapped as ecological landtypes (ELTs) and ecological land unit groups (ELUGs) for the purpose of ecological and natural community mapping, where these units represent potential natural vegetation. Thompson and Sorenson (2000) describe the natural communities represented by these various ecological types for Vermont.

Potential Natural Vegetation

Pre-European settlement vegetation was dominated by different groupings of species, depending upon the type of landscape in which they were found and the associated disturbance processes (Cogbill et al. 2002). Mountaintops and high slopes were dominated by montane spruce-fir, while sideslopes were dominated by a mix of conifers and hardwoods, and the foothills and lower slopes graded into hardwoods. Beech was the dominant tree species in the hardwood and mixedwood stands, accounting for as much as 30 to 50 percent of the trees recorded during town surveys, the highest level in New England (Cogbill et al. 2002). As the mountains graded into the valleys, softwoods switched from spruce and fir to hemlock and pine in mixedwood landscapes, and hardwood forests picked up oaks and pines in addition to the typical beech, birches, and maples. As warmer climate species became more prevalent further south and the physical environment became drier, oaks, hickories, and to some extent aspen, became more common.

The transition to a more “central hardwoods” composition of oaks and pines becomes most noticeable as one moves south from Vermont into Massachusetts and southern New York. A New England tension zone, marking the division between northern and southern species and communities, exists primarily south of Vermont, present only in the southwestern and southeastern corners of the State. This transition zone marks an important division between dominance of northern species, primarily beech, and southern species, primarily oak. Oak-dominated forests, and oak forests mixed with pine, have never been very abundant in northern New England or northern New York (Cogbill et al. 2002), which have a climate that is too moist and cold for these species to compete well with northern hardwoods.

Although LTAs can be used to determine the more common potential natural vegetation, pre-European settlement tree data, ELTs, and ELUGs can help to identify the potential natural vegetation of less common major forest communities that are important for biodiversity, such as oak and aspen-birch types. Looking at potential natural vegetation across landscapes and smaller land units is a way of evaluating ecological tendencies for these ecosystems, or how forest community composition is likely to change over time. Using potential natural vegetation to determine the appropriate levels and distribution of ecosystems of the landscape increases the likelihood that biological diversity will be maintained over time (Aplet and Keeton 1999).

Table 3.5-1 shows composition and abundance of potential natural vegetation that would be expected to occur on the GMNF under natural disturbance regimes. In order to evaluate major forest communities and ecological tendencies, LTAs were categorized as tending toward broad categories of potential natural vegetation, predominantly softwood, mixedwood (with either hemlock or spruce emphasis), or northern hardwood forest, based on the LTA descriptions and Cogbill et al. (2002). Three additional vegetation communities, aspen-birch, oak-pine, and non-forest communities, were identified as less common, but are still important to address in terms of composition and ecological tendencies, as they also provide

important habitat for a wide variety of plant and animal species. Data from ELTs, ELUGs, pre-European settlement surveys (Cogbill et al. 2002), and National Wetlands Inventory were used to identify the natural tendency of the Forest to support these less common vegetative communities.

Table 3.5-1: Composition and abundance of potential natural vegetation of the GMNF

Potential Natural Vegetation	Potential Abundance
	%
Northern hardwood	30-40
Mixedwood – spruce	35-45
Mixedwood – hemlock	5-15
Softwood	15-25
Oak-pine	1-3
Aspen-birch	1-3
Non-forest	1-2

Notes: Abundance, or ecological tendencies, of potential natural vegetation represents an approximate range based on LTA, ELT, and ELUG descriptions, Cogbill et al. 2002, and National Wetlands Inventory GIS maps.

The composition and abundance of potential natural vegetation shown in Table 3.5-1 suggests that northern hardwoods, mixedwood, and softwood forests were likely to have been abundant within the GMNF landscape, with mixedwood forests slightly more abundant and softwood forests slightly less abundant than northern hardwood forests. The remaining forest communities were likely to have been relatively rare, primarily due to the prevailing natural disturbance regimes during this time. This pattern of composition and abundance is different from existing conditions and will be discussed further in the Existing Conditions subsection of this analysis.

Natural Disturbance

Natural disturbance exerts a strong influence on vegetation composition, as well as forest age and structure, and was the predominant type of disturbance affecting forests in the analysis area during pre-European settlement times. The extent to which natural disturbances influence forest composition, age, and structure are influenced by a number of factors, including regional patterns of disturbance, landscape position of the forest, and forest composition and structure itself. These factors are described below and then applied to forested communities on the GMNF.

Regional Patterns of Disturbance

The difference in distribution and frequency of different types of natural disturbances can mean large differences in habitat suitability for plants and animals that rely on early or late-successional habitats, as well as the extent and stability of these habitats. Small canopy gap disturbances tend to close quickly, and are often dominated by the advanced reproduction of the existing canopy tree species. When advanced reproduction below the canopy is of a different forest type, however, even small canopy gaps can lead to a shift in forest composition over time. Large disturbances often facilitate colonization by pioneer species, those species with opportunistic life styles that can quickly dominate large open areas because of abundant sunlight and drier conditions. Aspen and paper birch are typical pioneer or early successional tree species often found in these types of openings in the canopy. These species are short-lived, however, and only tend to persist until another disturbance presents a new opportunity for reproduction. If large openings tend to occur less often than the life span of these species, they are likely to only persist in small proportions on the landscape.

In the Northeast, natural disturbances that create canopy gaps and damage or replace stands of trees or forests are predominantly wind-related disturbance events, but also include other disturbances like ice storms, insects and disease, fire, and flooding (including inundation caused by beavers). Native Americans also created openings and open landscapes through agriculture and burning, although these activities in northern New England were less prevalent than in other regions and were probably concentrated in the Champlain Valley and along the Connecticut River Valley in Vermont (DeGraaf et al. 1992, Johnson 1998). The history of fire on the GMNF is discussed further in the Wildland Fire Management section (3.17) of this chapter.

Northern New England was a predominantly forested landscape during the 18th century. Based on research compiled for the Northeast by Lorimer and White (2003), natural disturbances that damaged individual or small groups of trees in the forest canopy were fairly common and occurred regularly, while large stand-replacing disturbances were fairly rare. Across New England, Lorimer and White (2003) also describe a gradient in the frequency of historical stand-replacing events from a higher frequency near the coast, to lower frequencies in the interior of New England, particularly Vermont, where the exposure to large hurricanes and the prevalence of Native Americans and fire-prone ecosystems was far less than in most of New England.

In the forest types associated with inland regions of New England, including Vermont, disturbance events that created canopy gaps, such as wind and insect or disease outbreaks, did so by killing a few trees, leaving a gap that was usually less than 0.2 acres (Litvaitis 2003c). Larger events, such as hurricanes, damaging thunderstorms, and floods, can blow over or damage tens, hundreds, or thousands of forest acres. Lorimer and White (2003) estimate that among these same forest types, stand-replacing fires or catastrophic windstorms tended to occur no more than once every 300 years to far more than 1,000 years in any given stand, well beyond the life spans of most major tree species in the region. Lorimer and White (2003) also note that disturbance events of moderate severity that remove 30-60 percent of the canopy were also fairly common on the landscape, forming disturbed patches of one to three acres in size, and may have had more influence on forest structure and development than the larger, catastrophic disturbances.

Landscape Position

Variation in the level and frequency of disturbance was also affected by certain landscapes. Exposed ridges and other areas with thin or rocky soils were more likely to experience disturbances, such as windthrow or fire, and their physical characteristics increased the likelihood that these areas would have regular repeated disturbances (Lorimer and White 2003). Plant and animal species of early successional habitats may have come to rely on these places for a relatively stable supply of this habitat.

Forest Composition and Structure

Natural disturbances can also affect forested stands differently depending upon their age and composition. While large disturbance events tend to affect all vegetation in their path to some degree, smaller disturbances tend to affect trees that have grown old and are decaying, or have been damaged and are being preyed upon by insects or disease. Spruce-fir and aspen-birch stands tend to reach biological maturity at a younger age than hardwood, mixedwood, and oak stands. Consequently, stands of similar ages but differing composition will tend to be affected differently by natural disturbances.

Stands of between 70 and 100 years of age currently represent the dominant age class of the GMNF. Softwood and aspen-birch stands of this age are starting to decline and are probably being affected by natural disturbance as they would have during pre-European settlement times. Hardwood, mixedwood, and oak stands of these ages are still mostly healthy. While small natural disturbances, such as windthrow or ice storms, can damage individual trees in these age classes, they are less susceptible to breakage, as well as insects and disease (except where other disturbances have weakened them). Consequently, these types of forests are likely less affected by small natural disturbances than during pre-European settlement times. As these stands and trees continue aging, the potential impact from small natural disturbances will increase toward that expected under pre-European settlement conditions.

Northern Hardwood Forests

Across forest communities found on the GMNF, stand-replacing disturbance events likely affected less than ten percent of the landscape, and more often far less (Lorimer and White 2003). Stand-replacing disturbances appear to be less frequent in northern hardwood forests than in other forest types, with return times ranging from 1,000 to 3,000 years. Only about one to three percent of northern hardwood forest across the landscape is expected to be in the seedling or sapling stage of development that results from natural disturbance regimes associated with wind or fire (Lorimer and White 2003). About 70 to 89 percent of this landscape is expected to be in forests older than 150 years.

Mixedwood and Softwood Forests

For mixedwood forests with spruce as the dominant conifer, on moderate slopes, and in areas with more productive soils, one to three percent of the landscape is expected to be affected by stand-replacing disturbances, with return times of around 800 years for fire and 2,500 years for wind. These forests are also expected to be similar to northern hardwood forests in the proportion of forest older than 150 years. For mixedwood/spruce forests or spruce-fir forests on rocky ground, swamps, or steep, high elevation sites, from six to seven percent of the landscape is predicted to have been severely disturbed and in the seedling/sapling stage, primarily due to a more frequent return time for wind disturbance of 285 years. An accompanying smaller proportion of this landscape is predicted to be over 150 years old, anywhere from 28 to 49 percent.

Disturbance in particular can have a dramatic effect on the proportion of softwoods on the landscape. After substantial disturbance, such as fire or a major wind event, some areas that tend toward softwoods (primarily spruce-fir and hemlock) regenerate as northern hardwood or mixedwood forest, and areas that tend toward a mixed condition regenerate as northern hardwood forest. Where softwood seed sources remain, a softwood understory develops and gradually grows into and mixes with the hardwood overstory. Given enough time, these softwoods will often replace the hardwoods. Where nearby seed sources have been lost, reestablishment of softwood trees in these areas may take hundreds of years and in some cases may not occur. In forests of pine mixed with other hardwoods, stand-replacing disturbances often have the opposite effect, with stands becoming dominated by pine and then eventually being replaced by hardwoods.

Aspen and Paper Birch Forests

Aspen and paper birch communities are early successional communities that are replaced by other forest types unless disturbance regenerates them. In the pre-European settlement landscape of the GMNF, aspen and paper birch represented about one percent of trees surveyed (Cogbill et al. 2002). Both species had strong affiliations with towns that had strong oak composition at that time (Cogbill et al. 2002) and were likely exposed to and responded to similar patterns of natural disturbance as described for oak forests. Paper birch is also known to be a common pioneer species of montane spruce-fir forests. Given that these montane softwood forests are fairly dynamic, experiencing regular disturbance from windthrow and possibly landslides and fire, it is reasonable to assume that paper birch would also occur in small patches within softwood forests. Lorimer and White (2003) indicate that between one and seven percent of the dominant forest communities in the region are likely to have been in a regenerating state under natural disturbance regimes. Some of these patches are likely to be large enough to support regeneration of birch and aspen.

Oak and Oak-Pine Forests

In Vermont during the 18th century, forest communities of hardwoods or softwoods mixed with oak were associated more strongly with the broader valleys than any other landscape, and so may have been influenced by Native American activities, particularly fires. Today, oak and mixed hardwood-oak or hemlock-oak forests on the GMNF are strongly associated with the escarpment landscape on the edge of the Champlain Valley, which is dominated by

dry, rocky, droughty conditions, and is exposed to weather fronts and thunderstorms moving across the Champlain Valley. Lorimer and White (2003) estimate that catastrophic wind disturbance was likely infrequent in oak forests of interior New England, and that the frequency and effect of wind disturbance in these forests would be similar to northern hardwoods. Given the landscape position and environmental conditions on the GMNF where these forests currently occur, it is likely that fire and wind disturbance were more prevalent on this part of the Forest than would otherwise be predicted based on natural disturbance patterns for inland New England. Mann et al. (1994) estimated in one area of the escarpment adjacent to the GMNF that small fires were likely every 18 years on average, and that stand replacing fires tended to occur every 150 to 200 years.

Human-caused Disturbance

Within Vermont and the northern New England landscape, humans have had dramatic effects on the composition and structure of vegetation as well as some of the associated ecological processes, like succession or fire. During pre-European settlement times, Native American disturbances tended to be small and widely scattered in the mountains and more intensive and concentrated in the valleys (Johnson 1998). The types of disturbances that occurred in the mountains were not likely to have caused permanent changes in the landscape, its vegetation, or associated processes (Thompson and Sorenson 2000). Consequently, the GMNF landscapes were likely at least 90 percent forested during pre-European settlement times (Cogbill et al. 2002, Lorimer and White 2003).

Exploration and homesteading by Europeans during the 17th to mid-18th century, and permanent settlement that followed, led to rapid conversion of the Vermont forested landscape to a more open landscape. By the mid-19th century, only 25 to 30 percent of the State remained forested (Johnson 1998). This dramatic change in vegetation contributed to losses of forest species and habitat, with accompanying increases in open field and thicket habitat and associated species. Before this time, these habitats and species had occurred on the landscape in small quantities or only in association with Native American settlements in the valleys.

During the period of European settlement, prior to federal ownership of the lands associated with the GMNF, several factors had a profound influence on the types of vegetation found across the Forest. Selective logging of spruce and other softwoods during the 19th century reduced their relative proportion on the landscape by removing most seed-producing trees, and led to a hardwood-dominated landscape. During this same period, which coincided with the arrival of railways and trains, a much higher incidence of fire was noted from lands that would become the GMNF (Johnson 1998, Richburg and Patterson 2000, Mann et al. 1994). Fires encouraged the reproduction of oaks, aspen, and paper birch, increasing their abundance in the landscape. Hill farming also encouraged changes in vegetation by maintaining open conditions of meadow, brush, and young forest, and fragmenting more mature forest into smaller blocks. Sheep farming in particular was instrumental in increasing oak abundance because oak sprouts vigorously after being browsed. Once sheep were removed, oak sprouts were poised to dominate in places where they were once only a minor part of the forest composition.

As a result of these broad and dramatic changes in vegetation and ecosystems of Vermont, the ability of the land to produce logs, forage, and crops eventually declined, especially when compared to new lands opening up in the West. By the early 20th century, upland or “hill” farms were being abandoned for more productive lands. This loss of land productivity also led to public awareness of the need for conservation of resources and ultimately to the establishment of the GMNF for conservation and restoration of timber, soil, and water resources. The Forest and surrounding landscapes of Vermont have been recovering and regrowing ever since, such that now the lands of Vermont are around 78 percent forested, reversing the condition of the land 150 years ago (Wharton et al. 2003). The forest use history has resulted in a forested

landscape on the GMNF and in the region in general that is predominantly 70 to 120 years old, with very few small patches of older forest or old growth.

In addition to the land use history, management practices applied by the Forest Service to lands within the GMNF have also affected the composition and structure of vegetation. The Forest has historically been managed for a variety of uses, primarily timber production and watershed protection prior to the 1960s, and for multiple resource values and uses in subsequent years, as mandated by legislation and regulation. Activities affecting the distribution of forest habitats included conversion of hardwood or mixed stands to softwoods to improve habitat for deer, and maintenance of or conversion to aspen, birch, and upland openings in order to improve habitat for species associated with these habitats. Remaining vegetation management on the Forest has focused on maintaining the current distribution of existing types, predominantly northern hardwoods (including oaks) and softwoods.

Existing Forest Plan Management Direction

The goals that direct Forest Service management of forest communities are found on pages 4.04, 4.05, and 4.08 of the 1987 Forest Plan. Goals for resource protection provide direction to nurture and protect ecosystems and their interrelationships and complexity. Protection of resources is to occur at both coarse scales such as watersheds, soils, and uncommon or outstanding biological areas, as well as at fine scales such as diversity of plant and animal communities, and threatened, endangered, and sensitive species.

There are several goals specific to vegetation management, including those that direct the agency to provide a well-distributed variety of vegetative conditions and types to enhance diversity. Increases in softwoods, aspen, upland openings, oak, and other less common vegetative types are encouraged to meet wildlife habitat needs. Continuous forest cover is to be maintained on 66 percent of the Forest, and within these areas of continuous cover most of the land is not to be managed for timber production. Clearcutting is to be minimized.

Vegetative Composition

Forest-wide standard and guideline composition objectives in the 1987 Plan are identified for vegetative diversity and to maintain viable populations of vertebrate species found on the Forest. The 1987 Forest Plan composition objectives are shown in Table 3.5-2. The Forest Service identified the desire to maintain or increase uncommon vegetation types, including hemlock, aspen, black cherry, alder, oak-hickory, black spruce, white pine, white oak, hedgerows, and orchards. Species valuable for mast, including hophornbeam, grape, juniper, barberry, cherry, apple, plum, oak, and beech are identified for increase or expansion where possible. About 94,100 acres (29%) of the Forest were designated to management areas where old growth forest conditions would be provided, Wilderness (5.1), Remote Backcountry Forest (6.1), White Rocks NRA (8.1D), and The Cape RNA (8.1D). Forest structure was to be attained through management of age classes, rotation ages, and protection or recruitment of appropriate numbers of snag and den trees.

Table 3.5-2: Composition objectives from the 1987 Forest Plan.

Type	% of Forest Area
Northern Hardwood	61-78
Softwoods	12-20
Aspen and Birch	5-10
Oak	1-3
Permanent Openings	3-5
Wetlands	1

Age Class Distribution

The 1987 Plan provided Forest-wide standard and guidelines for age class objectives that vary by rotation age and forest type (Table 3.5-3). These objectives are applicable only to stands where vegetation is managed. Age classes are designed primarily for regulation of the stands for timber management, with enhanced regenerating age classes for the wildlife values that this age class provides. Each age class in

each forest type represents structural differences in the development of stands, and provides for a diversity of habitat types and structures. In addition, structural diversity is enhanced through standards and guidelines that reserve snags, den trees, mast trees, nest trees, and their replacements during timber management activities.

The 1987 Plan provides overall direction for timber management in Forest-wide and MA standards and guidelines, and Appendix A. Enhancing vegetative diversity, wildlife habitats, and vistas, along with improving the health and condition of the forest ecosystem and production of high-quality sawtimber, are general goals for timber management.

Forest-wide and management area standards and guidelines, as well as MA direction, in the 1987 Plan largely dictate the types of harvest methods to be used. Although the 1987 Plan allows most harvest methods under any MA where timber harvesting is allowed, some MAs emphasize certain methods. Management areas for continuous forest cover (2.1 and 2.2) emphasize uneven-aged systems, and MAs for even-aged timber stands or deer wintering areas (3.1, 4.1, 4.2, and 6.2) emphasize even-aged systems with varying rotation ages to maintain desired conditions. Management areas for ski areas and ski area expansion (7.1 and 9.3) do not directly address management of forest communities, but areas of forest exist in these MAs and they are often maintained and managed as forest. Special MAs (8.1), such as those for trails or old growth conditions, as well as Significant Streams (9.4) generally do not allow harvesting of timber, except to enhance the values associated with those areas. Wilderness (5.1), Remote Backcountry Forest (6.1), and Newly Acquired Lands (9.2) MAs do not allow timber harvesting, although individual tree removal is permitted for very specific purposes as outlined in Wilderness legislation or MA direction, for instance to remove hazard trees along trails.

Even-aged management may be used to: achieve a diversity of stand types and age classes; regenerate species which are shade intolerant or intermediately shade intolerant; regenerate high risk and sparse stands; prevent the spread of insects and disease; and produce high-quality sawtimber and other wood products. In the 1987 Plan, approximately 39 percent of the GMNF has an emphasis on this type of management for these purposes, including the Mosaic of Vegetative Conditions (3.1), Deer Wintering Areas (4.1 and 4.2), and Semi-primitive Areas (6.2A).

Table 3.5-3: Age class objectives for management area where even-aged silviculture is practiced, based on the 1987 Forest Plan.

Forest Type	Age Class	Desired Range
		(%)
Northern Hardwood	Regenerating	6-10
	Young	30-50
	Mature	36-47
	Old	5-28
Softwoods	Regenerating	6-12
	Young	18-36
	Mature	36-55
	Old	5-40
Aspen	Regenerating	16
	Young	48
	Mature	31
	Old	5
Birch	Regenerating	12
	Young	48
	Mature	35
	Old	5
Oaks	Regenerating	6-10
	Young	30-50
	Mature	24-35
	Old	5-40

Source: 1987 Forest Plan p. 4.29
Notes: Age class objectives varied by rotation age within each age class and for each type; desired range represents the range of objectives across the various rotation ages for that particular age class and type combination

Uneven-aged management may be used primarily in areas where there is a desire to maintain continuous forest cover, such as in areas with highly sensitive views and in riparian areas. Uneven-aged management may also be used to: produce a diversity of forest types and age classes within a stand; maintain continuous deer winter cover; maintain shade along streams; regenerate tree species which are tolerant of shade; and produce high-quality

sawtimber and other wood products. In the 1987 Plan, approximately seven percent of the GMNF has this type of management emphasis for these purposes within the Continuous Forest Cover (2.1A and 2.2A) management areas.

Proposed Changes in Management Direction Common to All Alternatives

The revised Plan continues much of the 1987 Plan direction for management of vegetation, while updating direction related to composition.

The revised Forest Plan Goal 2 directs the Forest Service to maintain and restore quality, amount, and distribution of habitats to produce viable and sustainable populations of native and desirable non-native plants and animals. Composition, structural, and age class objectives, previously Forest-wide standards and guidelines under the 1987 Plan, are located in the goals and objectives section of the revised Plan. Composition objectives have been updated to reflect, in general, long-term ecological tendencies of the Forest toward a higher proportion of softwood and mixedwood forest types (Table 3.5-4). Openings, early successional habitats of aspen and birch, and oak continue to be emphasized at current levels or higher to support species associated with those habitats, some of which are at risk of losing viability (see also the Wildlife and Species of Potential Viability Concern sections of this Chapter).

Table 3.5-4: Composition objectives proposed for the revised GMNF Forest Plan.

Type	% of Forest Area
Northern Hardwoods	30-40
Mixedwoods	45-55
Softwoods	15-25
Aspen and Birch	1-5
Oaks	1-5
Upland Openings	1-5
Wetlands	1-2

Source: Revised Forest Plan

As in the 1987 Plan, the revised Plan also provides objectives for age classes of various forest types (Table 3.5-5). The revised Plan simplifies the age class and rotation age objectives from those in the 1987 Plan by providing a desired age class distribution range for each type, regardless of rotation age. Rotation ages are also expressed as either the standard age or a range of extended ages, and criteria are provided specifying that standard ages are used for timber production, and extended ages could be used to meet other resource objectives. The age class and rotation age ranges also provide managers the flexibility to adapt to conditions found in the field. Forest-wide standards and guidelines for reserve trees were retained.

Where even-aged silvicultural systems are applied, each stand of trees will have trees that are all the same age, but stands across the MAs will generally vary in age by the distribution pattern indicated in Table 3.5-5. A new objective was added to manage a minimum of 20 percent of lands suitable for timber management using uneven-aged silvicultural systems to achieve resource objectives.

The revised Plan also adds additional objectives, standards, and guidelines directed at vegetation. In the revised Plan, northern hardwoods, mixedwoods, softwoods, and oaks are maintained and enhanced on sites ecologically suited to these types. Working with these ecological tendencies will help to enhance the recovery of ecosystems on the GMNF, and will help to conserve and restore the biological diversity of these ecosystems. Oak, aspen-birch, early successional, and opening habitats are identified specifically for maintenance due to their value for wildlife and their dependence on both natural and human-caused disturbance for their persistence. Direction in the revised Plan specifies that management of old growth characteristics be achieved on at least five percent of each ecological type on the Forest, and that late successional and old age classes will increase in acreage. Rare or outstanding biological or ecological features, which include rare, unique,

or exemplary natural communities, are to be conserved.

Table 3.5-5: Age class objectives proposed for the revised GMNF Forest Plan.

Forest Type	Age Class	Desired Range
	(years)	(%)
Northern Hardwoods	Regenerating	5-10
	Young	30-50
	Mature	35-50
	Old	5-30
Softwoods & Mixedwoods	Regenerating	5-15
	Young	15-40
	Mature	35-55
	Old	5-40
Aspen	Regenerating	10-20
	Young	45-55
	Mature	25-35
	Old	3-5
Birch	Regenerating	5-15
	Young	45-55
	Mature	30-40
	Old	3-5
Oaks	Regenerating	5-15
	Young	45-55
	Mature	30-40
	Old	5-10

Management Areas

Broad MA direction is similar to the 1987 Plan, although several MAs have been combined and some new MAs have been developed.

Management areas that contain lands suitable for timber production and allow harvesting include Diverse Forest Use, Diverse Backcountry, Escarpment, Remote Wildlife Habitat, and Moosalamoo Recreation and Education Area. Diverse Forest Use is simply a combination of the 1987 Plan MAs Continuous Forest Cover, Even-aged Forest, and Deer Wintering Areas. Within this management area, both even-aged and uneven-aged management are allowed, depending upon project-specific goals and objectives. Management area direction is similar for Diverse Backcountry to that in the 1987 Plan, where primarily even-aged timber management is allowed on longer rotations.

New MAs that contain lands suitable for timber production allow both even-aged and uneven-aged management approaches. The Escarpment Special Area was added to foster management of oak ecosystems and their associated rare species within the forests and woodlands of the escarpment along the western side of the Forest. The Remote Wildlife Habitat MA was added to support a diversity of wildlife habitats through vegetation management, often on longer rotations, while limiting recreational use to existing uses, generally in more remote settings. The Moosalamoo Recreation and Education Area MA emphasizes recreational uses and special values in the area around Mount Moosalamoo, as well as demonstration of multiple-use management, including timber harvesting.

In all MAs that contain lands for suitable timber production, vegetation manipulation is common, and certain forest communities may be favored over others depending on the techniques used. All of these MAs allow management to support oaks, aspen-birch, and opening habitats.

The remaining MAs in the revised Plan are not considered suitable lands for timber production and can be divided into two groups: those where vegetation management or recreational development is likely to occur; and those where natural processes predominate and vegetation management or recreational development is very limited to non-existent. While these two groups are worth differentiating for some of the subsequent analyses in this section, they act as a single group in terms of comparison with MAs where substantial acreages of vegetation can be manipulated to alter composition, age class, and structure.

Management areas that continue to allow vegetation management include: White Rocks NRA, the Appalachian Trail, the Long Trail, Recreation Special Areas, Alpine Ski Areas, Alpine Ski Area Expansion Areas, Eligible Scenic and Recreational Rivers, and Significant Streams (Alternative A only).

Management areas where vegetation primarily develops under natural processes include Remote Backcountry Forest, Wilderness,

Wilderness Study Areas, Ecological Special Areas, Research and Candidate Research Natural Areas, Alpine/Subalpine Special Area, Eligible Wild Rivers, and Newly Acquired Lands (Alternative A only). Vegetation management in these areas is generally limited, for example to remove trees for health or safety reasons, with the most limitations in Wilderness, Wilderness Study Areas, and Research and Candidate Research Natural Areas. Natural processes such as fire that have been suppressed in the past may be allowed or prescribed in some cases (generally not in Wilderness or Wilderness Study Areas).

Existing Condition

Indicator 1 – Amount of Each Major Forest Community (Composition and Abundance)

The distribution of major forest communities on the GMNF is predominantly the result of a combination of ecological tendencies, natural disturbance, and land use history. The current abundance of these communities is displayed in Table 3.5-6 and is compared with ecological tendencies from Table 3.5-1.

Table 3.5-6 shows that softwood and mixedwood forest are less abundant than would be expected based on ecological tendencies, and northern hardwood forest, forest, and non-forest habitat are more abundant than would be expected. Oak-pine forest is at the low end of what is predicted based on natural tendency. Aspen-birch is at the high end of what is expected based on natural tendency. Some of the difference may be related to mapping scales associated with the LTAs used to develop ecological tendencies, and those used to inventory stands for current abundance levels. Much of the difference between current and expected condition, however, is related to the historical land use of what is now the GMNF.

Table 3.5-6: Current composition and abundance of the GMNF by major forest community compared to ecological tendencies for potential natural vegetation.

Forest Community	Ecological Tendencies	Amount (2004)	Status (2004)
	(%)	(acres)	(%)
Northern hardwood	30-40	289,646	76
Mixedwood	40-60	39,017	10
Softwood	15-25	25,319	7
Aspen-birch	1-3	11,531	3
Oak	1-3	3,781	1
Upland openings	<1	3,790	1
Wetland openings	1-2	7,244	2

Source: Forest GIS data; 1987 Forest Plan
Notes: Existing abundance based on Forest GIS data; forest community information is not available for some newly acquired lands and so totals may not match totals in other tables.

Northern Hardwood, Mixedwood, and Softwood Forest Communities

The differences among northern hardwood, mixedwood, and softwood forest communities are not always as distinct as the other three forest communities. Northern hardwood forests are dominated by sugar maple, beech, and yellow birch, in varying proportions and in association with other tree species. Many northern hardwood forests have a small component of softwood species. When that softwood component accounts for more than 25 percent of the trees, the forest type is considered mixedwood. Softwood forest communities tend to be dominated by either red spruce-balsam fir at the higher elevations and on rocky moderate elevation sites, or by hemlock and white pine at the lower elevations. Most softwood forest communities also have a small component of hardwood species. When about two-thirds of the trees in a stand are softwoods, it is considered softwood forest communities.

Only northern hardwood forests are abundant and well-distributed across the Forest, although pre-European settlement conditions would suggest a greater abundance and wider

distribution of mixedwood and softwood forests (Table 3.5-6). Currently, northern hardwood forests are the dominant vegetation of most of the landscapes of the Forest outside of the Valley Bottom, Escarpment, Upper Mountain Slope-Mountain Top, and Alpine LTAs.

Softwood and mixedwood forests are far less common than would be expected due to softwood harvesting, predominantly of red spruce, during the late 1800s and early 1900s. This harvesting on the Forest led to the removal of most of the mature softwoods from the landscape and loss of seed sources, which has resulted in slow recovery of these species as a component of current forests. Areas where a strong seedling, sapling, and young pole softwood component exists on the Forest today are generally restricted to Upper Mountain Slope and Mountain Top LTAs, or parts of the Precambrian Plateau LTA, where softwoods were likely dominant during pre-European settlement times. Hemlock is also generally restricted to the Escarpment LTA or smaller ravine landscapes where it experienced limited harvesting due to the extreme terrain.

Activities that have been undertaken on the Forest to assist in the recovery of softwoods include conversions of about 3,000 acres of hardwood or mixedwood stands to softwoods for deer wintering habitat, and protection of hemlock stands.

Aspen-Birch Forest Communities

Aspen and paper birch forests are early successional forest communities that tend to form after large stand-replacing disturbances, and are replaced by other forest types unless regenerated by disturbance. These species are intolerant of shade, tend to be short-lived, and stands fall apart quickly once mature, allowing the developing later successional forest type to dominate. At the higher elevations, paper birch is the common early successional species, while at the lower elevations, paper birch and aspen both fill this role. Aspen-birch habitats are important to some wildlife species (see Wildlife section).

Aspen-birch habitats are distributed in small amounts (Table 3.5-6) across the Forest, and most of this habitat on the Forest is dominated by paper birch and is within the mountain slope and upper mountain slope landscapes. The majority of the larger blocks of aspen-birch habitat on the Forest are paper birch stands at moderate to high elevations. At lower elevations, aspen-birch habitat is typically found in small, isolated patches or in areas where harvest has been more intensive.

In the pre-European settlement landscape of the GMNF, aspen and paper birch are estimated to have occurred at similar or slightly lower abundance levels compared to current amounts (Table 3.5-6). However, these forest communities have been declining from historically high levels of abundance 50 to 60 years ago. Abandonment of extensive upland hill farms over a 50 to 100 year period starting late in the 19th century led to a long period where early successional habitats dominated the landscapes of the GMNF. Pioneer tree species, particularly aspen and birch, thrived in this environment. As the GMNF became established and recovery of late-successional forest communities received priority, many of these early successional habitats began to decline. More detail on how this habitat decline has affected animal species on the Forest can be found in the Wildlife and Wildlife Habitat section of this chapter.

Activities that have been undertaken over the last 15 years to improve the distribution and abundance of this forest community include maintenance of existing aspen and birch stands, and conversion of northern hardwood stands to aspen or birch, all amounting to about 600 acres.

Oak and Oak-Pine Forest Communities

Oak and oak-pine forests are those that are dominated by red, black, white, and/or chestnut oak, sometimes in mixtures with each other and with white, red, and/or pitch pine. Because these forests are dominated by species that require open, light-filled environments to reproduce, disturbances or naturally harsh environmental conditions are generally what

perpetuate these forests in Vermont (Thompson and Sorenson 2000). Fire, coarse sandy substrates, and a regular supply of acorns from drier ridgetop oak stands may be the mechanisms that naturally maintain the presence of oak and pine. Some landscapes, particularly southern and western exposures of the lower mountains, major river corridors, and sandy or rocky dry lands, provide growing conditions more suitable for the species affiliated with these forests. Even within these landscapes, oak and oak-pine forests are eventually succeeded by or mix with hemlock or northern hardwoods in all but the driest, warmest sites.

Oak and oak-pine forests currently represent around one percent of the landscape of the GMNF, which is at the low end of the ecological potential of the landscape to support these forests (Table 3.5-6). These communities have always been limited in distribution within the GMNF, restricted primarily to the warm, dry environments of the Escarpment LTA, as well as southern or western exposures at lower elevations of the Low Mountain/Small Hill and Valley Bottom LTAs. Even within the Escarpment, these forest types are uncommon, as much of this landscape is dominated by a mix of northern hardwoods (particularly beech and red maple) and hemlock with oak and pine. Oak and oak-pine forests also occur intermittently in the Taconic Mountains at lower to moderate elevations, particularly toward the southern and western border of Vermont. Very little oak forest in the Taconics is under federal ownership at this time.

Forests of oak and oak-pine are currently declining from slightly greater abundance 20 years ago. These communities, similar to aspen and birch, grew in abundance as a result of increased fire and sheep browsing during the European settlement period, followed by abandonment that allowed these communities to mature over the past 50 to100 years. Many existing oak and oak-pine stands have understories of more shade-tolerant tree species, and while these stands may persist for a while, they will eventually be replaced by other forest communities.

The decline of oak-dominated forests is of concern due to its habitat value for wildlife and rare species (see also Appendix E). Activities the GMNF has undertaken to enhance oak-dominated forests include: removing overstory northern hardwoods in stands where they mix with oaks; prescribed fire for preparing seedbeds and reducing northern hardwood competition; planting oak seedlings; and protecting oak seedlings from browsing and competition by using barriers around seedlings. These actions have been successful in some cases.

Non-forested Communities

Upland openings tend to be dominated by grasses, forbs, such as goldenrod and ferns, or shrubs, such as raspberries, meadowsweet, or alder, or a combination of these types of vegetation. They are maintained in a non-forested condition primarily through management that includes mowing or burning. Some upland openings are created by natural disturbances or natural conditions, such as abandoned beaver meadows or rock outcrops. Some are created through human disturbances, like transmission line corridors or alpine ski trails. These open lands meet the needs of wildlife species of open habitats nonetheless. Still others are old field remnants of historical hill farms that have been kept open since ownership by the government. Open wetlands are predominantly associated with beaver on the Forest and consist of beaver flowages in various states of activity or abandonment. Some abandoned beaver meadows will dry up and serve more as upland openings, while others will stay wet.

Existing openings in general tend to be small and widely distributed, accounting for a small proportion of the Forest (Table 3.5-6). About half of the existing openings are wetlands or otherwise associated with beaver flowages. Most of the wet openings on the Forest are associated with the small hill, low slope, valley, and plateau landscapes of the Forest, and are most abundant in the southern portion of the Forest. Upland openings are distributed more evenly across landscapes, although they are

still more common in flatter landscapes. Open bogs and fens are very rare on the Forest.

While the existing proportion of wet openings and ecological tendencies for this habitat are similar, the current proportion of upland openings is slightly larger than would be expected under natural disturbance regimes (Table 3.5-6). ELUG mapping for defining potential natural vegetation helps to identify where cliffs, rock, talus, and alpine habitat are likely to occur, and National Wetlands Inventory mapping helps to identify where open wetlands occur on the landscape. It is these two sources that provide the basis for the open uplands and open wetlands ecological tendencies in Table 3.5-6. There is no indication that permanent openings other than these types occurred in the uplands except in association with Native American settlements and dynamic larger river corridors that were located primarily off the Forest.

The larger proportion of existing upland openings than ecological tendencies would suggest is a result of Forest Service management and historical legacy. The Forest Service has been maintaining existing and creating new upland openings for animal and plant species that benefit from the habitat the openings provide. This is because, like aspen-birch, this habitat experienced a dramatic increase in abundance during the European settlement period, followed by a long but equally dramatic decline in abundance as forests have become reestablished in these areas. This decline in habitat abundance has also been associated with declines in abundance of species associated with these habitats. While some existing upland openings represent natural open conditions that are likely to remain stable over time, most represent a legacy of the historical settled landscape that was predominantly open and continue to be maintained open through Forest Service management. More detail on how this habitat decline has affected animal species on the Forest can be found in the Wildlife and Wildlife Habitat section of this chapter.

Rare and Uncommon Natural Communities

Alpine Meadow/Subalpine Krummholz

The GMNF includes the southernmost extent of alpine communities in Vermont. Here, the predominant forms of alpine habitat are dry to mesic meadows, low shrubby heaths, and barren lichen-covered rock, all part of the alpine dry/mesic heath/meadow system. Subalpine krummholz forest occurs in the more sheltered locations at the edge of the alpine zone and consists of stunted black spruce and balsam fir.

These communities for purposes of this discussion are areas mapped as Ecological Landtype (ELT) 14, which is defined by soils that undergo cryoplanation, a soil process that involves repeated freezing and thawing of the soil. These communities encompass about 1,000 acres in two patches in the North Half of the Forest. Most of this is subalpine krummholz, as the alpine meadow habitat is limited to a few acres at the top of Mt. Abraham. Small patches of subalpine krummholz located elsewhere on the GMNF that are not mapped as ELT 14 are considered part of the softwood forest community.

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. These habitats 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.

Rock Outcrops and Cliffs

These habitats include cliffs, rock outcrops, talus slopes, and rocky ridges. These sites are often classified as boreal cliff or outcrop natural communities when they occur above 2,000 feet in elevation, and temperate cliff or outcrop natural communities when they occur below 2,000 feet in elevation. These habitats are also

classified based on whether they tend to be acidic or calcareous in nature, as these differences result in very different natural communities.

The boreal and acidic versions of these habitats tend to occur as small, widely scattered patches, surrounded by or included in forest of various types. There are numerous, small acidic outcrops and ridges throughout the Forest. Cliffs of any type are relatively uncommon, but are also widely scattered across the Forest. A long, narrow, and mostly continuous band of temperate acidic and calcareous rock and cliff habitat occurs along the western edge of the Forest along the Route 7 corridor extending from Bristol to the Massachusetts border. This is one of the dominant features of the Escarpment LTA, along with oak and hemlock forests. While about 37,000 acres or ten percent of the GMNF is classified as ecological types that have frequent outcrops, only about 1,000 to 3,700 acres, or less than one percent of the Forest, is classified as representing actual outcrops or cliffs.

Wetlands

Wetland natural communities include both forested and non-forested types. Non-forested or open wetlands of a variety of sizes and types, such as beaver meadow complexes, shrub swamps, peatlands, sedge meadows, wet upland meadows, and roadside ditches, occur on the Forest. Most open wetlands on the GMNF are associated with rivers and are influenced by recent beaver activity; few are old and stable wetlands like peatlands. In fact, peatlands tend to be rare on the Forest, particularly calcareous peatlands such as rich or intermediate fens.

Forested wetlands include floodplain forests, hardwood swamps, and softwood swamps, as well as less obvious wetland habitats within conifer and hardwood forests, such as vernal pools and seeps. Forested wetlands on the GMNF are most often spruce-fir-tamarack swamp, hemlock or red spruce-hardwood swamp, or red maple-sphagnum acidic basin swamp, and occasionally red maple-black ash seepage swamp. Forested wetlands that are rare on the GMNF, occurring only once or twice, include black spruce swamp, northern white cedar swamp, red maple-black gum swamp, and calcareous red maple-tamarack swamp. Sugar maple-ostrich fern floodplain forest probably occurred along the larger rivers at the edges of the Forest, but there are no intact or functional occurrences known currently from the Forest.

Non-forested communities, open wetlands, and wetlands in general are concentrated within the low hill, low slope, plateau, and valley landscapes of the Forest. These landscapes are more prominent in the southern portion of the Forest, although they are also common in the western portion of the North Half of the Forest. Wetlands constitute between one and two percent of National Forest System (NFS) lands. National Wetland Inventory maps show more than 3,300 acres of open and scrub-shrub wetlands on the GMNF, averaging a little over three acres in size, and ranging in size from less than an acre to 41 acres. These maps also show a similar acreage of forested wetlands with similar size characteristics. A recent survey identified approximately 650 open wetlands in the South Half of the Forest, and approximately 200 on the North Half (Williams 1996). Calcareous wetlands of all types tend to be rare on the Forest.

While many wetlands tend to be associated with particular landscapes across the Forest, seep and vernal pool habitats are much more widely distributed, being most common in ecological types that have shallow hardpan or shallow to bedrock soils. They are also generally not mapped as part of National Wetland Inventory maps because they are hard to detect from the air; consequently their distribution is not well known. Rich northern hardwood and lowland spruce-fir forests particularly tend to include seep and vernal pool habitat, although these small wetland habitats are also found embedded within the full spectrum of hardwood and softwood forest communities.

Rich Northern Hardwood Forests

Rich northern hardwood forest habitat is a forested natural community dominated by sugar maple; white ash is also common, while basswood and butternut are occasional (Thompson and Sorenson 2000). Beech and yellow birch are less abundant than they would be in a typical stand of northern hardwoods. On occasion, hemlock, red spruce, and red oak occur in these stands as well. Transition limestone hardwood forest may be considered part of this group, as it represents the enriched mesic conditions of the community at lower elevations and warmer climates (Thompson and Sorenson 2000).

Rich northern hardwood forests are fairly uncommon on the GMNF, but tend to be more common in the mountains of Vermont than in New Hampshire or Maine. The smallest and most isolated patches occur in the Green Mountains at moderate elevations; the largest patches occur in the Taconic Mountains, where the community tends to reach its most characteristic development. Often, the community is associated with calcareous substrates, including limestone, marble, dolomite, calcareous schist, and calcareous till. Bedrock maps of Vermont indicate calcareous rocks are restricted to small, narrow, widely scattered bands in the Green Mountains, although it is more common along the escarpment on the western edge of the Forest, as well as in the Vermont and Champlain Valleys and the Taconic Mountains. Calcareous rock types expected to provide potential rich northern hardwood habitat based on ecological mapping (Burbank 2004) account for about 4,600 acres on the Forest, or about one percent of National Forest System lands. Patches of this rock-based habitat generally range from less than an acre to about 212 acres in size, and average four acres in size.

Although the distribution and abundance of calcareous rock and related rich northern hardwoods can be predicted, other occurrences of this community are difficult to predict due to limited data on the distribution of calcareous soils and tills in the mountains of Vermont. This community can also form in places in the landscape that are moist and tend to pool organic matter (referred to as a composting effect). Small scale landforms such as toe slopes, coves, and colluvial slopes can provide rich northern hardwood forest communities in places that are mesic and are at elevations dominated by northern hardwoods, although many of these places do not turn out to be enriched when investigated in the field. Consequently, rich northern hardwood forests appear to have a limited, and somewhat unpredictable, distribution in the GMNF, estimated to be less than two percent of NFS lands.

Indicator 2 – Proportion of Each Major Forest Community in Various Age Categories (Age Class Distribution)

For the purposes of this analysis, forest communities on the GMNF have been divided into four broad age classes: regenerating, young, mature, and old. Regenerating forest is generally 0 to 9 years old, following a stand-replacing natural disturbance or harvest. Young forest starts at age 10 and lasts between 30 and 50 years, depending on the forest type. Mature forest encompasses the ages at which harvest is most desirable for each forest type. Old forest starts after the traditional or standard rotation age for each forest type, generally more than 80 to120 years.

The vegetation on most lands in the GMNF has been growing and aging. Most forest stands are currently between 70 and 120 years old, placing them in the mature or old age classes (Table 3.5-7). Mature and old forests tend to occur in large blocks across the Forest. Only a small proportion of the Forest falls within the old age class, and still less is older than 150 years. It will take another 30 to 80 years for substantial proportions of the Forest to move into the oldest age classes.

While this large pulse in harvesting at the turn of the century has placed the Forest outside of what is expected ecologically for the mature and old age classes, the regenerating and young age classes have fallen back to levels that are within the ecological range of variability (Table 3.5-7). Regenerating forest habitats typically occur in small patches and are not

inventoried as new stands unless they are of sufficient size, usually around 20 acres. Consequently, the current condition of this age class as measured through stand inventory (Table 3.5-7) is a slight underestimate of the actual level of disturbance and associated regenerating forest.

Table 3.5-7: Forest-wide summary of current age class distribution by forest community

	Regen.	Young	Mature	Old
	Ac (%)	Ac (%)	Ac (%)	Ac (%)
Northern hardwood	1,192 (<1)	34,786 (12)	217,755 (76)	34,144 (12)
Mixedwood	336 (1)	2,303 (6)	24,389 (63)	11,463 (30)
Softwood	83 (<1)	1,862 (8)	14,864 (60)	7,933 (32)
Aspen-birch	89 (1)	1,120 (10)	1,949 (17)	8,218 (72)
Oak	37 (1)	265 (7)	1,453 (41)	1,794 (51)
Totals	**1,737 (<1)**	**40,336 (11)**	**260,410 (71)**	**63,552 (18)**

Source: Forest GIS data.
Notes: These forest communities do not include upland openings, most wetlands, water bodies, or some recently acquired lands on which there is no age data. Totals in this table will not match those in other tables.

Old growth forest is a subset of the old age class; it tends to occur as small isolated stands currently on the Forest. Most known old growth stands are in Research Natural Areas, Ecological Special Areas, or in existing Wilderness.

Indicator 3 – Acres of Timber Harvest Treatments (Forest Structure)

This indicator evaluates active management treatments that may affect within-stand complexity. For this analysis, within-stand complexity refers to the vertical structure and associated species diversity at the stand scale, as well as within-stand components such as snags, cavity trees, and coarse woody debris. Vertical structure is the bottom to top configuration of above ground vegetation within a forested stand and varies with forest types and stand ages.

Stand complexity changes markedly during forest succession, from a relatively simple structure in early successional stands to a more complex structure as stands age. This increase in complexity generally occurs as the overstory matures, some trees die and leave canopy gaps, new patches of young trees (called “cohorts”) grow into the gaps, and individual canopy trees grow to different heights. The staggered timing and variety in gap size and shape produces variation in the vertical structure of the stand, which also leads to variation in overall plant and animal species diversity (DeGraaf et al. 1992). As stands age and self-thin, there are also increased amounts of standing snags and woody debris on the forest floor. This maturation process takes tens to hundreds of years depending on forest type. The natural succession of forested stands to a mature and eventually old growth condition generally provides the greatest vertical diversity and overall stand complexity of any of the earlier seral stages.

Forest structure is also influenced by manipulations of vegetation by humans, including timber harvesting, stand improvement and reforestation, fire use, and conservation of structural components like snags and cavity trees during harvesting operations. Harvest methods and other manipulations of vegetation also vary in the extent to which they affect forest structure.

In general, methods of harvesting that produce one large patch of trees of the same age (or single-cohort methods), such as clearcutting or the traditional shelterwood method, initially simplify vertical stand structure, and depending on the rotation length, may not provide an opportunity to develop more complexity prior to the next harvest. Partial harvesting methods, such as shelterwood with reserves or thinning, as well as many other activities that don’t involve timber harvesting, can be used to specifically increase structural complexity by managing for mixtures of tree species that grow at different rates and to different sizes. As trees are retained in subsequent thinnings and harvests, stand complexity can approach what one might find in a multi-aged stand. Multi-age stands created through selection harvests,

which create several small cohorts of new trees at different times in the same stand, may provide the highest amount of vertical structure of the methods discussed in this analysis.

A recent paper by Seymour et al. (2002) compared harvesting methods to the range of natural variation expected in forests of the Northeast. In this context, the paper intended to determine the extent to which different harvesting methods created the age class distribution and forest structure one might have expected for these forests under natural disturbance regimes. The researchers found that multi-cohort methods, such as selection harvesting, two-cohort methods such as variable retention (retention of at least 44 square feet of basal area per acre), and long rotation management (rotations of around 190 years or more) all compare favorably with the expected range of natural variation for northeastern forests.

Table 3.5-8: Harvest methods applied to the GMNF from 1987 through 2001

Treatment	Average annual harvest	Total 15-year harvest	% of total harvest
	Acres	Acres	%
Clearcut	180	2,700	13
Shelterwood regeneration	194	2,910	14
Shelterwood removal	154	2,310	11
Thinning	400	6,000	29
Selection	442	6,630	32
Stand improvement	329	4,935	--
Total	**1,370**	**20,550**	**100**

Source: GMNF Retrospective (USDA Forest Service 2002)

Table 3.5-8 provides the timber management activities that have been applied to the GMNF from 1987 through 2001 (USDA 2002c). Timber harvesting activities undertaken over the past 15 years that manipulate forest structure have been limited on the Forest, affecting about five percent of the landbase or approximately 21,000 acres, and averaging approximately 1,400 acres of harvest per year (Table 3.5-8). These activities overall contribute to forest structure by adding some age class diversity to the Forest as a whole.

Of the total amount of harvest that occurred during this time period, harvesting using single-cohort methods like clearcutting, shelterwood regeneration, and overstory removal harvests accounted for approximately 7,900 acres, or 38 percent of the total harvested acres (Table 3.5-8). While clearcutting in particular tends to simplify forest structure, the total 15-year clearcut acreage represents less than one percent of the GMNF.

Partial harvesting and selection methods were used on three percent of the landscape, adding a small amount of vertical structural complexity to the Forest overall. In addition, site preparation and stand improvement techniques, including fire use, have been used on 4,900 acres, contributing to structural diversity on over one percent of the Forest. However, harvesting and other vegetation management activities that were anticipated in 1987 overall did not occur at expected levels due to a number of factors, primarily related to budget and staff levels. Only five percent of the Forest has been affected by vegetation management since 1987.

Consequently, natural succession has generally played a much larger role in the development of structural complexity over the last 15 years on the Forest than management. Because the Forest is predominantly even-aged, with close to 60 percent between the ages of 80 and 120 years, and more than 90 percent less than 150 years, it currently has far less structural complexity than would be expected under natural disturbance regimes. As more than half of the stands on the Forest are becoming mature, however, these stands are likely starting to provide some additional structure as trees decay and die and canopy gaps become more common.

3.5.1.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Indicator 1 – Amount of Each Major Forest Community (Composition and Abundance)

Ecological tendencies based on land type association (LTA) mapping and analysis of pre-European settlement tree data (Cogbill et al. 2002) estimate the direction and magnitude by which forest community composition and abundance is expected to change over time on National Forest System lands in most MAs (Table 3.5-1). Within MAs Diverse Forest Use, Diverse Backcountry, Escarpment, Remote Wildlife Habitat, Moosalamoo Recreation and Education Area, and to some extent White Rocks NRA, vegetation management could alter forest community composition, particularly for the oak, aspen-birch, and opening communities. Land allocation to these MAs varies by alternative, and alternatives would therefore have varying effects on the composition and abundance of some of these forest communities over the short term (next 15 to 20 years) or long term (next 150 or more years).

For the major forest communities, there is currently no modeling available that provides predictions of actual changes in abundance over time. The SPECTRUM model used for harvest level analysis did not analyze conversions from one type to another, and oak was not modeled by SPECTRUM due to its initial low abundance. The previous discussion on ecological tendencies and revised Plan objectives suggests that both natural conversions through forest succession, as well as conversions to halt succession and maintain important habitats, are important in understanding trends in abundance. Consequently, the focus of the analysis for this indicator will be the estimated trends in abundance based on vegetation management activities that are allowed to occur within the various management areas. When information on harvesting activities predicted by SPECTRUM helps to explain effects, that information is used to supplement the effects analysis.

The following analysis of effects looks at two ways in which management areas can influence composition. First, management areas are analyzed in terms of the opportunities they provide to maintain the current abundance of existing stands of certain forest communities. When most existing stands of a particular community are within management areas that are likely to support their continued existence, then it is also likely that the current abundance of that community will be maintained. However, when the emphasis of a management area does not support the maintenance of a particular community, then current abundance is likely to decline.

Second, management areas were analyzed in terms of the opportunities they provide to increase the abundance of particular communities through expanding existing stands or creating new stands of that community. For some communities, particularly oak and oak-pine, these opportunities are limited to certain LTAs, and the distribution of management areas in relation to LTAs is also analyzed for these communities. Where management areas offer opportunities for creation or expansion of various communities, this can help to offset losses of opportunities to maintain existing stands through management area allocation. In cases where both existing stands and opportunities for new stands of a particular community are supported, then overall abundance is most likely to increase.

Effects Common to All Alternatives

Northern Hardwood, Mixedwood, and Softwood Forest Communities

The Forest-wide composition objectives in the revised Plan take into account that shifts in the broader forest communities of northern hardwoods, mixedwoods, and softwoods are long-term and reflect ecosystem recovery from historical land uses. While current composition of these three communities suggests that only northern hardwoods are well-distributed (Table

3.5-6), the landscape-level ecological tendencies on the Forest indicate that all three would become well-distributed over several decades to centuries. Since Forest-wide composition objectives reflect these long-term tendencies for northern hardwoods, mixedwoods, and softwoods, regardless of alternative (Table 3.5-4), there are no substantial differences in how well the alternatives would move the Forest toward these composition tendencies.

All alternatives provide abundant opportunities for both management and natural succession towards the composition objectives for these forest communities. Vegetation management may contribute to or accelerate the inevitable natural shifts in composition for these communities across alternatives, but it would account for only a two percent increase in the composition of mixedwoods and softwoods combined over the short-term. Over several decades to centuries, this shift may become more noticeable, but again would not likely vary by alternative. Because changes in abundance and composition of these communities do not vary by alternative, these communities are not discussed further in relation to this indicator.

The remaining forest communities, aspen-birch, oak, and upland openings, tend to occur in very limited quantities under natural disturbance regimes. Consequently, within MAs that do not allow the creation or maintenance of these communities, they may become less abundant. Forest-wide composition objectives in the revised Forest Plan reflect a desire to increase, or at least maintain, the current abundance of these communities, regardless of alternative (Table 3.5-4). Increases are only likely to occur within MAs that allow vegetation management for these purposes, and the allocation of these MAs varies by alternative.

Oak and Oak-Pine Forest Communities

Although most current oak and oak-pine forests on the GMNF would gradually convert to other forest communities if natural disturbance or management does not maintain them, the conversion takes centuries, as the dominant trees can live for more than 200 years. Therefore, outside of MAs in which vegetation management for oak and oak-pine takes place, the abundance of these communities is likely to remain stable over the short-term. Vegetation management to maintain and enhance oak and oak-pine forest is permitted within Diverse Forest Use, Diverse Backcountry Forest, Escarpment, Remote Wildlife, and Moosalamoo Area management areas. Within these management areas, the abundance of oak and oak-pine forests is expected to remain stable or increase slightly over the short-term.

Variation among alternatives is generally related to the level of emphasis placed on oak management within these five management areas. While all five of the MAs allow vegetation management for oak, and Forest-wide objectives promote the expansion of oak forests, the Escarpment MA is of particular importance because maintenance of these oak and oak-pine communities is the primary focus of this MA. The emphasis, desired future condition, and standards and guidelines for this MA all work toward enhancing these communities and increasing their abundance. In addition, this MA is restricted to the LTA in which oak and oak-pine communities are most likely to occur now, or be enhanced or created in the future.

Consequently, the Escarpment MA is considered to offer a high level of opportunity for maintenance and creation of these communities, while the remaining four MAs are considered to offer a more moderate level of opportunity. Wherever the Escarpment MA occurs across alternatives, opportunities to maintain and increase the abundance of oak and oak-pine communities are improved. Because the amount of this MA varies substantially by alternative, the overall effects of the alternatives on oak abundance also vary, and are discussed further for each alternative.

Non-forested Communities

Natural permanent openings related to wetlands and rocky outcrops are not abundant in terms of acreage, but are generally well-distributed in small patches across the Forest. They tend to be restricted to certain physical resource conditions. Succession of these types of openings to forested conditions can take

centuries, and it is expected that most would remain open for at least the short-term. Some wet openings that are created and then abandoned by beaver can become reforested over the short-term. These wet openings are often treated as upland openings and are maintained when feasible, often by burning. Standards and guidelines for protection of TES species and habitats would ensure that those open areas critical to species of viability concern would be maintained in an open condition, regardless of alternative or MA allocation.

Because upland openings are not as well-distributed as wetland openings, vegetation management has traditionally been used as a tool to enhance the abundance and distribution of open upland communities on the Forest. It is also a tool to perpetuate abandoned beaver meadows that may revert to forest fairly quickly.

All MAs permit the maintenance of existing openings for wildlife, with the exception of Research Natural Areas, Ecological Special Areas, the Alpine/Subalpine Special Area, Remote Backcountry Forest, Wilderness, and Wilderness Study Areas. Alternatives vary in the amount of upland openings that occur in MAs that restrict their maintenance, from 191 to 321 acres (three to eight percent of all upland openings). Most of the opening loss has already taken place, as the majority of these acres are within existing Wilderness. Consequently, it is unlikely that any alternative would substantially reduce existing acres or proportion of upland openings on the Forest. The abundance of this habitat will remain at the low end of the composition objective range defined in the revised Forest Plan, around one percent, unless new openings are created.

The creation of new openings may occur in to the Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Moosalamoo Recreation and Education Area, and White Rocks NRA MAs. Because White Rocks NRA standards and guidelines place additional restrictions on the creation of new openings, it is considered to offer only moderate opportunities for this activity. The other four management areas are considered to offer a high level of opportunity to create new openings.

The ability to create new openings, which increases the abundance of openings on the Forest, does vary by alternative in relation to the allocation of MAs where this activity is permitted. There are currently around 5,200 acres (slightly more than one percent) of existing upland openings (Table 3.5-6). In order to meet Forest-wide objectives to increase upland openings to as much as five percent of the Forest, as many as 14,800 acres of additional new openings would be needed within these MAs. The differences among alternatives in lands available to create openings are discussed under the effects of each alternative.

In addition to the creation and maintenance of openings for wildlife purposes, development also can result in conversion of forested communities into non-forested conditions. On the Forest, development would include construction and maintenance of developed recreation facilities, backcountry recreation facilities, motorized and non-motorized trails, ski area facilities and trails, utility corridors, wind turbines, and communication facilities.

The openings associated with these developments often provide suitable habitat for species of upland openings. Some of these types of developments are small enough that they are considered part of the surrounding habitat, while others are large enough to be considered non-forested stands during inventory. The level of on-Forest development across alternatives would generally not alter the abundance of these openings at a landscape scale because such development is expected to account for few additional acres of this community. Most existing developments are not likely to disappear from the Forest over the short-term, and so many of these types of open communities would continue to exist, regardless of the MA in which they fall.

Aspen and Birch Forest Communities

The aspen-birch community, because it is short-lived, is perhaps the most sensitive to the allocation of MAs that allow the vegetation management needed to perpetuate it. Because it can occur across most landscapes of the Forest, its distribution and abundance across the Forest is dictated largely by the distribution and abundance of MAs in which vegetation management is allowed. Management areas that allow creation and maintenance of aspen-birch communities include Diverse Forest Use, Diverse Backcountry, Escarpment, Remote Wildlife Habitat, Moosalamoo Recreation and Education Area, and White Rocks NRA. As with upland openings, White Rocks NRA standards and guidelines place additional restrictions on the amount and distribution of management for this habitat. Consequently, White Rocks NRA is considered to offer moderate opportunities for aspen-birch management, while the others noted offer high opportunities.

Across all alternatives, the abundance of existing stands of aspen-birch is expected to decline by more than 50 percent over the short term (Table 3.5-9). Between 6,500 and 7,000 acres of aspen-birch are allocated to MAs that prohibit their maintenance. Of the remaining acres of this type, SPECTRUM modeling predicts that between 1,500 and 1,800 acres will be harvested over the next several decades at a rate of between 25 and 30 acres per year across alternatives. This amount of aspen-birch forest represents only 0.4 percent of the Forest, below the range set in the Forest-wide composition objectives.

With 89 percent of existing aspen-birch stands being in the mature to old age classes (Table 3.5-7), it is clear that much of the existing 11,500 acres of this community is likely to disappear over the short-term on the Forest, regardless of alternative. Because the alternatives fall within five percent of each other in terms of allocation to MAs that either prohibit or allow aspen-birch management, the differences among alternatives are minor and inconsequential when compared to the overall likely decline in existing abundance of this type across alternatives.

In order to mitigate this loss of existing acreage of aspen-birch, either new stands of aspen and birch need to be created, or existing stands need to be expanded. Anywhere from 2,200 to 18,500 acres of additional aspen-birch forest will be required in order to stay within the long-term composition objective range (1-5%) set by the revised Plan (Table 3.5-4). In order to simply maintain the existing acreage of this type on the Forest, between 9,700 and 10,000 acres of new aspen-birch forest will need to be created and maintained over the long term.

While some of these acres will come from natural disturbances, most will come from both timber harvesting and other vegetation management activities. These activities include both commercial and non-commercial clearcutting of hardwoods to create aspen-birch stands, as well as release of aspen-birch trees from competing hardwood vegetation.

Creation of new stands and expansion of existing stands can only take place in MAs that permit these activities. Consequently, the amount of acres allocated to these MAs is important to understanding the extent to which alternatives can mitigate the loss of existing stands, as well as increase the abundance of this type beyond the current level. The variation among alternatives in the land available for creation and enhancement of aspen-birch forest is further discussed under the effects of each alternative.

Table 3.5-9: Acres and percent of existing aspen-birch stands in different management opportunity levels by alternative

Alternative	None to Low[1]	Moderate[2]	High[3]
	Acres (%)	Acres (%)	Acres (%)
Alternative A	6,487 (56)	1,035 (9)	4,009 (35)
Alternative B	6,804 (59)	1,035 (9)	3,654 (32)
Alternative C	6,491 (56)	1,035 (9)	3,967 (35)
Alternative D	7,015 (61)	1,035 (9)	3,444 (30)
Alternative E	6,990 (61)	1,074 (9)	3,468 (30)

Source: Forest GIS data
Notes:
[1] Management Areas that allow no to low management opportunities include: Remote Backcountry Forest (RBF), Wilderness (WIL), Wilderness Study Area (WSA), Appalachian Trail (AT), Long Trail (LT), Recreation Special Area (RSA), Alpine Ski Area (SKI), Alpine Ski Area Expansion (SKIX), Research and Candidate Research Natural Area (RNA), Ecological Special Area (ESA), Alpine/Subalpine Special Area (ALP), Eligible Wild, Scenic, or Recreational Rivers or Significant Streams (WSR), and Newly Acquired Lands (9.2).
[2] Management Areas that allow moderate management opportunities include: White Rocks NRA (NRA).
[3] Management Areas that allow high management opportunities include: Diverse Forest Use (DFU), Diverse Backcountry Forest (DBF), Escarpment (ESC), Remote Wildlife (RWL), and Moosalamoo Recreation and Education Area (MRA).

Alternative A

Oak and Oak-Pine Forest Communities
Alternative A provides the greatest proportion of acres (78%) of existing stands of oak forest in MAs with a moderate to high opportunity for maintaining oak forest community types (Table 3.5-10). Twenty-two percent of existing stands are in MAs that would not allow oak management, although most would remain oak over the short-term due to the longevity of the dominant species in these stands. Over the long-term, many of these stands are likely to succeed to northern hardwood or mixedwood forests unless natural disturbance or fire management regenerates them.

The eventual loss of these oak stands will require the conversion of an additional 1,000 acres of existing northern hardwood or mixedwood stands to oak, within MAs that allow this management, in order to at least maintain the minimum one percent composition objective for oak on the Forest. In order to increase acres, additional conversions would be necessary through an increased emphasis during vegetation and fire management on oak regeneration, amounting to as much as 17,000 additional acres.

Table 3.5-10: Acres and percent of existing oak and oak-pine stands in different management opportunity levels by alternative

Alternative	None-Low[1]	Moderate[2]	High[3]
	Acres (%)	Acres (%)	Acres (%)
Alternative A	846 (22)	2,936 (78)	0 (0)
Alternative B	1,355 (36)	1,349 (36)	1,077 (28)
Alternative C	1,130 (30)	911 (24)	1,742 (46)
Alternative D	1,130 (30)	456 (12)	2,196 (58)
Alternative E	1,130 (30)	738 (20)	1,914 (51)

Source: Forest GIS data
Notes:
[1] Management Areas that allow no to low management opportunities include: RBF, WIL, WSA, AT, LT, RSA, SKI, SKIX, RNA, ESA, ALP, WSR, and 9.2.
[2] Management Areas that allow moderate management opportunities include: DFU, DBF, RWL, MRA, and NRA.
[3] Management Areas that allow high management opportunities include: ESC.

In looking at the opportunities that this alternative provides to increase oak forest beyond existing stands, an evaluation of how LTAs that ecologically support oak and oak-pine forests are distributed among different management opportunities can be helpful. LTAs with ecological characteristics that are conducive to growing oak and pine (Escarpment and Valley Bottom LTAs) are most likely to provide the best opportunities for increasing oak and oak-pine forests beyond existing levels. This could involve such activities as releasing oak trees from competing northern hardwood vegetation, or using fire to reduce competition and create seedbeds for natural regeneration. When these LTAs are allocated to the Escarpment MA, opportunities for increasing oak and oak-pine forests are then maximized due to the primary emphasis on these communities within this MA.

Table 3.5-11 shows how the two LTAs on the Forest that ecologically support oak forests are distributed among management areas with differing opportunity levels. The MA opportunity levels are the same as in Table 3.5-10. Alternative A is the only alternative that does not provide for opportunities to increase the abundance of oak forest at the high opportunity level (Table 3.5-11). Management within the areas offering moderate opportunities for oak would also work toward the overall Forest-wide objectives of maintaining and increasing the oak community. Without the focus and attention provided to these communities by the Escarpment management area, the abundance of oak is less likely to increase over the long term, and more likely to be maintained at the low end of the composition objective range.

Table 3.5-11: Acres and percent of LTAs with ecological tendencies to support increasing the abundance of oak and oak-pine forest in different management opportunity levels by alternative

Alternative	None-Low[1]	Moderate[2]	High[3]
	Acres (%)	Acres (%)	Acres (%)
Alternative A	16,118 (41)	23,283 (59)	0 (0)
Alternative B	14,925 (38)	21,873 (56)	2,604 (7)
Alternative C	15,282 (39)	16,346 (41)	7,968 (20)
Alternative D	15,514 (39)	7,545 (19)	16,486 (42)
Alternative E	15,529 (39)	10,325 (26)	13,691 (35)

Source: Forest GIS data
Notes: LTAs that ecologically support oak forests include the Escarpment and Valley Bottom LTAs.
[1] Management Areas that allow no to low management opportunities include: RBF, WIL, WSA, AT, LT, RSA, SKI, SKIX, RNA, ESA, ALP, WSR, and 9.2.
[2] Management Areas that allow moderate management opportunities include: DFU, DBF, RWL, MRA, and NRA.
[3] Management Areas that allow high management opportunities include: ESC.

Activities that are likely to take place over the short-term that support the maintenance and restoration of oak and oak-pine forests can also help identify differences in expectations by alternative. Table 3.5-12 provides information about four activities that are likely to occur on the Forest that contribute to maintenance and enhancement of this community. Table 3.5-12 indicates that Alternative A has the lowest level of potential regeneration harvesting that would regenerate oak forests of all the alternatives, although release and thinning are equivalent across alternatives. The low level of regeneration harvesting, when added to the lack of any allocation of lands to the Escarpment MA with its emphasis on oak management, means that this alternative would be the least effective at increasing acres of oak forest toward the upper end of the composition objective range, or beyond what currently exists on the Forest.

Table 3.5-12: Expected activity levels related to the maintenance and restoration of oak forests over the next 20 years across alternatives.

Activity	Alt A	Alt B	Alt C	Alt D	Alt E
Average annual acres oak and oak-pine forest released from hardwoods	200	200	200	200	200
Average annual acres shelterwood regeneration harvest in hardwood and oak forests	980	1,262	1,385	1,260	1,318
Average annual acres shelterwood removal harvest in hardwood and oak forests	394	654	461	611	592
Average annual acres thinning in hardwood and oak forests	935	958	911	940	919
Total average annual acres treated for maintenance and restoration of oak forests	2,509	3,074	2,957	3,011	3,029

Source: SPECTRUM modeling (acres averaged over first two decades); Appendix D of revised Plan
Notes: SPECTRUM modeling did not model harvesting of oak forests separately due to the small number of acres and limited data for this type.

Non-forest Communities

Alternative A provides fewer acres than the other alternatives in MAs with moderate or high opportunities (218,168 acres) for creation of new upland openings, and the most acres in lands that do not allow opening creation (182,524; Table 3.5-13). In order to increase the abundance of non-forest communities to the upper end of the composition objective range in the revised Forest Plan, as many as 14,500 acres need to be created. Under this alternative, the 14,500 additional acres of potential new openings would need to be created from a smaller available landbase (218,168 acres) than other alternatives. Consequently, opportunities for this activity may be fewer, and the abundance of upland openings will likely not increase as much as in other alternatives.

Table 3.5-13: Acres and percent of lands allowing the creation of new upland openings in different management opportunity levels by alternative

Alternative	None-Low[1]	Moderate[2]	High[3]
	Acres (%)	Acres (%)	Acres (%)
Alternative A	182,524 (45)	22,758 (6)	195,410 (49)
Alternative B	111,223 (28)	22,758 (6)	266,711 (66)
Alternative C	144,234 (36)	22,758 (6)	233,700 (58)
Alternative D	172,638 (43)	22,758 (6)	205,296 (51)
Alternative E	156,778 (39)	22,758 (6)	221,156 (55)

Source: Forest GIS data
Notes:
[1] Management Areas that allow no to low management opportunities include: RBF, WIL, WSA, AT, LT, ESC, RSA, SKI, SKIX, RNA, ESA, ALP, WSR, and 9.2.
[2] Management Areas that allow moderate management opportunities include: NRA.
[3] Management Areas that allow high management opportunities include: DFU, DBF, RWL, and MRA.

Aspen and Birch Communities

Alternative A provides the least amount of acres in lands with moderate to high opportunities (218,168 acres) for creating new stands of aspen-birch forest, and the most acres in lands where this management is prohibited (182,524 acres; Table 3.5-14). This alternative also provides the least number of acres of harvesting treatments that would maintain and enhance this community, although release treatments are consistent across alternatives (Table 3.5-15). The additional acres needed to increase the abundance of aspen-birch forest beyond existing stands that can be maintained under all alternatives, ranging from 2,200 to 18,500 acres, will need to be converted from a smaller available landbase than in other alternatives (218,168 acres). A smaller available landbase provides fewer opportunities for management, and so the abundance of

aspen-birch forest is not likely to increase as much in this alternative as in others.

Table 3.5-14: Acres and percent of lands allowing the enhancement and creation of aspen-birch forest in different management opportunity levels by alternative

Alternative	None-Low[1]	Moderate[2]	High[3]
	Acres (%)	Acres (%)	Acres (%)
Alternative A	182,524 (45)	22,758 (6)	195,410 (49)
Alternative B	108,329 (27)	22,758 (6)	269,605 (67)
Alternative C	135,746 (34)	22,758 (6)	242,188 (60)
Alternative D	154,928 (39)	22,758 (6)	223,006 (55)
Alternative E	142,342 (35)	22,758 (6)	235,592 (59)

Source: Forest GIS data
Notes:
[1] Management Areas that allow no to low management opportunities include: RBF, WIL, WSA, AT, LT, RSA, SKI, SKIX, RNA, ESA, ALP, WSR, and 9.2.
[2] Management Areas that allow moderate management opportunities include: NRA.
[3] Management Areas that allow high management opportunities include: DFU, DBF, ESC, RWL, and MRA.

Table 3.5-15: Expected activity levels related to the maintenance and enhancement of aspen-birch forests over the next 20 years across alternatives.

Activity	Alt A	Alt B	Alt C	Alt D	Alt E
Average annual acres of clearcut harvest in aspen-birch forest	20	24	24	23	23
Average annual acres of non-commercial clearcut harvest for aspen-birch	200	200	200	200	200
Average annual acres of clearcut in hardwood forest for aspen regeneration	64	88	77	70	62
Total average annual acres of clearcut harvest for maintenance and restoration of aspen-birch	284	312	301	293	285

Source: SPECTRUM modeling (acres averaged over first two decades); Appendix D of revised Forest Plan.
Notes: SPECTRUM modeling did not model conversions and non-commercial activities. One quarter of the hardwood clearcutting acres are expected to be for aspen-birch conversion.

Alternative B

Oak and Oak-Pine Forest Communities
Alternative B, maintains 64 percent of existing oak stands within MAs of moderate to high opportunity levels (Table 3.5-10), which is less than all the other alternatives. There are consequently fewer opportunities to maintain existing oak forest with this alternative, although this still represents a substantial proportion of oak forest in management areas that allow maintenance and enhancement. This reduction is also mitigated by the allocation in this alternative of 28 percent of existing oak stands to the Escarpment MA, where management of oak and oak-pine forests are emphasized (Table 3.5-10). In addition, this alternative allocates a small amount (seven percent) of the LTAs that ecologically support the creation and enhancement of additional oak forest

communities to the Escarpment MA, more than Alternative A, but substantially less than the other alternatives (Table 3.5-11). Potential harvesting and release treatments that maintain and enhance oak would be highest in this alternative (Table 3.5-12).

Consequently, this alternative overall is likely to result in the maintenance of the existing abundance of oak on the Forest through the increased levels of harvesting that support oak management, and increased opportunities to create new and enhance existing oak stands within appropriate LTAs. These activities should compensate for the loss of some existing oak stands to MAs that do not permit their management. This alternative is not as likely to increase oak abundance as much as Alternatives C, D, and E, which allocate a higher proportion of the Forest to areas with high management opportunities. This alternative will therefore tend to maintain oak abundance at the low end of the long-term composition objective range.

Non-forest Communities
Alternative B provides more acres than the other alternatives in MAs with moderate to high opportunities for upland openings creation (289,469 acres; Table 3.5-13). It is more likely that substantial increases in the abundance of upland opening communities can be achieved with this alternative when compared to the others due to the larger landbase available. This alternative is therefore more likely than the others to increase the abundance of upland openings close to the 14,500 additional acres needed to reach the upper end of the desired long-term composition range.

Aspen and Birch Communities
Alternative B provides the greatest number of acres in lands with moderate to high opportunities for the creation of new stands of aspen-birch forest (292,363 acres; Table 3.5-14). Harvests that maintain and enhance aspen and birch communities are at their highest potential levels in this alternative (Table 3.5-15). Overall, this alternative is more likely than the other alternatives to increase the abundance of aspen-birch forest toward the upper end of the desired long-term composition objective range of five percent of the Forest.

Alternative C

Oak and Oak-Pine Forest Communities
Alternative C maintains 70 percent of existing oak stands within MAs providing moderate to high opportunities for oak forest maintenance and enhancement (Table 3.5-10), which is equivalent to Alternatives D and E. Alternative C maintains 46 percent of the existing oak stands within the Escarpment MA, which is substantially more than in Alternatives A or B (Table 3.5-10). In addition, this alternative allocates 20 percent of the LTAs where creation and enhancement of additional oak forest is most likely to be successful to the Escarpment MA. This is more than double the amount in Alternative B, but half as much as in Alternative D (Table 3.5-11). Slightly lower levels of harvest and release treatments to maintain and enhance oak forests occur with this alternative than in Alternatives B, D or E, although substantially more than in Alternative A (Table 3.5-12).

As a result, this alternative is expected to maintain the existing abundance of oak and may slightly increase its abundance over the long term due to the increased acreage of LTAs that support oak forests and existing oak stands in the Escarpment MA. This increase in overall oak abundance will likely be greater than for Alternatives A and B, but less than under Alternatives D and E. Overall, this alternative will tend to maintain oak abundance at the lower to middle end of the desired long-term composition objective range.

Non-forest Communities
Alternatives C and E are similar, allocating 256,458 and 243,914 acres (or 64 and 61 percent), respectively, of the Forest to MAs that permit upland opening creation (Table 3.5-13). It is likely that Alternatives C and E will lead to increases in the abundance of upland openings to a greater level than alternatives A and D, due to the greater amount of land available for the creation of new openings. These alternatives are expected to increase upland opening

abundance toward the middle of the desired long-term composition objective range.

Aspen and Birch Communities
Alternatives C and E are similar, allocating 66 percent (264,964 acres) and 65 percent (258,350 acres) of the Forest, respectively to MAs that permit the creation of new stands of aspen-birch forest (Table 3.5-14). This proportion, while higher than Alternatives A and D, is lower than Alternative B. The potential harvesting under Alternative C, however, is higher than under Alternatives A, D, and E, and lower than under Alternative B (Table 3.5-15). Overall, Alternative C is expected to increase the abundance of aspen-birch forest more than Alternatives A and D, due to the greater amount of land available for the creation of this community, and higher amounts of potential harvesting for aspen. Alternative C is likely to increase aspen-birch abundance toward the lower to middle portion of the desired long-term composition objective range.

Alternative D

Oak and Oak-Pine Forest Communities
Alternative D appears likely to be the most effective alternative in maintaining existing oak forests and increasing the overall abundance of oak on the Forest. While allocating the same proportion of existing oak stands to areas that permit oak vegetation management as Alternatives C and E (70-71%; Table 3.5-10), this alternative, allocates the greatest proportion of existing oak stands (58%) to the Escarpment MA; it also allocates the greatest proportion of LTAs that support oak forest (42%) to the Escarpment MA (Tables 3.5-10 and 3.5-11). It also is expected to have a higher level of harvesting and release treatments that support oak forest than the Alternatives A and C, and similar to Alternative E (Table 3.5-12). These factors combined suggest that this alternative is expected to increase oak abundance across the Forest substantially more than Alternatives A through C, and slightly more than Alternative E, toward the middle to upper end of the desired long-term composition objective range.

Non-forest Communities
Implementation of Alternative D may encounter some of the same difficulties as Alternative A at increasing the abundance of upland opening communities across the Forest. While allocating a slightly greater amount of the Forest than Alternative A (228,054 acres) to MAs with moderate and high opportunities, the increase is slight (2%). As with Alternative A, up to 14,500 additional acres of potential new openings would need to be created from a smaller available landbase in order to maintain the abundance of this community within the desired long-term composition objective range. Consequently, opportunities for creation of new openings may be fewer, and increases in abundance are likely to be less than in the other alternatives except Alternative A. It is likely that this alternative will maintain the abundance of upland opening habitat at the low end of the composition objective range, where it is currently.

Aspen and Birch Communities
Alternative D allocates 61 percent of Forest lands to MAs that allow the creation of new aspen-birch stands, a proportion halfway between that provided under Alternative A and under Alternatives C and E, and less than under Alternative B (Table 3.5-14). The lesser amount of potential harvesting for regeneration of this community, along with lower allocation to lands where aspen-birch communities can be created, indicates that this alternative would likely be less effective at increasing the abundance of this community than all other alternatives with the exception of Alternative A. This alternative will tend to create enough new aspen-birch forest to maintain this community at the low end of the desired long-term composition objective range.

Alternative E

Oak and Oak-Pine Forest Communities
Compared to the other alternatives, Alternative E would likely be almost as effective as Alternative D, and more effective than the remaining alternatives, at maintaining and increasing oak communities across the Forest. It allocates over half of existing oak stands to the Escarpment MA (51%), slightly less than

Alternative D (58%) (Table 3.5-10). It also provides somewhat less acreage of LTAs that support oak forests (35%) to the Escarpment MA than Alternative D (42%) (Table 3.5-11). However, it is expected to have slightly higher levels of harvest and release treatments to support oak than Alternative D (Table 3.5-12). This alternative will likely increase the abundance of this community over the long-term toward the middle to upper end of the desired long-term composition objective range.

Non-forest Communities
The effects of Alternative E are the same as those discussed under Alternative C. This alternative is expected to increase upland opening abundance toward the middle of the desired long-term composition objective range.

Aspen and Birch Communities
The effects of Alternative E are similar to those discussed under Alternative C, in that they have similar proportions of the Forest allocated to areas that support aspen-birch management. SPECTRUM modeling predicts a lower proportion of hardwood clearcutting for this alternative than other alternatives except Alternative A, which means a smaller number of acres of conversion of hardwoods to aspen-birch. This may be supplemented by non-commercial aspen management, which generally depends on partnerships and volunteers. If non-commercial aspen management can help mitigate the lower amounts of commercial management expected, then overall this alternative is likely to increase aspen-birch abundance toward the lower to middle portion of the desired long-term composition objective range, as with Alternative C. If such non-commercial activities prove to be an unreliable management tool (more so than commercial activities), then this alternative may result in outcomes similar to Alternative A, at the low end of the composition objective range.

Indicator 2 – Proportion of Each Major Forest Community in Various Age Categories (Age Class Distribution)

As a result of the variation in abundance of MAs in which age class can be manipulated across alternatives, different amounts of each age class would be expected on the Forest over the short and long-term, when compared to current conditions, and across alternatives. Tables 3.5-16 through 3.5-20 display the expected trends in age classes across the Forest in the short-term, and if proposed management continued for the long-term. As indicated in these tables, there are not substantial differences among alternatives, and so the discussion of effects on this indicator will focus on those common to all alternatives.

The SPECTRUM model was used to estimate the potential future age class distribution of four forest types within lands receiving even-aged management prescriptions (see FEIS Appendix B for more information on the SPECTRUM model). The age class distribution on lands not receiving these prescriptions is estimated based on Lorimer and White (2003) and Forest inventory data (see also Lorimer and White [2003] for additional assumptions and caveats associated with their age-class projections under natural disturbance regimes).

Table 3.5-16: Projected Forest age class distribution for Alternative A, at 20 and 150 years

	Regen.	Young	Mature	Old
	(%)	(%)	(%)	(%)
20 years				
Northern hardwood/oak	5-6	16-17	44-46	32-34
Mixedwood	3-5	9-10	35-37	50-51
Softwood	6-8	10-12	40-42	39-43
Aspen-birch	8-9	13-15	11-13	64-67
All Types	**5-6**	**15-16**	**42-44**	**35-38**
150 years				
Northern hardwood/oak	4-6	24-27	12-15	51-59
Mixedwood	3-5	20-21	24-26	50-51
Softwood	7-8	19-22	15-21	49-58
Aspen-birch	7-9	24-28	13-19	45-54
All Types	**5-6**	**23-26**	**14-17**	**51-58**

Source: Spectrum; Forest GIS data; Lorimer and White 2003.
Notes: These data are based on projections using estimates for each age class based in part on Lorimer and White (2003), in combination with harvesting predicted by Spectrum modeling. Only NFS lands with forest type data are included.

Table 3.5-17: Projected Forest age class distribution for Alternative B, at 20 and 150 years

	Regen.	Young	Mature	Old
	(%)	(%)	(%)	(%)
20 years				
Northern hardwood/oak	6-7	17-18	44-46	30-32
Mixedwood	3-4	10-11	39-41	45-46
Softwood	6-8	10-12	40-42	39-43
Aspen-birch	8-10	13-15	10-12	64-67
All Types	**6-7**	**16-17**	**42-44**	**33-35**
150 years				
Northern hardwood/oak	6-7	32-35	14-17	42-48
Mixedwood	6-8	21-22	23-24	48-49
Softwood	6-8	19-23	14-20	50-59
Aspen-birch	8-9	25-28	13-18	45-53
All Types	**6-7**	**30-32**	**15-18**	**43-49**

Source: Spectrum; Forest GIS data; Lorimer and White 2003.
Notes: These data are based on projections using estimates for each age class based in part on Lorimer and White (2003), in combination with harvesting predicted by Spectrum modeling. Only NFS lands with forest type data are included

Table 3.5-18: Projected Forest age class distribution for Alternative C, at 20 and 150 years

	Regen.	Young	Mature	Old
	(%)	(%)	(%)	(%)
20 years				
Northern hardwood/oak	6-7	17-18	43-45	31-33
Mixedwood	3-5	9-10	39-41	46-47
Softwood	6-8	10-12	40-42	40-43
Aspen-birch	8-10	13-15	10-12	65-68
All Types	**6-7**	**15-16**	**41-43**	**34-36**
150 years				
Northern hardwood/oak	5-6	30-33	14-17	44-51
Mixedwood	6-8	22-23	27-29	43-44
Softwood	6-8	19-23	15-20	50-59
Aspen-birch	7-9	25-28	14-19	44-53
All Types	**6-7**	**28-31**	**15-18**	**44-51**

Source: Spectrum; Forest GIS data; Lorimer and White 2003.
Notes: These data are based on projections using estimates for each age class based in part on Lorimer and White (2003), in combination with harvesting predicted by Spectrum modeling. Only NFS lands with forest type data are included

Table 3.5-19: Projected Forest age class distribution for Alternative D, at 20 and 150 years

	Regen.	Young	Mature	Old
	(%)	(%)	(%)	(%)
20 years				
Northern hardwood/oak	6-7	16-17	45-47	31-33
Mixedwood	3-5	8-10	39-41	47-48
Softwood	6-8	9-11	40-42	40-44
Aspen-birch	8-9	13-15	10-12	65-68
All Types	**5-7**	**14-15**	**43-45**	**34-37**
150 years				
Northern hardwood/oak	5-6	28-31	13-16	47-54
Mixedwood	5-7	27-28	24-25	41-43
Softwood	6-8	19-22	15-21	50-59
Aspen-birch	8-9	25-28	14-19	44-53
All Types	**5-6**	**27-30**	**14-17**	**47-53**

Source: Spectrum; Forest GIS data; Lorimer and White 2003.
Notes: These data are based on projections using estimates for each age class based in part on Lorimer and White (2003), in combination with harvesting predicted by Spectrum modeling. Only NFS lands with forest type data are included

Table 3.5-20: Projected Forest age class distribution for Alternative E, at 20 and 150 years

	Regen.	Young	Mature	Old
	(%)	(%)	(%)	(%)
20 years				
Northern hardwood/oak	6-7	16-18	44-46	31-33
Mixedwood	3-5	8-10	38-40	47-48
Softwood	6-8	10-12	42-44	40-44
Aspen-birch	8-10	13-15	10-12	64-68
All Types	**6-7**	**15-16**	**42-44**	**34-36**
150 years				
Northern hardwood/oak	5-6	28-31	14-17	46-53
Mixedwood	5-7	24-26	25-26	43-44
Softwood	6-7	19-23	14-20	50-59
Aspen-birch	7-9	25-28	14-19	44-53
All Types	**5-6**	**27-30**	**15-18**	**46-52**

Source: Spectrum; Forest GIS data; Lorimer and White 2003.
Notes: These data are based on projections using estimates for each age class based in part on Lorimer and White (2003), in combination with harvesting predicted by Spectrum modeling. Only NFS lands with forest type data are included

Effects Common to All Alternatives

Age class of forest communities would be altered by vegetation management in Diverse Forest Use, Diverse Backcountry, Escarpment, Moosalamoo Recreation and Education Area, and Remote Wildlife Habitat MAs. In all other MAs, as well as within the unsuitable lands within these MAs, forest communities would generally be allowed to mature, except where natural disturbance occurred, or where restoration or wildlife management occurred, using vegetation management to achieve specific MA objectives. New development outside of these five MAs would be restricted to trail and backcountry facility development where such development is allowed; ski area development would be restricted to Ski Areas and Ski Area Expansion areas. Trail and backcountry facility developments impact only small patches of ground, so they would not actually alter the age of whole forest stands. Ecological restoration and wildlife management activities outside of the five MAs noted would also be of very limited extent.

Therefore, across at least one-third of the Forest, in all alternatives, forest communities would continue to age, moving from the mature to old age class except where large-scale natural disturbance occurred. Diverse Backcountry and Remote Wildlife Habitat MAs, by employing extended rotations of anywhere from 150 to 300 years, would also contribute to the maturation of forest habitat out of the mature age class into the old age class within these areas.

Tables 3.5-16 through 3.5-20 indicate that across all alternatives and forest communities, there is expected to be a substantial reduction in the mature age class, particularly after 150 years, while the other age classes show increases (see also Table 3.5-7 for comparison with existing age-class distributions). The decrease in proportion of this age class is attributed to the regulation of a substantial number of acres of lands suitable for even-aged management that are currently in the mature age class. This will inevitably lead to increases in the younger age classes. The decrease in the mature age class is also attributed to increases in the old age class through natural maturation of forests on lands allocated to MAs that do not allow even-aged management across Alternatives B–E, as well as extended rotation ages in Diverse Backcountry and Remote Wildlife MAs, and the maintenance of the Newly Acquired Lands allocations under Alternative A.

Across alternatives, the old age class grows from about 18 percent currently, to about 33 percent of the Forest after 20 years, to about 50 percent of the Forest after 150 years. Although the long-term (150-year) projection for this age class varies slightly by alternative, being slightly higher in Alternatives A, D, and E, and slightly lower in the remaining alternatives, these differences are not substantial or important when compared to the overall tripling of the current amount of this age class under all alternatives.

Increases in the regenerating and young age classes are the direct result of even-aged harvest methods to achieve desired Forest Plan age class objectives (Table 3.5-5). Compared to the overall proportion of regenerating age class on the Forest currently (Table 3.5-7), all alternatives increase the proportion of this age class across the Forest by at least five times. Increases in the young age class follow directly from increases in the regenerating age class from which the young class develops. Because the young age class represents several decades compared to the one decade represented by the regenerating age class, the proportion of land in the young age class may be several times higher than in the regenerating age class.

Indicator 3 – Acres of Timber Harvest Treatments (Forest Structure)

The following analysis looks at the general long-term effects to within-stand complexity of major forest communities due to the varying MA allocations and associated harvesting and natural development trends. The effects discussed here generally do not pertain to the short-term, as forest structure takes decades or centuries to develop, and appreciable or measurable differences are not likely to be

found over the short term. This analysis uses the Spectrum modeling that estimates acreages of different treatments by forest community for each alternative. In addition, the acres that are not harvested are compared in order to take into account the effects that forest succession has on increasing within-stand complexity. Table 3.5-21 displays the relative amounts of harvest treatment methods to be used on an average annual basis over the 150-year projection period to maximize present net value.

Effects Common to All Alternatives

Based on projections of harvesting over the long term (Table 3.5-21), all alternatives rely on similar amounts of even-aged and uneven-aged harvesting methods for regeneration of trees. The shelterwood method, both delayed and standard, is the dominant even-aged method; clearcutting makes up only about 7 to 8 percent of the average annual cut. Partial cutting through thinning accounts for 24 to 34 percent of the cutting likely to occur on the Forest over this timeframe. Selection cutting represents 16 to 27 percent of the harvesting across alternatives.

The use of the clearcutting method is quite minimal on the Forest across all alternatives and is not likely to have substantial effects on within-stand complexity of the regenerating stands over the long-term. When compared to other regeneration harvest methods, clearcutting simplifies within-stand species and structural diversity. This effect is mitigated to a large extent by the dominance of the various shelterwood and uneven-aged methods in the alternatives. These methods add structural diversity by maintaining mature trees in the canopy for a period of time after the initial regeneration harvest. In addition, the management of stands under long rotations within the Diverse Backcountry Forest and Remote Wildlife Habitat management areas helps to increase structural and age class diversity. Prescribed fire is allowed in all of the alternatives and across most of the MAs to help restore and maintain native plant communities and facilitate successful regeneration of some species.

Overall, the regeneration harvest methods and prescribed fire uses in the alternatives provide the Forest with the ability to increase within-stand complexity and restore and maintain native plant communities over the long-term through active management treatments. While the small amount of clearcutting in the alternatives slightly reduces the Forest's ability to improve within-stand complexity through timber harvesting, it is generally small enough to be considered negligible to overall structure of the Forest. In addition, reserve tree standards and guidelines apply to clearcutting as well, and so some structural components would be maintained even under these treatments.

While the alternatives vary slightly in the average annual acres projected for cutting over the long-term, all alternatives propose regenerating a little less than one percent of the lands suitable for timber production per year over this timeframe (Table 3.5-21), which amounts to less than half of one percent of the Forest per year over the long-term. With around half of the Forest developing old conditions over the long-term (Tables 3.5-16 through 3.5-20), a significant proportion of the Forest will continue to succeed through natural processes and develop increasing within-stand complexity over time. Consequently, all alternatives appear likely to be effective at improving stand structural diversity over the forested acres of the GMNF over the long-term, given the diversity of harvesting methods and the relatively low, but steady, level of annual harvesting.

Table 3.5-21: Average annual acres of harvest projected by Spectrum for various harvest methods over the 150-year modeling period, by alternative.

Harvest Methods	Alt. A acres	Alt. B acres	Alt. C Acres	Alt. D acres	Alt. E acres
Even-aged Regeneration Methods					
Clearcut % of harvests	369 8%	457 8%	419 8%	408 8%	348 7%
Shelterwood Regeneration Cut % of harvests	914 20%	1,194 21%	1,203 23%	1,128 22%	1,213 23%
Overstory Removal Cut % of harvests	857 19%	1,072 19%	1,123 21%	1,075 21%	1,130 22%
Partial Cut – Thinning % of harvests	1,555 34%	1,344 24%	1,540 29%	1,643 32%	1,466 28%
Uneven-aged Regeneration Methods					
Individual Tree/Group Selection Cut % of harvests	834 18%	1,536 27%	969 18%	829 16%	1,054 20%
Total Regeneration[1]	1,283	1,651	1,622	1,536	1,561
Total Harvest	4,529	5,603	5,254	5,083	5,211
Total Not Harvested[2]	249,710	196,179	213,666	228,512	218,416

Source: Amounts are derived from Spectrum outputs by decade on all suitable forested acres. See glossary for definitions of harvest methods.
[1] Regeneration harvests include clearcuts and shelterwood regeneration cuts
[2] Total not harvested = 400,692 acres minus the acres that were assigned a harvesting prescription by the Spectrum model

Cumulative Effects

Each of the proposed alternatives to revising the Forest Plan for the GMNF relies on differing forest management strategies for shaping future forest composition, age class, and structure on the lands managed by the Forest Service. The cumulative effects to forest composition and structure associated with the implementation of a proposed alternative are analyzed within the context of the ecoregions in which the GMNF resides.

While there are limited data regarding composition, age class, and structure of forests within the ecoregions as a whole, Forest Inventory and Analysis (FIA) data for Vermont and portions of the State containing NFS lands can be used to help describe the context for this analysis (Wharton et al. 2003). Within the southern portion of Vermont that includes all of the GMNF, this inventory data suggests that from 1983 to 1997, forests of northern hardwoods and spruce-fir have increased in extent by seven and three percent, respectively. Conversely, forests of pine, oak, and aspen-birch have been declining. While pines and oaks have declined by about 3 percent, aspen-birch has undergone a dramatic decline of 42 percent across this region. Within the northern portion of the State, northern hardwoods show similar increases, while spruce-fir forests have increased by 13 percent. Oaks and pines have also decreased in this region as they have in the southern region, but aspen-birch forests have increased by 17 percent. The decline in oaks, pine, and aspen-birch is likely related to the maturation of the forests in the southern region,

while the increase of aspen-birch in the northern region is likely related to an increase on forest cover there from abandonment of open lands (Wharton et al. 2003).

In the analysis area, agricultural land is fairly abundant in the Champlain and Vermont Valleys along the western edge of the Forest, as well as along the Connecticut River Valley east of the Forest. These lands provide large and small open habitats, while elsewhere such open lands are generally few, small, and widely scattered. The FIA data indicate that agricultural lands have declined in abundance from previous inventories.

FIA data (Wharton et al. 2003) for all of Vermont also indicates a similar trend in age class distribution to that found on the Forest. The proportion of timberland in the mature/old age classes has increased by 23 percent since 1973, while the proportion in the regenerating age class has declined by 35 percent over the same time. The decline in regenerating forest is related to the natural succession of abandoned farmland to forest over those 30 years. The increase in mature and old age classes is the result of natural maturation of forest lands that were abandoned at the turn of the century.

Effects Common to All Alternatives

Across alternatives, the distribution and abundance of the more common forest communities would become more balanced over the long-term, with decreases in northern hardwoods as softwoods and mixedwoods increase. This trend in increasing softwood composition is reflected in the regional trends as well, and is expected to continue region-wide as the forests in the analysis area recover from 18th and early 19th century land use history. Consequently, trends in composition across the analysis area are reflected and supported through management objectives associated with all of the alternatives.

The cumulative effects of the alternatives on age class structure are also similar. All alternatives provide for increasing trends in regenerating, young, and old age classes, with an associated decline in the mature age class, which currently makes up 71 percent of the age class distribution on the Forest. Consequently, over the long-term, the age class distribution across the Forest will likely be more balanced. The slow steady decline in the regenerating age class will be reversed, and the small proportion of old forest on the Forest now will be increased to around half the Forest. In the parts of the Forest where natural disturbances will predominate, which account for about half of the Forest, the old age class will predominate. In areas where timber is managed, but where uneven-aged silvicultural systems are used, or where rotation lengths approach 200 years, age class structure may also approach what might be expected under natural disturbance regimes (Seymour et al. 2002). The improvement in proportion of old forest will also provide for increased structural diversity across all alternatives. In areas where timber is managed using even-aged techniques, age classes will be evenly distributed by decade, approximating the objectives in the Forest Plan.

The increase in the regenerating age class would be particularly important within the southern portion of Vermont, where the Forest resides, and where substantial declines in this forest community have occurred. As this part of Vermont becomes more developed, it is likely that the GMNF will become an increasingly important source of these regenerating forest communities in the greater ecoregion.

The increase in the old age class may also prove to be important within the analysis area because there is only a small proportion of Vermont (14%; Wharton et al. 2003) that is public land where large forests are allowed to mature past an economic rotation age. Across the remainder of the State and the region, increased population and development pressures are likely to lead to harvesting of mature forests either for economic gain or for conversion to non-forest land. While forest land continues to increase across the region, the rate of increase has slowed over the last 30 years, and it is likely that over the next 100 to 150 years this trend will change. At that point, the availability of old forest with high levels of structural diversity would become more important to regional levels of biodiversity

because the amount of forest land will be finite and may start to decline.

The regional declines for the less common forest communities of oak-pine and aspen-birch, as well as open lands associated with agriculture, suggest that management objectives associated with these types in the Forest Plan can play an important role in maintaining and enhancing the distribution and abundance of these communities. As the alternatives vary in their effectiveness at working toward these objectives, the cumulative effects associated with these forest communities are discussed under the effects of each alternative.

Alternative A

The lower emphasis on the management of oak-pine, aspen-birch, and open uplands in this alternative would mean that management on the GMNF is not likely to alleviate the regional decline of these forest communities. This alternative may be able to maintain the existing low proportions of these communities on the Forest, but it is not likely to be very effective at increasing their proportions on the Forest. More than 50 percent of existing aspen-birch stands are in MAs under this alternative where they cannot be managed, so over the long-term existing stands of this type would convert to other more common types, depending upon ecological conditions. In addition, less land is available in this alternative in MAs that allow timber management, which limits the Forest's ability to create more of these less common communities through management activities.

Alternative B

The cumulative effects of this alternative on oak-pine communities are similar to those discussed for Alternative A. Only a small proportion of the Forest is allocated to MAs that emphasize oak-pine management, so while the overall proportion of this type may remain stable and at the low end of the desired objectives, it would be difficult to increase this proportion. The lower emphasis on this type in this alternative would mean that management on the GMNF is not likely to alleviate the regional decline of this forest community. Because this community is ecologically restricted in distribution and abundance in Vermont under natural conditions, even small losses in these communities can have increasingly important ramifications for the organisms associated with the habitat it provides.

This alternative is expected to have positive cumulative effects on the Forest-wide and regional trends in open upland and aspen-birch communities. This alternative has the greatest proportion of the GMNF within MAs where these communities can be created and therefore provides the greatest opportunity of all the alternatives at mitigating the regional decline in these communities. While changes of a few percentage points on the Forest would not lead to substantial changes at a regional level, these small percentage changes can still be important for uncommon communities and the species associated with them. As development pressures continue to lead to losses in open uplands and some forest land, the availability of these communities on the Forest will become increasingly important over time.

Alternatives C and E

Both of these alternatives are expected to have positive cumulative effects on the abundance of oak-pine, aspen-birch, and open upland communities. These alternatives are likely to be effective at increasing the abundance and distribution of all three communities, with Alternative E slightly more effective than Alternative C for oak-pine communities, and Alternative C more effective than Alternative E for aspen-birch. In either case, however, the fact that all three communities are likely to see increasing proportions on the Forest under these alternatives would help to mitigate the regional declines in these communities. Consequently, these two alternatives have the potential to provide for the greatest degree of community diversity of all the alternatives and would contribute to regional diversity over time as development and habitat conversion elsewhere continue to impact these communities.

Alternative D

Under Alternative D, oak-pine communities are expected to have positive cumulative outcomes. This alternative, as well as Alternative E, provides the greatest emphasis on oak-pine management, both of existing stands and ecologically suited stands. Consequently, these alternatives provide the greatest opportunity to reverse the decline across the Forest in this community, but also to enhance regional community diversity by mitigating the overall regional decline in this community. These alternatives maximize opportunities for management of this forest community and may help to provide habitat for many species associated with it.

In contrast, this alternative is similar to Alternative A in terms of open upland and aspen-birch communities. This alternative limits the amount of land within MAs that allow creation of these communities more than do the other alternatives except Alternative A. Consequently, opportunities to increase the proportion of these communities on the Forest and mitigate regional declines in these communities are reduced compared to the other alternatives.

3.5.2 Forest Health

Issue Statement

Public concern is focused on the forest health of the Green Mountain National Forest (GMNF) and how the Forest ecosystems can respond to increasing local, national, and global insect and disease threats. Of particular concern is the use of forest health management activities to limit and suppress damage from these threats, and whether pesticides will be used on the GMNF to aid in these efforts. An additional concern is the impacts on forest health from acid deposition. Acid deposition is addressed in the Soils (3.2), Water (3.3), and Air (3.4) sections of Chapter 3. Impacts from non-native invasive species (NNIS), another threat to forest health, are addressed in the Vegetation subsection (3.5.3) on NNIS.

Indicator – Amount of Suitable Timber Acres to Maintain Healthy Stand Conditions to Reduce the Threat of Insects and Disease

The amount of land suitable for timber production varies among alternatives by the amount of land allocated to management areas where timber production is appropriate. The greater the amount of land suitable for timber production, the greater the ability to conduct silvicultural treatments, including timber salvage harvesting.

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the Green Mountain National Forest. This area represents National Forest System (NFS) lands that could be impacted by insects, pathogens, and other forest health concerns.

The analysis area for cumulative effects includes all GMNF lands and the lands administered by other owners, both public and private, within the GMNF Proclamation Boundary.

3.5.2.1 Affected Environment

Introduction

Maintaining forest health is an important aspect to sustaining the ecological, economic, and social values of the GMNF. The GMNF provides jobs, landscape stability, wildlife habitats, biological diversity, clean water, scenic vistas, and diverse recreational opportunities. Changes in forest health can affect the quality of these values.

A healthy, sustainable forest has the capacity across the landscape for renewal, for recovery from a wide-range of disturbances, and for retention of its ecological resiliency while meeting current and future needs of people for desired levels of values, uses, products, and services.

Before European settlement, natural disturbances of the forest ecosystem, such as native insects, pathogens, weather events, and fire, were the dominant threats to forest health. European settlement brought dramatic changes, however, including exotic insects and diseases. Chestnut blight, white pine weevil, Dutch elm disease, gypsy moth, and butternut canker forever changed the composition and dynamics of the GMNF forest ecosystem.

As world commerce expands, the threat of exotic insect and disease introductions substantially increases the threat to forest health in the United States (Bridges 1995), including the GMNF. Today, although insects and disease cycle through the GMNF in any given year, very few are considered major problems warranting treatment. Major insect and disease outbreaks have not occurred on the GMNF in recent years.

More than 360 exotic insects and approximately 20 exotic diseases are known to occur in the United States (Bridges 1995). Many have been established on the GMNF and others pose an immediate threat. The GMNF is a dynamic and ever-changing biological system. While natural processes have regulated the growth, development, maturation, death, and replenishment of GMNF ecosystems for centuries, silvicultural methods can be used to respond to increasingly more complex forest health issues (Gottschalk 1995).

Many insects and diseases have evolved into a role of killing weakened trees and removing them from the ecosystem. Natural disturbances such as ice and wind storms have the effect of damaging trees. This creates habitat for insects and disease, which can further kill trees that had been weakened. When conditions are such that many weakened, low-vigor, and slow-growing trees are present, stands can be made healthier by silvicultural treatments that increase the vigor and growth of trees and stands, making them more resistant and less vulnerable.

Within areas of the GMNF appropriate for silvicultural treatment, properly timed stand treatments can improve the balance in ecosystem functions by slowing or accelerating the pace of natural succession and reducing the impacts from insects and disease. Silvicultural treatments can influence stand health by maximizing stand growth and vigor, manipulating insect and disease habitat, and increasing forest diversity. Forest health has emerged as an important national issue in need of attention.

To address forest health issues, the Healthy Forests Restoration Act (HFRA) was enacted in 2003. The HFRA has five areas of national concern:

- Wildfires and forest health
- Non-native invasive insects and pathogens
- Invasive plant species
- Outbreaks of native insects
- Changing ecological processes

Through the legislative authorities contained in the HFRA, this act provides agencies with new tools and better procedures to restore the health of our forests and rangelands.

Existing Forest Plan Management Direction

The 1987 Forest Plan directs the Forest Service, through Forest-wide and management area standards and guidelines, to maintain an integrated pest management program that will include a variety of forest management practices and activities to prevent, limit, and suppress pest damage. The emphasis in the 1987 Plan is to protect forest vegetation from a variety of pests, including disease, damaging insects, and plant species which hinder reforestation or tree growth. The 1987 Plan also recognizes pests that affect recreation experiences, such as mosquitoes and poison ivy. The use of pesticides is discouraged under the 1987 Plan, but is an available option when other methods are not adequate to address the pest problem.

Proposed Changes in Management Direction Common to All Alternatives

The revised Forest Plan emphasis includes a proactive approach to maintaining the health of forest ecosystems rather than the 1987 Plan's focus of protecting specific forest resources. Forest health is a national issue and there is a need to maintain ecological resiliency rather than focus protection efforts on individual resources, such as timber. As in the 1987 Plan, the revised Forest Plan retains specific direction for the use of biological, silvicultural, or chemical controls in Forest-wide and management area standards and guidelines. Chemical controls will only be used when other methods are ineffective.

Existing Condition

On areas of the GMNF that are managed for timber, there is a greater diversity of forest types, age classes, and vigorously growing trees. Forest surveys have shown that these areas are generally healthier than areas not managed for timber. Conversely, the higher elevations, which generally include Wilderness and remote backcountry areas, and other lands not managed for timber, are the most vulnerable to insect, disease, and weather disturbances. Natural disturbance regimes are appropriate in areas not managed for timber. The introduction of non-native insects and disease can alter the natural disturbance regimes. Past introductions have forever changed the dynamics of the Forest.

Beech bark disease (beech scale-nectria complex) first appeared on the GMNF in the 1960s. The disease initially killed many beech trees that had little resistance. The timber salvage harvesting that followed resulted in record levels of timber harvesting on the GMNF. American beech, however, continues to remain a sizeable component of northern hardwood stands in New England.

During the 1990s, oak forests on the GMNF and throughout New England were impacted by an outbreak of gypsy moth. Gypsy moths have periodically impacted oak forests in the State since their initial discovery in Vermont in the 1930s (Vermont Department of Forests, Parks, and Recreation 2004).

The most notable, recent impact to forest health on the GMNF occurred as a result of the region-wide ice storm that occurred in January 1998. A total of 56,000 acres were impacted in the higher elevations on the North Half of the GMNF, primarily on unsuitable timber lands. Some species, such as sugar maple, white ash, and red oak, demonstrated a strong ability to regenerate live crowns and recovered well following the ice storm. American beech, paper birch, and yellow birch, however, did not respond well and have shown greater mortality. Large-scale timber salvage efforts were not undertaken due to the location on lands not suitable for timber production.

In addition to past insect, disease, and natural disturbance occurrences on the GMNF, there is currently an outbreak of balsam wooly adelgid in some spruce-fir stands on the Forest. Drought conditions in 2002 weakened trees prior to the outbreak, reducing tree resistance and increasing mortality. The wooly adelgid has caused considerable defoliation of hemlocks in the eastern United States and has been detected along the coast of Maine, southern New Hampshire, and Massachusetts. In 2004, an accidental importation of the insect occurred from nursery stock that was grown outside of Vermont and imported here. The nursery stock was destroyed and it is not certain if the outbreak has been curtailed.

It is unknown what risks to forest health will be introduced in the future. Preventing introductions of exotic organisms is a global problem that requires international cooperation. The GMNF needs to monitor forest health and develop strategies to prevent, or eradicate, exotic pests. Areas of concern that have been identified include two insect pests, the Asian long-horned beetle and the emerald ash borer, that have been found in the United States but are not currently known to occur in northern New England. Additionally, there is concern that Sudden Oak Death (SOD), an introduced disease previously

confined to California, has been found in the eastern United States. Many scientists feel the SOD could dramatically change forest ecosystems in the East. While none of these concerns pose an immediate threat to the GMNF, they could spread into the area and drastically impact Forest resources.

3.5.2.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Indicator 1 – Amount of Suitable Timber Acres to Maintain Healthy Stand Conditions to Reduce the Threat of Insects and Disease

Effects Common to All Alternatives

Silvicultural treatments promote healthy forest stands using two approaches. The first approach includes proactive timber harvesting before a stand exhibits insect or disease infestation by promoting healthy, vigorous, growing trees. The second approach includes the salvage of infested trees to remove the pests from the forest, thus protecting healthy trees and preventing the continued spread of the pests or diseases.

Management areas that allow the first approach and contain lands suitable for timber production include: Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Moosalamoo Recreation and Education Area, and Green Mountain Escarpment.

Management areas that allow salvage harvesting include: Diverse Forest Use, Diverse Backcountry, Remote Wildlife, Moosalamoo Recreation and Education Area, Green Mountain Escarpment and Newly Acquired Lands (MA 9.2).

Alternative A

Alternative A represents the current management alternative. A total of 157,673 acres of lands suitable for timber production would be available with this alternative (Table 3.13-6). A total of 3,500 acres of potential annual timber harvesting could occur with this alternative, including an anticipated 350 acres (10%) of salvage timber harvesting.

This alternative would have the least opportunity for timber harvest and consequently fewer opportunities to maintain forest health through silviculture.

Alternative B

Alternative B would have the highest opportunity for timber harvesting. A total of 216,430 acres of lands suitable for timber production would be available with this alternative (Table 3.13-6). A total of 4,703 acres of potential annual timber harvesting could occur with this alternative, including an anticipated 470 acres (10%) of salvage timber harvesting.

This alternative would have the greatest opportunities to maintain forest health through silviculture.

Alternative C

This alternative would be intermediate in the opportunity for timber harvesting compared to the other alternatives. A total of 193,791 acres of lands suitable for timber production would be available with this alternative (Table 3.13-6). Approximately 4,034 acres of potential annual timber harvesting could occur with this alternative, including an anticipated 400 acres (10%) of timber salvage harvesting.

This alternative would have an intermediate opportunity to maintain forest health through silviculture.

Alternative D

This alternative would have the second lowest opportunity for timber harvesting. A total of 180,381 acres of land would be suitable for

timber production (Table 3.13-6). Approximately 3,834 acres of potential annual timber harvesting could occur with this alternative, including an anticipated 380 acres (10%) of timber salvage harvesting.

This alternative would have slightly more opportunities than Alternative A, but less opportunity than the other alternatives, to maintain forest health through silviculture.

Alternative E

This alternative is similar to Alternative C in the opportunity for timber harvesting. A total of 189,616 acres of land would be suitable for timber production (Table 3.13-6). Approximately 4,055 acres of potential annual timber harvesting could occur with this alternative, including an anticipated 410 acres (10%) of timber salvage harvesting.

This alternative would be intermediate in the opportunity to maintain forest health through silviculture (similar to Alternative C).

Cumulative Effects

Non-native insect and diseases can dramatically change forest ecosystems globally, including the GMNF. As the movement of people and their materials increase around the world, the risk of introducing foreign organisms increases. The most efficient way to address the issue is to prevent their entry. Once an introduction occurs, eradication efforts are needed to stop their spread.

Forests can be managed through silviculture to maintain vigor and diversity of forest types and age classes to resist both native and non-native outbreaks. Areas of the GMNF suitable for timber management will have the greatest opportunity to remain healthy. Outside of suitable timber lands, natural disturbance are appropriate. The risk of major outbreaks from non-native organisms has a greater probability of disturbances outside the natural range of variability.

3.5.3 Non-Native Invasive Species

A non-native invasive species is an organism that has been purposefully or accidentally introduced outside its original geographic range and is able to proliferate and aggressively alter its new environment, causing harm to the economy, environment, or human health (Executive Order 13112, February 3, 1999). An infestation is defined as an area where a population of invasive species exists (USDA 2004e).

Issue Statement

Public concern is focused on the need to evaluate current management direction for non-native invasive species (NNIS). This is an issue within the broader topic of restoration, protection, maintenance, and enhancement of biological and ecological diversity, and conservation of species, communities, and ecosystems. This section addresses NNIS; wildlife and threatened and endangered species (TE) are discussed in individual Chapter 3 sections (3.6 and 3.8).

Indicator 1 – Acres in Management Area Allocations Most Subject to Ground Disturbing Activities that have Potential to Increase NNIS

The first indicator to be used in this effects analysis is acres in management area allocations most subject to ground-disturbing activities that have the potential to increase NNIS. NNIS establish more readily in places where the ground is disturbed, for example, where bare soil has been exposed and/or the soil has been loosened. As NNIS increase, native and desirable non-native species face greater competition for resources, and management for biological and ecological diversity and conservation of species, communities, and ecosystems becomes more challenging.

While a myriad of management activities and Forest uses can cause ground disturbance, ground-disturbing management activities that are most conducive to spreading NNIS include:

- Timber harvest
- Trail and recreation facility development, use, and maintenance (including alpine ski areas)
- Designating trails for new uses, which would change the extent to which use of a travel corridor is ground-disturbing
- Utility corridor development and maintenance, including wind power and communication sites
- Surface development for mineral exploration and extraction
- Aquatic habitat restoration
- Prescribed fire
- Road development (temporary and permanent), maintenance, and closures (road closing involves soil disturbance, but once closed, the roadbed receives less disturbance)

Management areas that would be most subject to all or most of these ground-disturbing activities are Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Escarpment, Recreation Special Areas, Moosalamoo Recreation and Education Area, National Recreation Area, Alpine Ski Areas, and Alpine Ski Area Expansion. Other management areas either allow very few of these activities, or allow them only under very limited circumstances. This indicator highlights the differences among management area allocations under each alternative allowing ground-disturbing activities that have the potential to increase NNIS.

Indicator 2 – Acres in Management Area Allocations Most Likely to have an Increase in Pathways for Dispersing NNIS

The second indicator to be used in this effects analysis is acres in management area allocations most likely to have an increase in pathways – mostly linear openings – along which NNIS can disperse. NNIS disperse to new sites via a variety of means, including wind, water, the fur, feathers, and digestive tracts of wild and domestic animals, and vegetative reproduction. Patterns of infestation indicate that dispersal follows human travel corridors (seeds are easily transported on people's vehicles, footwear, clothing, and gear) and other linear openings. These pathways can provide the combination of disturbed ground, increased light, and avenues for seed movement that can enable NNIS to become established in new areas. The more pathways there are for dispersing NNIS, the more the composition of the interiors of natural communities shifts away from native species, making it harder to maintain biological and ecological diversity and conserve species, communities, and ecosystems.

Management activities that could increase pathways for dispersing NNIS include:

- Timber harvest
- Trail and recreation facility development
- Designating trails for new uses, which would change the extent to which a travel corridor is a pathway for NNIS dispersal
- Utility corridor development, including wind power and communication sites
- Surface development for mineral exploration and extraction
- Road development (temporary and permanent)

Likewise, a decrease in pathways for dispersal could occur if existing trails or roads were closed, or existing uses of trails were prohibited. The acres in management area allocations most likely to have an increase in pathways for dispersal are one indicator of the relative potential of the alternative to increase NNIS on the Forest. Management areas that would be most subject to all or most of the activities that increase pathways of dispersal are Diverse Forest Use, Diverse Backcountry, Remote Wildlife, Escarpment, Recreation Special Areas, Moosalamoo Recreation and Education Area, National Recreation Area, Alpine Ski Areas, and Alpine Ski Area Expansion. Other management areas either allow very few of these activities, or allow them only under very limited circumstances. This indicator highlights the differences between management area allocations under each

alternative allowing potential increases in pathways for dispersing NNIS.

Indicator 3 – Acres in Management Area Allocations Most Subject to Activities that Increase the Amount of Light Reaching the Ground

The third indicator to be used in this effects analysis is the acres in management area allocations most subject to management activities that increase the amount of light reaching the ground. Many NNIS establish most readily in areas exposed to sunlight. While there is overlap between activities that disturb the ground and activities that increase light, there are also instances in which one happens without the other (for example, hand-cutting small amounts of woody vegetation can increase light without disturbing the ground); for this reason, they are analyzed separately. The more light reaches the ground, the more NNIS can become established, making it harder to maintain biological and ecological diversity and conserve species, communities, and ecosystems.

Management activities that could increase light include:

- Timber harvest
- Trail and recreation facility development and maintenance
- Utility corridor development and maintenance, including wind power and communication sites
- Surface development for mineral exploration and extraction
- Openings maintenance
- Prescribed fire
- Road development (temporary and permanent) and maintenance

The acres in management area allocations that would be most subject to activities that increase the amount of light reaching the ground is an indicator of the relative potential of an alternative to increase NNIS on the Forest. Management areas that would be most subject to all or most of the activities that increase light reaching the ground are Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Escarpment, Recreation Special Areas, Moosalamoo Recreation and Education Area, National Recreation Area, Alpine Ski Areas, and Alpine Ski Area Expansion. Other management areas either allow very few of these activities, or allow them only under very limited circumstances.

This indicator highlights the differences among management area allocations under each alternative that allow activities that potentially increase the amount of light reaching the ground.

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the Green Mountain National Forest (GMNF). This area represents National Forest System (NFS) lands where NNIS occur or could become established, and the land where other National Forest resources could receive impacts from the spread of NNIS. The analysis area for cumulative effects includes all GMNF lands and adjoining lands administered by other owners, both public and private, because activities on NFS lands have the potential to spread NNIS to adjacent lands, and conversely, adjacent land activities may spread NNIS to NFS lands.

3.5.3.1 Affected Environment

Introduction

This section of the affected environment focuses on plant NNIS; other organisms, such as insects and diseases, are addressed as part of Forest Health (3.5.2).

Non-native invasive species and their impact on other resources have become a nation-wide concern. As a threat to biodiversity, invasive plants are second only to habitat destruction (The Nature Conservancy, NYSO 2004). For centuries, humans have moved plant, animal, and other species around the world, both intentionally

and unintentionally (National Agricultural Library 2004). In most cases, non-native plants do not pose a threat to biodiversity; the few that are cause for concern are those that aggressively spread into natural communities (Vermont Agency of Natural Resources and The Nature Conservancy of Vermont 1998).

There is a federal noxious weed list that includes species that could be problematic anywhere in the country (Plant Protection and Quarantine 2002). Some states have developed their own lists, and each National Forest has its own list of priority species. The GMNF NNIS list currently consists of all 21 species included in the Vermont quarantine rule (Vermont Department of Agriculture, Food and Markets 2002), plus one species on the federal list that has been found in Vermont. These 22 species occur in three broad classes of environments: aquatic, riparian, and terrestrial. Each of these broad classes occurs on the National Forest, and is therefore susceptible to infestation by NNIS (Table 3.5.3-1).

Introduction of plant NNIS can occur in a variety of ways. Seeds may be dispersed by wind, water, wildlife, and human activity. NNIS may also spread by vegetative means, such as underground stems and buds, or plant fragmentation. Some aquatic species produce bud-like over-wintering structures. While the Forest Service has no control over dispersal by wind, water, wildlife, or vegetative growth, they can control management activities and influence human activity on the Forest.

Existing Forest Plan Management Direction

Direction in the 1987 Forest Plan is part of Integrated Pest Management, but does not focus on plant NNIS. Additional current direction pertains to the protection of Threatened, Endangered, and Sensitive (TES), but does not specifically address NNIS. Even though the 1987 Forest Plan does not directly address NNIS, the GMNF has begun to address this issue through utilization of national and regional Forest Service direction that emphasizes NNIS inventory, mapping, and monitoring; prevention and education; control; research; and administration and planning.

Proposed Changes in Management Direction Common to All Alternatives

The revised Forest Plan has an objective to minimize adverse effects of NNIS on National Forest resources and incorporates NNIS into goals and objectives for ecosystem management, education, and relationships with partners and community organizations. The revised Plan goals include Goal 2 to “Maintain and restore quality, amount, and distribution of habitats to produce viable and sustainable populations of native and desirable non-native plants and animals” and Goal 9 to “Demonstrate innovative, ecologically sound management practices that can be applied to other lands.”

The revised Forest Plan includes Forest-wide and management areas standards and guidelines that direct the Forest Service to incorporate information on the status and threat of NNIS infestation as part of project development, to use standardized methods for determining risk, and to identify measures that can be undertaken to prevent and control the spread of NNIS during project implementation. It also provides guidance regarding treating infestations, requires inclusion of NNIS prevention methods in contracts and permits, provides direction regarding seed mixes and mulch, and outlines an integrated pest management approach that includes methods of prioritizing prevention and control activities.

Existing Condition

Varied recreational and management activities occur on the GMNF that have the potential to disperse NNIS or increase the likelihood that they will become established at a given site. The increase in dispersal and establishment is above what would happen naturally as a result of seed transport by wind, water movement, and in the fur, feathers, feet, and digestive tracts of wild animals. Given that the Forest Service has no control over dispersal and establishment that

happens naturally, the amount of NNIS infestation that would occur naturally becomes, to a certain extent, an acceptable threshold of infestation.

Despite prevention and control efforts, NNIS will continue to disperse and become established to at least some degree, since no methods for prevention and control are 100 percent effective. Left unchecked, however, NNIS have the potential to impact other resources, including contributing to the decline of TES species and biodiversity. At this point, there is no indication that competition with NNIS is pushing any Regional Forester Sensitive Species (RFSS) toward federal listing or loss of viability on the Forest. Very few of the places surveyed have substantial infestations of NNIS, which puts the Forest Service in the fortunate position of being able to focus primarily on prevention. An unacceptable threshold would be for NNIS to increase to the level at which they could contribute to decline in TES species on the Forest. In addition, it would be unacceptable to lose biodiversity in habitats that are currently not infested or minimally infested, if methods of avoiding infestation were available.

Problematic species that do or could occur on the GMNF include Eurasian watermilfoil in aquatic habitats, Japanese knotweed in riparian habitats, and Morrow honeysuckle in terrestrial habitats. For a complete list of NNIS tracked on the GMNF, see Table 3.5.3-1. Statewide distribution information for NNIS is not currently available; Forest distribution is available to a limited extent, and is discussed by habitat, below. Many areas on the Forest have not had surveys for NNIS. Some are remote and the likelihood of infestation, at least as a result of human activity, is minimal.

Aquatic habitats on the Forest, including all high-elevation ponds, have been surveyed and no NNIS were found (GMNF, unpublished data). The only riparian area on the Forest that has been surveyed is along the White River, which is heavily infested with Japanese knotweed (GMNF, unpublished data). Several sites that were both infested and in need of improved riparian buffers are now parts of a long-term floodplain forest restoration project.

Table 3.5.3-1: GMNF NNIS 2004 list and associated major habitat types.

	Terrestrial	Riparian	Aquatic
Species on Federal Noxious Weed List			
Giant Hogweed	X	X	
Species on VT Quarantine List			
Goutweed	X		
Tree of heaven	X		
Garlic mustard	X		
Flowering rush	X		
Oriental bittersweet	X		
Japanese knotweed	X	X	
Frogbit			X
Honeysuckle – Bell, Japanese, Amur, Tartarian, Morrow	X		
Purple loosestrife	X	X	
Eurasian water-milfoil			X
Yellow floating heart			X
Common reed	X	X	
Curly leaf pondweed			X
Buckthorn – common & glossy	X		
Water chestnut			X
Black swallow-wort	X		

Terrestrial habitats that have been surveyed on the Forest include: all major access points – trailheads, parking lots, and developed recreation sites; skid roads from 20 past timber sale areas; 124 maintained wildlife openings; some Special Areas and all candidate and Research Natural Areas; and a variety of small project areas (GMNF, unpublished data). Of the 69 access points surveyed, 15 were infested with at least one NNIS (Japanese knotweed, purple loosestrife, common reed, Morrow honeysuckle, garlic mustard, or buckthorn); most infestations were less than one-tenth acre in size. Of the 20 closed timber sale areas surveyed, only one skid road had an occurrence of NNIS (Japanese knotweed). Thirteen of the 124 wildlife openings, some of which include riparian habitats, have small infestations of NNIS (buckthorn, purple loosestrife, common reed, and honeysuckle); the other 111 do not currently have any of the species on the NNIS list. Of the project areas surveyed, infestations were minimal to non-existent.

A number of public education projects have been initiated: a native seed production program is in the planning stages; prevention is beginning to be incorporated into projects during the planning stage; and Forest Service staff and volunteers are learning and implementing national data collection protocols.

3.5.3.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Direct and indirect effects of alternatives would include increased dispersal of NNIS into areas not yet infested, creation of additional suitable sites for the infestation of NNIS, and facilitation of their establishment and growth. NNIS associated standards and guidelines and other measures for minimizing the spread of NNIS are effective when implemented. Under all alternatives, it is anticipated that the spread of NNIS will be minimized and the effects of implementing one alternative over another would be minimal. The opportunity for human error exists, however, and NNIS will still disperse by means other than human activity and will still be able to take advantage of the increased soil disturbance, pathways for dispersal, and light that result from management activities and recreational use of the Forest.

For the direct and indirect effects analysis, the three indicators with the potential to facilitate the establishment, growth, and dispersal of NNIS are combined because of their interconnected relationships. The short and long-term impacts from recreational use and management activities that could cause ground disturbance, increase pathways of dispersal, and allow more light to reach the ground are lowest in Alternative A, highest in Alternative B, and intermediate for Alternatives D, C, and E, from lowest to highest, respectively. This suggests that the protection and maintenance of biodiversity and conservation of ecosystems would be most supported by Alternative A and least supported by Alternative B (Table 3.5.3-2).

Indicators 1, 2, and 3 – Potential to Facilitate the Establishment, Growth, and Dispersal of NNIS

Effects Common to All Alternatives

Alternatives A through E do not differ in their potential to spread NNIS as a result of ground-disturbing activities associated with maintenance of trails and recreation facilities, existing utility corridors, and road closures. They also do not differ in their potential to increase the amount of light getting to the ground as a result of maintenance of existing utility corridors or roads. There are no effects common to all alternatives with regard to activities that can increase pathways for dispersing NNIS.

Although there is opportunity for soil disturbance within the MAs discussed, only a relatively small portion of the MAs would actually be subject to ground-disturbing activities in any given alternative. The estimated acreage for various ground disturbing activities is provided in the Forest Plan Proposed and Probable Practices

(revised Forest Plan, Appendix D). Although these acres are specific to Alternative E, they are not expected to vary by alternative except those associated with timber harvest activities. The Timber Management section of Chapter 3 (Table 3.13-8) provides the potential acres harvested under each alternative.

Alternative A

In Alternative A, 261,168 acres (67%) are in management area allocations that are most subject to ground-disturbing activities, an increase in pathways, and activities that increase light reaching the ground. These activities have the potential to increase, disperse, or facilitate the establishment of NNIS (Table 3.5.3-2). This acreage ranks second in supporting the protection and maintenance of biodiversity and conservation of ecosystems (Table 3.5.3-2).

Alternative D

In Alternative D, 249,506 acres (62%) are in management allocations with the most potential to facilitate the establishment, growth, and dispersal of NNIS (Table 3.5.3-2). This alternative has fewer acres than any other alternative and most supports the protection and maintenance of biodiversity and conservation of ecosystems.

Alternatives B, C, and E

Alternatives B, C, and E management allocations with the most potential to facilitate the establishment, growth, and dispersal of NNIS range within two percent of another (72%-74%; see Table 3.5.3-2).

Cumulative Effects

Given that NNIS can spread to or from adjacent lands or water bodies, the area of analysis for cumulative effects includes all GMNF lands, (including water bodies), plus all adjacent lands. Adjacent lands are any lands that are close enough for any established population of NNIS to spread to or from NFS lands; dispersal distance varies not only between species, but as a result of different dispersal opportunities. Cumulative effects would be the result of all previous and foreseeable future management activities, natural events, and recreational use of the Forest that have either resulted in infestations of NNIS or made habitat suitable for them on the National Forest and adjacent lands.

New standards and guidelines, which are the same across alternatives, are designed to minimize the spread of NNIS and aid in the control of existing occurrences and restoration of habitats on NFS lands; they also encourage cooperation with willing adjacent landowners. These measures will minimize the spread of NNIS within the GMNF, from the GMNF to adjacent lands under other ownership, and vice versa.

It is not possible, however, to be 100 percent effective in prevention and control during management activities, nor is it possible to prevent the dispersal of NNIS from NFS land onto private land, and vice versa, that would occur naturally, in the absence of Forest management activities and recreational use. In addition, the Forest Service has no control over activities on adjacent lands that could facilitate NNIS establishment, growth, and dispersal, although educating the public about NNIS is an objective under Goal 9.

Activities that could facilitate NNIS establishment, growth, and dispersal on adjacent land under other ownership are similar to those that could do so on NFS lands, plus development, agriculture, and any other management, business, or recreation activities that could disturb ground, increase light, or provide opportunities for dispersal of NNIS.

Although Vermont now has a quarantine in effect that prohibits the importation, movement, sale, possession, cultivation, and/or distribution of certain NNIS, except under very specific, limited circumstances (Vermont Department of Agriculture, Food and Markets 2002), most people are unaware of the quarantine and/or are not familiar with most species on the quarantine list. In addition, those who are aware of the quarantine and skilled in identifying NNIS may not know how to avoid inadvertently facilitating the spread and establishment of NNIS on their land. In this regard, goals, objectives, standards, and guidelines aimed at prevention and control of NNIS in the revised Forest Plan are likely to have a beneficial effect, not only on NFS lands, but on adjacent lands as well.

Despite the potential beneficial effects of the revised Forest Plan, infestation of new sites, both on the National Forest and on adjacent lands, is likely to continue to occur to at least some degree. Infestation of new sites can ultimately lead to loss of biodiversity and alteration of habitat for TES and other more common native and desirable non-native species, including forage for wildlife and tree seedlings that could grow into harvestable timber. In addition, the recreational value of the National Forest or adjacent land can decrease if species targeted for hunting or fishing have diminishing amounts of suitable habitat, or trail and other recreational facilities become entangled in shrubby NNIS, such as non-native honeysuckles or buckthorn. Increased infestation of NFS land could lead to increased infestation on adjoining private land, causing similar problems there, and vice versa. While there may be more opportunities for NNIS establishment, growth, and dispersal in Alternatives B, C, and E than Alternatives D and A (Table 3.5.3-2), the goal of the new standards and guidelines is to prevent this to the extent possible. In this regard, the new standard and guidelines, regardless of the alternative chosen, represent a substantial step toward minimizing the problems caused by NNIS.

Table 3.5.3-2: Acres in management areas that are most likely to allow activities associated with the indicators for increased spread, establishment, and growth of NNIS

Indicator[1]	Alt. A Current Mgt.	Alt. B	Alt. C	Alt. D	Alt. E
	Acres (%) Rank	Acres (%) Rank	Acres (%) Rank	Acres (%) Rank	Acres (%) Rank
Indicator 1: Acres in MA allocations most subject to ground-disturbing activities that have potential to increase NNIS	267,168 (67%) 2	296,105 (74%) 5	294,092 (73%) 4	249,506 (62%) 1	286,664 (72%) 3
Indicator 2: Acres in MA allocations most likely to have an increase in pathways for dispersing NNIS	267,168 (67%) 2	296,105 (74%) 5	294,092 (73%) 4	249,506 (62%) 1	286,664 (72%) 3
Indicator 3: Acres in MA allocations most subject to activities that increase light reaching the ground or edge habitat	267,168 (67%) 2	296,105 (74%) 5	294,092 (73%) 4	249,506 (62%) 1	286,664 (72%) 3

[1]Management areas that are most subject to activities that disturb ground, increase pathways for NNIS dispersal, and increase the amount of light which can reach the ground are: Diverse Forest Use, Diverse Backcountry, Remote Wildlife, Escarpment, Recreation Special Areas, Moosalamoo Recreation and Education Special Area, National Recreation Area (NRA), Alpine Ski Areas, and Alpine Ski Area Expansion; NRA is included in the NNIS section – but not soil or heritage resources – because of the number of activities that have more effect on NNIS than the other resources.

3.6 WILDLIFE AND WILDLIFE HABITAT

Issue Statement

Public concern is focused on the types and mixtures of habitats on the Green Mountain National Forest (GMNF) that will provide diversity of terrestrial wildlife species while meeting other resource objectives. Public concern includes debate about the appropriate distribution and amount of two major vegetative conditions: wintering habitat for white-tailed deer and early successional habitat. These habitats provide important opportunities for the region's wildlife species. A third issue is reclusive wildlife – those species that fare better in the absence of human disturbances. A fourth issue focuses on the efficacy of management indicator species (MIS), and how effectively population trends of selected MIS assess the effects of management actions on wildlife populations and habitats. This is an issue within the broader topic of restoration, protection, maintenance, and enhancement of biological and ecological diversity, and conservation of species, communities, and ecosystems.

Environmental and vegetative conditions on the GMNF are discussed in other sections of this chapter relative to soils (Section 3.2), water (Section 3.3), air (Section 3.4), vegetation (Section 3.5), and areas of special significance (Section 3.11).

Indicators

The Forest Service's efforts to provide for viability of wildlife species is based on conservation and enhancement of habitats. Ensuring viability on a species-by-species basis is difficult or impossible, but management efforts can affect the availability of suitable habitat, which in turn supports individual wildlife species.

The Forest Service approaches indicators for the GMNF wildlife and habitat on two different scales. Coarse-scale indicators track general changes for resource concerns, including deer wintering habitat, early successional habitat, and habitat for reclusive species. Individual MIS also address deer wintering habitat and early successional habitat, as well as three other habitat types that are important for wildlife: aspen and aspen-birch forest, oak and oak-pine forest, and aquatic-riparian habitat. Fine-scale indicators track species that "fall through the cracks" of the coarse filter. These include threatened or endangered (TE) species of plants and animals (Section 3.8) and Regional Forester sensitive species (RFSS) and species of viability concern (Section 3.10). The Biological Evaluation (BE: Appendix E) also addresses potential effects of the revised Forest Plan alternatives on TE species and RFSS.

In its Notice of Intent (NOI) to prepare an Environmental Impact Statement and a revised Land and Resource Management Plan for the GMNF (67 FR 22043), the Forest Service identified major issues likely to vary by alternative. Issues related to biodiversity and ecosystem management included "conservation of remote and unfragmented habitat to meet wildlife needs." Indicator 3 in this section (Acres Available as Habitat for Reclusive Wildlife Species) includes discussion and analysis of contiguous tracts of remote habitat for wildlife.

Although fragmentation is mentioned in the NOI, it is not included as a separate indicator for Wildlife and Wildlife habitat for several reasons. "Fragmentation" in this discussion of wildlife and wildlife habitat refers to "forest fragmentation," the process whereby contiguous tracts of forest land undergo permanent or long-term change to non-forest uses (after Rosenberg et al. 1999, 2003). These non-forest uses include urban, commercial, and industrial development; construction of housing; agriculture; gravel pits and other mineral extraction facilities; roads, golf courses, ski areas, campgrounds, and other developed recreational facilities; and permanent upland openings for wildlife. The GMNF land base includes developed recreation facilities in several locations and 2,889 acres (≈1%) managed under special use permits for alpine ski areas. The GMNF also includes permanent

roads, many of which are town and State highways, and several developed recreation facilities. The revised Forest Plan does not include actions that create or advance forest fragmentation to any meaningful measure under any of the alternatives.

"Forest fragmentation" does not include temporary openings created by timber harvest, other vegetation management activities, or natural events. These "stand disturbing" events do create temporary breaks in the forest canopy that are important components of habitat diversity and ecological processes. These temporary openings are not removed from the forest ecosystem, but rather they are regenerating forest stands that advance through seral or successional stages to older forest types. The five alternatives vary little from each other and from the existing condition on the Forest with respect to the predominance of mature and older forest habitats. See the discussion below under *Existing Condition* and under *Environmental Consequences, Effects Common to All Indicators and All Alternatives* in sections 3.6.1 and 3.6.2. Differences among alternatives with respect to temporary forest openings and permanent upland openings are discussed as early successional habitat under Indicator 2.

Indicator 1 – Acres of White-tailed Deer Wintering Habitat Allocated to Management Areas Allowing Vegetation Management

The first indicator is acres of wintering habitat for white-tailed deer, the relative allocation of those acres to different management areas (MAs), and the levels of vegetation management permitted in each MA. White-tailed deer are the most important game species in Vermont, and they are also highly valued by non-hunters (Vermont Deer Management Team 1997). Availability of quality wintering habitat, for both cover and browse, is an important and potentially limiting factor for deer in Vermont. The Forest Service's ability to manage vegetation in deer wintering areas is an important factor in assuring that the quality and condition of cover and browse remains high. This indicator highlights the differences among alternatives because the acres of deer wintering areas that can be maintained by vegetation management vary by alternative with the relative allocation of deer winter habitat to different management areas.

Indicator 2 – Early Successional Habitat Provided and Opportunities for its Management

The second indicator compares opportunities offered by each alternative for the Forest Service to create and maintain early successional habitat. Early successional habitat refers to shrubland, young pioneer (old field) habitats, and young, regenerating forests. These habitats are extremely important to many species of wildlife. Individual management area (MA) descriptions include varying opportunities for active vegetation and timber management, which are the primary tools for creation and enhancement of early successional habitat. This indicator highlights the differences among alternatives because the opportunity for management of early successional habitat varies between alternatives with the relative allocation of land to different MAs.

Indicator 3 – Acres Available as Habitat for Reclusive Wildlife Species

The third indicator is the amount of habitat available for reclusive wildlife species. This indicator is primarily designed to address the impacts of the developed recreation program and other sources of frequent or repeated disturbance on wildlife. Reclusive species usually fare better where contact with human recreation, trails, and open roads is limited. These species might be expected to occur more commonly in areas that provide remote or backcountry recreational opportunities and limit other sources of disturbance. This indicator highlights the differences among alternatives because levels of recreational access and other types of activities vary by alternative with the relative allocation of land to different MAs.

Indicator 4 – Habitat Available for Management Indicator Species and Their Population Trends

The fourth indicator is abundance and quality of habitat for management indicator species (MIS). MIS are a tool employed for assessing effects of management actions on wildlife populations at the Forest level. Changes in the abundance or quality of MIS habitat serve as indicators of the status of particular wildlife species, as well as for the other species that use these habitats and conditions. This indicator highlights the differences among alternatives because the management emphases of each alternative and the relative allocation of land to different MAs affect the amount, condition, and connectedness of these habitats.

Analysis Area

Unless otherwise noted, the analysis area for direct and indirect effects associated with wildlife and wildlife habitat includes all federal land managed by the GMNF. This includes a wide variety of vegetative conditions spread over diverse environmental settings, such as slope, aspect, and soil conditions.

The analysis area for cumulative effects includes all GMNF National Forest System lands and the lands administered by other owners, both public and private. Boundaries for the cumulative effects study area vary, depending on the particular issue or indicator. Few species of wildlife are confined to National Forest System lands; many species move freely on and off the Forest or migrate seasonally beyond the boundaries of the United States. Consequently, some wildlife and wildlife habitat issues may extend to the State of Vermont, to the New England-Adirondack Ecological Province, or beyond.

3.6.1 Affected Environment

Introduction

Land Use History

The recent history and current condition of wildlife and wildlife habitat on the GMNF and surrounding lands in Vermont are linked directly to historical and evolving patterns of land use, and their effects on the landscape. This land-use history is particularly relevant to the availability of early successional habitat.

During the 17th and 18th centuries, European settlers spread across the region clearing forests for farmland, lumber, fuel wood, and potash. The forestland in Vermont declined from about 80 percent of the landscape in 1780 to only 25 to 30 percent by the mid-1800s (Johnson 1998, Klyza and Trombulak 1999, DeGraaf and Yamasaki 2001). Large predators (wolf, mountain lion, and lynx) were extirpated, and game animals (white-tailed deer, elk, caribou, moose, black bear, and wild turkey) were seriously depleted or extirpated by hunting and habitat loss (DeGraaf and Yamasaki 2001).

Whole-scale abandonment of small farms occurred from about 1850 or 1870 through 1950 and fields and pastures reverted to forest (Johnson 1998, Klyza and Trombulak 1999). Loggers cut many of these forests during the early 20th century as they reached merchantable size. A new phase of forest regeneration occurred in the wake of this secondary cutting and continuing farm abandonment. From about 1930 to 1950, the Vermont landscape included extensive acreage of regenerating forests and shrublands (early successional habitat) interspersed with agricultural land and a mix of older-age forests. This rich mix of wildlife habitats supported bountiful populations of upland game species and provided many hunting opportunities. Since the 1950s, the trend has been towards reforestation. By 1980, Vermont was at least 75 percent forested (Johnson 1998, DeGraaf et al. 1992, DeGraaf and Yamasaki 2001). This trend of increasing forestation has

continued (Wharton et al. 2003). Land that was relatively inhospitable to forest wildlife a century before was becoming increasingly suitable to those species again, and less suitable to species that depend on early successional habitat.

Deer Wintering Habitat

Winter habitat for white-tailed deer is one of the major wildlife issues on the GMNF. Deer wintering areas, or "deer yards," include two basic habitat components required by white-tailed deer during winter: shelter from harsh weather conditions, and food or browse. Softwood stands with high crown closure create shelter or "cover," which provides protection from snow depth, wind, and cold temperatures. Hardwood and softwood regeneration provide accessible food or "browse." The quality of deer wintering areas is determined by forest stand characteristics, such as species composition, maturity, height, and closure of the canopy, which vary by site-specific features, such as elevation, slope, aspect, and soil type (Reay et al. 1990).

The Vermont Fish and Wildlife Department mapped potential deer wintering areas in Vermont during the 1980s. Although these mapped areas certainly identified locations used by deer during winter, they focused primarily on the softwood stand characteristics that provide suitable winter cover habitat. Mapped areas did not consider the availability of browse. The Vermont deer herd in 2004 is approximately half as big as it was in the early 1980s (Vermont Deer Management Team 1997) when wintering areas were mapped. Thus, mapped deer winter areas today may represent potentially suitable wintering habitat, not necessarily areas actually occupied by deer during winter.

The Forest Service evaluates deer wintering areas at the project level using all available tools, including: existing State maps of cover areas, silvicultural characteristics of stands, availability of browse on nearby lands, deer distribution and abundance data, and consultations with the Vermont Fish and Wildlife Department. The Forest Service then prescribes appropriate management actions to enhance these wintering areas.

Conditions that provide cover and browse for white-tailed deer during winter also provide suitable habitat during winter and other times of year to a wide variety of other species, such as sharp-shinned hawk, eastern wood-peewee, red-breasted nuthatch, golden-crowned kinglet, solitary vireo, blackburnian warbler, snowshoe hare, red squirrel, northern flying squirrel, and fisher (DeGraaf et al. 1992, DeGraaf and Yamasaki 2001).

Early Successional Habitat

Early successional habitat is dominated by seedling to sapling-sized trees or persistent shrubs. In everyday language these sites may be called "thickets" or "shrubland" (Litvaitis 2003b, c). This includes pioneer sites (cleared areas reverting to forest) with species like aspen, paper birch, and white pine, as well as regenerating forest with seedlings and saplings from the surrounding, older-age forest. Early successional communities typically are dependent on stand-disturbing events, such as fire, wind throw, flood, timber harvest, or agriculture, that create forest openings, which allow sunlight to reach the ground. The species and characteristics of vegetation on these sites progress through reasonably predictable successional (or seral) stages, reverting eventually to mature forest. Early successional habitat can persist without disturbance on "poor-quality" sites, such as those that are extremely wet or dry, at high elevation, on poor or rocky soils, or in areas underlain by ledge (DeGraaf et al. 1992, Brooks 2003, DeGraaf and Yamasaki 2003, Litvaitis 2003b, c).

The relative availability of early successional habitat in much of New England at the beginning of the 21st century may be similar to that before European settlement, but the overall character of the contemporary landscape is very different. Increasing human population has brought residential developments, roads, industrial parks, and parcelization of forestland into smaller tracts. In addition, changing demographics, values, and economy affect how private owners manage their woodlands, typically reducing the amount of

acreage subjected to timber harvest (Brooks 2003, Wharton et al. 2003).

Natural disturbance processes, such as windthrow, flooding, or fire, also can create openings in the forest canopy, including mature and old stands, allowing sunlight to reach the forest floor. Many forests in northern New England, however, are mid-successional, largely even-aged, and relatively young ecologically. Conditions under which natural disturbance processes can effectively create diverse forest habitats, including openings of early successional habitat, may not be realized for another 100 years or more, and fire has been largely eliminated as a landscape-altering force (Litvaitis 2003a, Lorimer and White 2003). Consequently, the availability of early successional habitat of the GMNF and in the surrounding region, currently and for the foreseeable future, depends primarily on its creation through vegetation management activities.

Early successional habitat is extremely important to many species of wildlife. This importance is particularly apparent for birds, as the diversity and density of bird species is greater in early successional habitats than in other stages of forest development. Many bird species occur only in early successional habitat (Litvaitis 1993, DeGraaf et al. 1992, Hunter et al. 2001, Thompson and DeGraaf 2001, Keller et al. 2003). By contrast, many bird species that occur in mature forests tend to use a wider range of habitat, ranging from old, mature forests to young regenerating forests (Hagan and Grove 1999, Hartley and Burger 2004).

Regenerating and young forest habitats are important to such wildlife species as eastern milk snake, alder flycatcher, eastern bluebird, chestnut-sided warbler, common yellowthroat, American redstart, song sparrow, indigo bunting, red-breasted grosbeak, American goldfinch, eastern cottontail, snowshoe hare, bobcat, red fox, black bear, and moose. Species that occur in permanent upland openings include the smooth green snake, American woodcock, willow flycatcher, savannah sparrow, eastern cottontail, and meadow vole (DeGraaf et al. 1992, DeGraaf and Yamasaki 2001).

Reclusive Species

Reclusive species refers to those wildlife species that need or prefer habitats in which they can avoid or minimize contact with, and disturbance from, humans. Of particular concern are impacts of recreational activity and other sources of frequent or repeated disturbance on wildlife (Richens and Lavigne 1978, Boyle and Samson 1985, Miller et al. 1998, Hammond 2002). Reclusive species typically fare better where contact with human recreation, trails, and open roads is limited.

Habitat for reclusive species is not synonymous with continuous, mature, and old forest; contiguity of the forest canopy is not the primary concern for these species. In fact, many rely extensively on temporary or permanent forest openings, shrubland, and forest habitats of varying ages that break the continuous forest canopy, providing a mosaic of habitats with varying opportunities for cover and food. Black bears, for example, forage on plants and berries in forest openings and along forest edges; bobcats and northern goshawks prey on small mammals and birds that forage in open areas (DeGraaf and Yamasaki 2001, Hammond 2002, USDA 2003b).

Reclusive species are often thought to be large, mobile animals, particularly predators (for example, wolves, bobcats, bears) that inhabit large tracts of land or “deep woods” settings (Pramuk 1985). Concern may exist for other reclusive species, as well. Wood turtles, for example, are herbivores with home ranges as small as 10 to 15 acres along a stream (Tuttle and Carroll 1997). Collection of wood turtles as pets is a serious threat to the species (Hunter et al. 1999, SVE Herpetology Panel 2002, USDA 2002f). Management options leading to lower levels of human activity provide a lower likelihood of direct interaction between people and wood turtles, and thus a lower likelihood of turtles being collected and removed from the population.

The importance of secluded habitat may vary seasonally for particular species. Northern

goshawks, for example, are most sensitive to disturbance during nesting, and winter recreation may have little or no effect on them (Squires and Reynolds 1997, DeGraaf and Yamasaki 2001). Black bears may alter their daily activity cycles to avoid humans during much of the year, but they den during the winter, greatly reducing the likelihood of interaction with humans (Kolenosky and Strahearn 1987, *cited in* DeGraaf and Yamasaki 2001). Winter logging or intensive snowmobiling activity may be a problem in areas where bears den, but not in areas used primarily for non-winter foraging.

Existing Forest Plan Management Direction

Management direction contained in goals and objectives of the 1987 Plan is intended to provide sufficient habitat to maintain diverse, self-sustaining populations of wildlife. The 1987 Plan recognizes that the basic components of habitat (food, water, and cover) can be manipulated to promote or discourage different species of wildlife. Plan direction also points out that direct and indirect manipulation can affect wildlife habitat.

In 2002, the Forest Service amended the 1987 Plan to update many of the objectives, standards, guidelines, and monitoring requirements related to wildlife (USDA 2002d). Although the primary focus of these changes was the Indiana bat and other threatened and endangered species, they addressed snags and trees suitable for roosts, nests, and dens, mast-producing vegetation, and other habitat features important to many species of wildlife.

Management Area Direction

The Green Mountain National Forest is managed under the 1987 Plan with 15 different MA prescriptions. These MAs represent variations on five general vegetative conditions related to wildlife and wildlife habitat, and are discussed below as: 1) Mosaic of even-aged forests, 2) Deer wintering areas, 3) Uneven-aged forest, 4) Areas with limited vegetation management, and 5) Areas with no vegetation management.

1. Mosaic of Even-aged Forests
MA 3.1 represents the broadest diversity of timber and vegetation management and recreation opportunities among 1987 Plan MAs. Many different species of wildlife benefit from the varied conditions for food and cover created as vegetation passes through successional (or seral) stages from regenerating forests and shrubland through older forests. Different suites of species, notably migratory passerine birds (perching or song birds, such as wrens, swallows, warblers, thrushes, finches, and sparrows), exhibit associations with particular forest successional stages. Approximately 52,000 acres (13%) of the GMNF is in MA 3.1. [Note: acreages and percentages for current MAs presented in this section are calculated from the GMNF GIS database, which may vary from those published in the 1987 Forest Plan.]

2. Deer Wintering Areas
MA prescriptions 4.1 and 4.2 emphasize habitat to provide cover and browse for white-tailed deer during winter. One important feature of these MAs is dense softwood canopy closure that provides protection from deep snow, wind, and cold temperatures. The second feature is the availability of browse (food) to support deer through the winter. Timber and vegetation management are the primary tools available for maintaining or improving the quality of cover and the availability of browse (Reay et al. 1990). Management prescription 4.1 provides roaded natural recreation opportunities, whereas prescription 4.2 provides semi-primitive recreation. Approximately 34,000 acres (8.6%) of the GMNF is in MAs 4.1 and 4.2.

3. Uneven-aged Forest
MA prescriptions 2.1 and 2.2 emphasize continuous forest cover containing a relatively unbroken mixture of different-aged and different-sized trees. Shade-tolerant tree species tend to dominate these areas because large, sunny openings are not created. Prescription 2.1 provides roaded natural recreation opportunities whereas MA 2.2 provides semi-primitive recreation. The lack of openings and timber management limits the use of these areas by

some wildlife species. Other species (for example, ovenbird, black-throated blue warbler, Jefferson salamander, or West Virginia white butterfly) may benefit from the continuous canopy closure. Approximately 32,000 acres (8%) of the GMNF is in MAs 2.1A and 2.2A that are available for commercial timber harvest; 7,000 acres (1.8%) are in 2.1B and 2.2B and unavailable for commercial harvest.

4. Areas with Limited Vegetation Management

Several MA prescriptions allow timber or vegetation management only when it is compatible with the area's emphasis, typically recreation or protection of special areas or features. Consequently, management of wildlife habitat may be allowed but restricted in scope. MA prescriptions for Semi-primitive Recreation (MAs 6.2A and 6.2B: approx. 70,000 acres, 17%) encompass both even-aged and uneven-aged forests, including large areas of undisturbed forest where alteration by humans is not evident. Permanent upland openings are maintained and timber management can be practiced with long rotation. These areas emphasize semi-primitive recreation and opportunities for solitude. Thus, these areas provide the greatest benefit to the more reclusive wildlife species, such as black bears, bobcats, and northern goshawks. Commercial timber sales are not allowed on MA 6.2B lands. MAs for highly developed recreation areas (MA 7.1) or possible ski area expansion (MA 9.3) allow timber and vegetation management, but only where it is consistent and compatible with the recreation emphasis (3,700 acres, 1% of the GMNF).

The 1987 Forest Plan includes 13 Special Areas (MAs 8.1A through 8.1M) that protect areas having uncommon or outstanding biological, geological, recreational, cultural, or historical significance. Timber and vegetation management must be consistent with the intended purpose of each area. White Rocks National Recreation Area (NRA) (8.1B) emphasizes, "providing habitat for 'deep woods' species such as bobcat, bear, fisher, pileated woodpecker, and four toed salamander" (Pramuk 1985: p. B-17). The White Rocks NRA includes more than 22,000 acres (6%) of the GMNF; all other special areas combined represent another 24,000 acres (6%).

5. Areas with No Vegetation Management

MA prescriptions for Wilderness (MA 5.1: 59,000 acres, 15%) and Primitive Recreation (MA 6.1: 8,300 acres, 2%) prohibit vegetation management; alterations to the forest's conditions occur through forest succession, growth, and natural disturbance processes. Reclusive wildlife species may benefit from the isolated conditions, but vegetation management for maintenance or enhancement of wildlife habitat is not allowed.

Newly Acquired Land (MA 9.2) include more than 90,000 acres, or about 23 percent of the GMNF, on which only minor habitat maintenance can be carried out. Specifically, endangered, threatened, and sensitive species will be protected in Newly Acquired Land, and existing habitats, such as upland openings, may be maintained. Timber or vegetation management, including activities that create or improve wildlife habitat, are not permitted. These lands include a wide range of wildlife habitats, timber conditions, and recreation opportunities.

6. Areas with Variable Levels of Vegetation Management

Management Prescription 9.4 emphasizes protection of streams and rivers that may be eligible for inclusion under the National Wild, Scenic, and Recreational River System. MA 9.4 affects 45,500 acres (11%) of the GMNF, although this classification exists as a corridor overlaying other MAs rather than existing as a unique, stand-alone MA. Management objectives, primarily through standards and guidelines, operate on a variable scale, depending on the classification of the river segment and the objectives of the underlying MAs. The greatest relevance to wildlife of MA 9.4 is a beneficial emphasis on protecting the integrity of water quality and other habitat features along these riparian corridors.

Management Indicator Species

Management Indicator Species (MIS) are vertebrate or invertebrate species selected for monitoring habitat conditions on the Forest because their population changes are believed to indicate the effects of management activities (36 CFR 219.19(a)(1)).

Monitoring of indicator species began in 1987, in cooperation with the University of Vermont, Vermont Fish and Wildlife Department, Vermont Institute of Natural Science, and numerous volunteers. Analyses of monitoring results concluded that several selected MIS were ineffective as diagnostic indicators for habitat changes in their represented communities. Despite extensive monitoring, identification of trends in populations for many MIS or for their represented community associates and habitats may not be possible with any degree of certainty. Additionally, even if population trends can be identified, establishing cause-and-effect relationships between those trends and weather, physical or biological factors, or forest management practices may be difficult or impossible (Niemi 1997, Toth 2000). For these reasons, MIS selected for the revised Forest Plan focus on habitats subject to active structural manipulation, habitats that are likely to change substantially over time as a result of management activity, and species for which changes in abundance can be convincingly linked to changes in habitat conditions.

The 1987 Forest Plan identified 14 MIS for the GMNF (Table 3.6-1). One species, the chestnut-sided warbler, served as MIS for two different habitats: regenerating northern hardwoods and regenerating oaks. Proposed changes to MIS for the revised Forest Plan are discussed in detail below.

Table 3.6-1: Habitat communities, conditions, and MIS for the GMNF included in the 1987 Forest Plan.

Habitat type and condition	MIS
Regenerating northern hardwoods	Chestnut-sided warbler (*Dendroica pennsylvanica*)
Mature and overmature northern hardwoods	barred owl (*Strix varia*)
Regenerating and young softwoods	Snowshoe hare (*Lepus americanus*)
Mature and overmature softwoods	Blackpoll warbler (*Dendroica striata*) and White-tailed deer (*Odocoileus virginianus*)
Regenerating pioneers	Ruffed grouse (*Bonasa umbellus*)
Young pioneers	American beaver (*Castor canadensis*)
Mature and overmature pioneers	Yellow-bellied sapsucker (*Sphyrapicus varius*)
Regenerating oaks	Chestnut-sided warbler
Mature and overmature oaks	gray squirrel (*Sciurus carolinensis*)
Permanent grass-forb openings	American woodcock (*Scolopax minor*)
Cold-water streams	Brook trout (*Salvelinus fontinalis*)
Beaver flowage	Tree swallow (*Tachycineta bicolor*)
Marshy wetland	American bittern (*Botaurus lentiginous*)
Remote cliff	Peregrine falcon (*Falco peregrinus*)

Sources:
Draft Environmental Impact Statement (USDA 1985)
Appendix C of the 1987 Plan (USDA 1987)

Proposed Changes in Management Direction Common to All Alternatives

The 1987 Forest Plan addressed biodiversity primarily at small scales, such as at the individual species scale. The revised Plan will consider biodiversity and natural communities at a variety of landscape scales and patterns. The revised Plan will build on the 1987 Forest Plan, with a revised Plan goal (Goal 2) to maintain and restore quality, quantity, and distribution of habitats to produce viable and sustainable populations of native and desirable non-native plants and animals.

Standards and guidelines in the revised Forest Plan generally do not represent substantive changes in management direction. Most changes

reflect simplification, clarification, and definition. For example, standards and guidelines (S&Gs) for wildlife reserve trees in the revised Forest Plan provide more specific direction than the 1987 Plan for retention the trees and snags, including roost and den trees, as well as mast-producing trees and shrubs. These S&Gs do include some changes, such as emphasizing retention of uncut patches of trees during even-aged management. In the 1987 Forest Plan, S&Gs for deer wintering areas applied primarily to two specific MAs, although their guidance could be applied in other MAs, as well. In the revised Forest Plan, S&Gs for deer wintering areas apply Forest-wide.

Management Area Direction

MA direction exerts a major influence on the structure and condition of wildlife habitat. The proposed MAs in the revised Plan include few significant departures from the existing management prescriptions in the 1987 Plan. In general, the names applied to MAs emphasize the future condition of each area. Management prescriptions 2.1 and 2.2 (emphasizing continuous forest cover), 3.1 (the broadest diversity of timber-vegetation management and recreation opportunities), and 4.1 and 4.2 (deer wintering areas) from the 1987 Plan are merged into a single MA, Diverse Forest Use, in the revised Plan. MA prescriptions 6.1 and 6.2 change from Primitive Recreation and Semi-primitive Recreation to Remote Backcountry Forest and Diverse Backcountry, respectively. In the 1987 Plan, each special area is listed as a separate MA: 8.1A through 8.1M. In the revised Plan, many special areas are grouped as Ecological Special Areas or Recreational Special Areas.

Eliminating 1987 Plan MA prescriptions 4.1 and 4.2 (deer wintering areas) and incorporating them into the new Diverse Forest Use MA in the revised Plan does not preclude management opportunities for maintenance or enhancement of deer wintering habitat. In the revised Plan, standards and guidelines for management of deer wintering habitat apply Forest-wide, not only to MAs 4.1 and 4.2, as in the 1987 Plan. The intention of these changes in the revised Plan is to provide the Forest Service with maximal flexibility for managing deer wintering habitat Forest-wide, rather than focusing on particular MAs.

The revised Forest Plan provides several new MA opportunities. The most significant of these, relative to wildlife and wildlife habitat, is the Remote Wildlife Habitat MA. This MA emphasizes a mix of different-aged forest habitats, from early succession to old forests, for the primary benefit of wildlife, particularly reclusive wildlife species that are sensitive to human disturbance. The GMNF will employ a variety of tools to manage and enhance wildlife habitat. Road- and trail-oriented recreation is de-emphasized to minimize continuing disturbance to wildlife. This MA complements wildlife habitat management in other MAs.

The revised Plan also allocates lands to Wilderness Study Area in some alternatives. Wilderness Study Areas are those lands deemed suitable and recommended by the Forest Service for designation and management as wilderness. Wilderness offers habitat conditions favorable to some species of wildlife, notably large expanses of continuous forest and remoteness from disturbance, but Wilderness also prohibits vegetation management for creation or enhancement of wildlife habitat.

Management Indicator Species

The revised Forest Plan includes several changes to management indicator species (MIS) for the GMNF. Monitoring of MIS assesses the effectiveness of management efforts in terms of the amount and quality of habitat. The general approach for monitoring MIS is described in Chapter 4 of the revised Forest Plan.

The total number of MIS for the GMNF is reduced from 14 in the 1987 Forest Plan (Table 3.6-1) to 5 in the revised Plan (Table 3.6-2). Revised MIS are linked to two of the three major resource issues (deer wintering habitat and early successional habitat) and to three other important habitat types on the GMNF (aspen and aspen-birch, oak and oak-pine, and aquatic-riparian

habitat). Aspen and aspen-birch habitats at all successional stages are important to many wildlife species for cover and food. Oak is particularly important as a hard mast-producing species (Gullion 1984, DeGraff and Yamasaki 2003).

Table 3.6-2: MIS for the revised Forest Plan linked to resource issues or habitat types.

Major issue or habitat	MIS
Deer wintering habitat	White-tailed deer
Early successional habitat	American woodcock
Aspen and aspen-birch habitat	Ruffed grouse
Oak and oak-pine habitat	Gray squirrel
Aquatic-riparian habitat	Brook trout

Each of the selected MIS address issues or conditions directly associated with active habitat manipulation and with habitat conditions that are expected to change substantially over time. Deer wintering habitat requires vegetation management to encourage regeneration of desired species and prevent succession to less-desired forest types. Aspen and oak are shade-intolerant species that typically require specific management to encourage regeneration. Without management they may gradually diminish or disappear altogether from large portions of the GMNF. In northern New England, silvicultural management is the most successful tool for management of deer wintering areas and early successional habitat and for regeneration of aspen and oak (Reay et al. 1990, DeGraff et al. 1992, Oehler 2003). The Forest Service also actively manages aquatic-riparian habitat to enhance conditions for fish and other aquatic organisms through activities such as the introduction of large woody debris, stabilization of stream banks, or improving conditions for up- or down-stream passage of fish and other aquatic and riparian species.

There are several reasons why particular MIS are not carried forward from the 1987 Forest Plan to the revised Plan. Some MIS are ineffective as indicators for habitat changes in their represented communities. This may be caused by poor or ambiguous correlation to habitat change, by the adaptability of many species to changing conditions, or by confounding links to other habitat conditions (Capen et al. 1991, Niemi et al. 1997, Toth 2000). The yellow-bellied sapsucker is MIS for “mature and overmature pioneers,” although it may be more indicative of hardwood forests with abundant cavity trees.

Some MIS are linked to habitats that are generally protected, are subject to little or no active habitat manipulation, or for other reasons are not likely to undergo substantial change in amount or quality over time. These habitat/MIS combinations include wetlands (American bittern and tree swallow), high-elevation mature softwood forest (blackpoll warbler), or remote cliffs (peregrine falcon). Although northern hardwood forest on the GMNF is subject to management activity, the abundance of this habitat type and the suitability of conditions for barred owls are unlikely to change in the foreseeable future, particularly over the duration of the revised Forest Plan.

Other MIS represent some degree of redundancy. For example, several MIS could each represent a different seral stage or age of early successional habitat. The Forest Service selected American woodcock as an MIS linked to the initial stages of early successional habitat; male woodcock use forest openings as singing grounds during the spring breeding season (Sepik et al. 1981). Other species, such as the willow flycatcher, chestnut-sided warbler, and American redstart, follow in predictable intervals of several years each as the early successional habitat progresses through seedling, sapling, and pole stages before reverting to older forest. American woodcock also occur in various early successional habitats other than openings for foraging and brood-rearing (Sepik et al. 1981, DeGraaf et al. 1992, DeGraaf and Yamasaki 2001). Assuming continuing provision of adequate and suitable conditions for woodcock on the Forest over time, appropriate conditions for other species will also be provided as individual patches or stands of early successional habitat mature. Validation of such assumptions is a major component of the Monitoring and Evaluation Program (see Chapter 4 of the revised Forest Plan).

Overall changes in habitat for reclusive wildlife will be monitored largely through the Monitoring and Evaluation program rather than through specific MIS. Most of the MAs that will contribute to reclusive wildlife habitat (Wilderness, Wilderness Study Area, Remote Backcountry, Research Natural Areas, Ecological Special Areas, and Alpine/Subalpine Special Area) do not allow active vegetation management. Changes to forest structure on these lands will occur primarily through natural ecological processes, and they will slowly move toward old-growth conditions. This process will take decades or more, and change during the next 15 or 20 years is not likely to be measurable, particularly in terms of population status of any species that occurs in these habitats.

Active habitat manipulation is a significant aspect of the emphasis and desired future condition for the Remote Wildlife Habitat MA. Management activities will include creation of temporary openings for early successional habitat and regeneration of aspen or oak. Each of these management activities is covered by specific MIS (Table 3.6-2). The overall effectiveness of the Remote Wildlife Habitat MA, and of habitat for reclusive wildlife species on the GMNF in general, will be evaluated through a program that monitors and evaluates wildlife habitat conditions and wildlife use of those habitats, as well as the intensity, types, and distribution of recreational activities and other sources of continuing, human-related disturbances. Additionally, there is not a candidate species that could be linked as MIS in an unambiguous, cause-and-effect relationship as an indicator of levels of disturbance in reclusive habitat.

Existing Condition

The GMNF and Wildlife

The GMNF provides habitat for a diverse array of species, including more than 300 species of wildlife, including 17 species of fishes, and more than 400 species of vascular plants. Wildlife species that occur on the GMNF, and their respective populations, are greatly influenced by the populations of these species beyond the boundaries of the GMNF in Vermont, in the New England-Adirondack Ecological Province, and in northeastern North America, in general. Birds may occur on the Forest throughout the year, may undergo seasonal movements within the region, or may migrate annually as far as Central or South America. Other bird species winter in the GMNF region, after breeding farther north, or merely pass through the GMNF during migration. White-tailed deer and other mammals move freely on and off Forest lands. Because of this mobility, these species can disperse easily onto or off the Forest to reinforce depleted populations. Amphibians and reptiles, which may live their entire lives on the Forest, are dependent on region-wide populations for their long-term viability. Because these species do not disperse very far, extirpation of local genetic populations breaks the connectivity within the regional population and reduces the species' overall viability (SVE Herpetology Panel 2002).

Vegetative Conditions and Wildlife Habitat

The mixture and diversity of vegetative conditions and habitats found on the GMNF contribute to the continued presence of animal species found there. The small number of species that cannot have their continued presence and viability assured through management of these important vegetative conditions, lesser vegetative types, and important wildlife habitat components, are those species that are threatened or endangered (TE) or Regional Forester sensitive species (RFSS). Discussion of TE species and RFSS is provided in Sections 3.8 and 3.10 of this Chapter and in the Biological Evaluation (Appendix E).

The GMNF is largely contiguous forest with closed canopy cover predominated by northern hardwoods, which cover about 76 percent of the Forest (Table 3.5-6 in Vegetation). Mature or older stands also dominate the GMNF, accounting for almost 90 percent of the forested lands (Table 3.5-7 in Vegetation). Young forest accounts for about 11 percent of the GMNF and regeneration is less than one percent (Table 3.5-7 in Vegetation). Less than three percent of the Forest currently is in permanent upland openings or other non-forest conditions (Table

3.5-6 in Vegetation). This includes areas like wet and dry shrublands, open water (ponds, lakes, and reservoirs), rocky areas, gravel pits, and campgrounds. Although small acreages may be changed to non-forest uses (for example, camp grounds or parking facilities at trail heads), large-scale permanent or long-term removal of NFS lands from forest uses is unlikely.

Based on simulation results from the SPECTRUM forest growth model, mature and older conifer and mixedwood stands rarely drop below 70 percent canopy closure. Mature and older hardwood forests drop below 70 percent canopy cover for the first decade after a shelterwood harvest, and for the interval between first and second entries with delayed shelterwood harvests (A. Reger, personal communication, January 2005). During 1987 to 2003, the Forest Service averaged about 150 acres of shelterwood removal per year (Table 3.13-5 in Timber).

Deer Wintering Habitat

The primary components of deer wintering habitat are a core area, which is dominated by softwoods with high crown closure that provide shelter or "cover," and a mix of young hardwoods and softwoods that supply accessible food or "browse." White-tailed deer are at the northern limit of their range in Vermont and adequate wintering habitat, including both shelter and food, is essential for their survival. Availability of quality wintering habitat, for both cover and browse, is an important and potentially limiting factor for deer in Vermont (Reay et al. 1990, Vermont Deer Management Team 1997, DeGraaf and Yamasaki 2001).

Vegetation management is important in maintaining the quality of deer wintering habitat. Over time, many softwood stands in Vermont shift to hardwood composition, at which time they no longer provide suitable winter cover for deer. Appropriate thinning and regeneration cuts can maintain and enhance the quality of cover, and can also enhance the availability of browse (Reay et al. 1990). Management of deer wintering areas on the GMNF focuses on MA prescriptions 4.1 and 4.2. Activities typically take place at the project level. Deer wintering areas are examined and evaluated during the site inventory stage; appropriate habitat management prescriptions for these areas are then included as part of the project plan.

The deer herd in Vermont currently is about half as large as it was two decades ago when the Vermont Fish and Wildlife Department mapped potential deer wintering areas (Vermont Deer Management Team 1997, State of Vermont, Agency of Natural Resources Department of Fish and Wildlife 2004b). Consequently, occupancy of deer yards during winter is lower than it was 20 years ago. Deer yards located in lower elevations tend to be warmer and closer to open and agricultural land, which potentially provide greater availability of winter browse. Deer yards located in higher elevations may be less preferred by deer (C. Alexander, personal communication December 2004; S. Darling and D. Blodgett, personal communication January 2005). Additionally, occupancy of deer yards at any given time is not completely predictable. Deer respond to a variety of conditions, including but not limited to ambient temperature, snow fall, prevailing wind direction, quality of cover, availability of browse, and levels of human activity (C. Alexander, personal communication December 2004; S. Darling and D. Blodgett, personal communication, January 2005)). Providing suitable conditions in a deer wintering area does not guarantee that it will be occupied by deer during winter. Rather, maintenance of this habitat insures that it will be available for use by deer when needed.

Analysis of deer wintering areas in this section focuses on "deer yards" mapped by the Vermont Fish and Wildlife Department. The GMNF encompasses 19,919 acres of these deer wintering areas that are widely distributed throughout the Forest and managed under nine different MAs (Table 3.6-3). Some deer yards are located within MAs where timber and vegetation management are prohibited (Wilderness, Appalachian and Long Trails, Ecological Special Areas, existing and candidate Research Natural Areas, and Newly Acquired Land). Three of the State-mapped deer yards (a total of 2,240 acres)

are included in their entirety in designated Wilderness areas, as are portions of four other deer yards (437 acres). About 1,142 acres of deer yards are included in various special areas (Appalachian and Long Trails, Ecological Special Area, existing and candidate Research Natural Area), and 2,274 acres are in Newly Acquired Land. Combined, these MAs account for about 6,000 acres of deer yards that are unavailable for habitat management, or about 30 percent of all deer yard acres on the GMNF. Over time, many of these un-managed deer yards areas will gradually decline in quality as deer wintering areas; some may become entirely unsuitable.

Table 3.6-3: Distribution of deer wintering areas on the GMNF, by MA.

MA	Acres	(%)
Diverse Forest Use	10,840	(54%)
Wilderness	2,677	(13%)
Remote Backcountry	0	
Diverse Backcountry	1,822	(9%)
White Rocks NRA	1,165	(6%)
Appalachian Trail	891	(4%)
Long Trail	115	(<1%)
Ecological Special Area	94	(<1%)
Existing and candidate Research Natural Area	42	(<1%)
Newly Acquired Land	2,274	(11%)
Total	19,919	(100%)

Sources: GMNF GIS and database.

Forest age class distribution for GMNF softwood forests shows a general shift to a more mature forest with a concurrent decline in the amount of regeneration (0-9 year age class) forest in softwood, northern hardwood, and mixed forest types (see Section 3.5 Vegetation). The shift towards mature stands suggests that winter thermal cover is being maintained, and possibly enhanced. Conversely, the decline in regeneration suggests declining amount and quality of browse available for wintering deer (Toth 2000). Environmental analyses performed for recent timber sales (for example, USDA 2002a, USDA 2004a,c) identified the over-abundance of mature and old stands, particularly of northern hardwoods, resulting in a general lack of structural and age-class diversity in the project areas. Existing conditions in these project areas provide little browse and, in some cases, marginal cover for wintering deer. Similar appraisals are not available for the entire GMNF.

The Record of Decision for the 1987 Forest Plan (USDA 1986) emphasized regeneration of softwoods and called for converting 245 acres of hardwoods to softwoods each year to enhance deer wintering habitat on the Forest. Accomplishments have fallen below that goal. Since adoption of the 1987 Forest Plan, approximately 30 acres of northern hardwoods have been converted to softwoods in deer wintering areas each year (Table 3.6-4). Other habitat improvement efforts have also been carried out in and adjacent to deer wintering areas in conjunction with other Forest projects. These include patch clearcutting for browse production, regeneration cutting, fruit tree maintenance and improvement, and enhanced mast (such as apples, acorns, and beech nuts) production.

Early Successional Habitat

The availability of early successional habitat has declined across northeastern North America since the 1950s. This decline has taken place region-wide in general, but on the GMNF as well. Early successional habitat includes both permanent upland openings and temporary openings that are regenerating forest. Currently, only about three percent of the GMNF is in permanent upland openings or other non-forest conditions (Table 3.5-1 in Vegetation). A variety of timber and vegetation management activities create early successional habitat. The 1987 Plan called for about 1,400 acres of regeneration cuts each year, but management activities realized only about 350 acres (26%) of those cuts (Table 3.6-4). Consequently, less than one percent of the GMNF (1,737 acres) currently is in the regeneration (0-9 year) age class (Table 3.5-7 in Vegetation).

Table 3.6-4: Management activities that create early successional habitat on the GMNF, including projected annual acreage and percent realized during 1987 to 2001.

Activity	Projected acres	% realized
Hardwood[1] shelterwood regeneration	950	20%
Hardwood[1] clearcut	100	85%
Hardwood[1] clearcut for conversion to aspen	60	27%
Hardwood[1] clearcut for permanent upland openings	40	70%
Hardwood[1] clearcut for conversion to softwood	90	34%
Softwood clearcut	35	88%
Aspen-birch clearcut	110	16%
Total	1,385	26%[2]

Sources: GMNF 15 Year Retrospective.
Notes: [1] Includes both hardwood and mixed hardwood and softwood
[2] Weighted average

Reclusive Species Habitat

Habitat for reclusive wildlife is dependent primarily on preventing the impacts of developed recreation and other sources of frequent or repeated disturbance. Suitable conditions are provided by MAs that emphasize remote or backcountry recreational opportunities or otherwise limit sources of repeated disturbance. More than 90,000 acres (22%) of the GMNF currently are designated to MAs that provide conditions that can contribute to habitat for reclusive wildlife (Table 3.6-5).

Wilderness and Remote Backcountry (MA 6.1 Primitive Recreation under the 1987 Forest Plan) together provide about 67,300 acres (17% of the GMNF) in semi-primitive, non-motorized recreation, the most primitive recreational opportunity available of the GMNF. The White Rocks NRA includes almost 23,000 acres (6%) that promote "wild forest and aquatic habitat for wildlife" and "opportunities for primitive and semi-primitive recreation …" (PL 98-322, Sec. 201(b), Pramuk 1985). The White Rocks NRA is less remote than Wilderness, includes some snowmobile trails, and allows limited timber and vegetation management, primarily for creation, maintenance, or enhancement of wildlife habitat. Because of its vast size, however, the White Rocks NRA generally provides remote habitat conditions for wildlife. These three MAs provide the core of potential remote habitat for reclusive wildlife, occurring in large and contiguous acres. One candidate Research Natural Area (Mt. Horrid) and one Ecological Special Area (Branch Pond) also provide semi-primitive non-motorized settings that are contiguous to core remote areas, but together these MAs account for a small area (770 acres, ≈0.2%).

Table 3.6-5: Allocation of GMNF lands to MAs that contribute to remote habitat conditions for wildlife. Allocations are from Alternative A, the "no action" alternative of the revised Plan, which reflects current allocation under the 1987 Forest Plan.

MA	Acres[1]	(%)
Wilderness	59,001	(15%)
Remote Backcountry	8,316	(2%)
Research Natural Area (Mt. Horrid only)	120	(<1%)
Ecological Special Area (Branch Pond only)	450	(<1%)
White Rocks NRA	22,758	(6%)
Total	90,645	(22%)

Sources: GMNF GIS and database.
Note: [1] Acres rounded to nearest 100 acres.

Although these lands provide remote settings, they are predominated by relatively homogeneous, mature, closed-canopy, northern hardwood forest, thus providing less structurally diverse habitat conditions than other areas. Permanent openings, in upland settings or associated with wetlands, account for less than three percent of the GMNF landscape; temporary openings will be created through "natural" causes at a background level of one to three percent (see Section 3.5 Vegetation). Greater structural diversity can occur in parts of the White Rocks NRA as a consequence of habitat management activities.

Approximately 92,000 acres (23%) of the GMNF are in Newly Acquired Land. These lands are essentially in a holding status, pending assignment to a management area. Timber harvests or creation of new roads and trails is

prohibited on these lands, but many existing conditions, particularly recreation uses, continue at existing levels and existing roads and trails may be maintained. Although Newly Acquired Land generally will develop into continuous-canopy forest without harvesting or other vegetation management, they do not necessarily qualify as habitat for reclusive species because of their settings, existing roads, trails, and recreation uses.

MIS Habitat and Population Trends

Current conditions and trends for MIS selected for the revised Forest Plan are summarized in Table 3.6-6. Detailed information on all current MIS can be found in Toth (2000) and in the GMNF MIS Status Summary, which is included in the Forest Plan revision project file.

Table 3.6-6: Trends for populations (Pop) of GMNF MIS and the habitats (Hab) they represent, for New England, Vermont, and the GMNF.

MIS Species	New England		Vermont		GMNF	
	Pop	Hab	Pop	Hab	Pop	Hab
White-tailed Deer	V	V	↓	↓	↓	↓
American woodcock	↓* PIF[1] ↔ BBS ↓**SGS	↓	↑BBS ↓**SGS	V	?	↓
Ruffed grouse	↓** PIF ↔ BBS	↓	?	↓	?	↓*
Gray squirrel	↔	↑	?	V	?	↓ ↑A
Brook trout	↔	↔	↔	↔	↔	↑ ↑A

Sources: Raleigh (1982), Roy (1996), Partners in Flight (PIF 2000a, b), Toth (2000), Kirn (2000), North American Breeding Bird Survey (BBS: Sauer et al. 2003), Singing-ground survey (SGS: Kelly and Rau 2005), and the GMNF MIS Status Summary, which is documented in the Forest Plan revision project file.

Trend codes:
? = uncertain
V = Regionally variable
↑A = habitat increasing through acquisition
↑ = increase in abundance/quality
↔ = stable
↓ = decrease in abundance/quality
↓* = moderate decrease in abundance/quality
↓** = significant decrease in abundance/quality
[1]Partners in Flight physiographic areas 27- Northern New England (PIF 2000a) and 28 - Eastern spruce-hardwood (PIF 2000b)

1. White-tailed Deer

The white-tailed deer is the MIS for deer wintering habitat on the GMNF. The amount and condition of wintering habitat for deer are discussed under a separate heading, above. Vermont is home to an estimated 125,000 to 140,000 white-tailed deer, about half as many as in 1970 (Vermont Deer Management Team 1997, State of Vermont, Agency of Natural Resources Department of Fish and Wildlife 2004b). In 2004, the buck harvest in Vermont was below the State's management plan objective for the fourth consecutive year (State of Vermont, Agency of Natural Resources Department of Fish and Wildlife 2004a, b). Whether the harvest data are indicative of further decline in the deer herd or are caused by other factors is uncertain. No data are available for estimating the number of deer that might winter on the GMNF.

2. American Woodcock

The American woodcock is selected as MIS for the early stages of early successional habitat. The amount and condition of early successional habitat in general is presented above. Woodcock use permanent and temporary forest openings for courtship display and for night roosting sites (Sepik et al. 1981). This specific habitat, along with early successional habitat in general, has declined in the Northeast (Dwyer et al. 1983, Kelley 2001), Partners in Flight (PIF 2000a) identified early successional forest/edge habitat and the American woodcock as a priority habitat-species suite with a stated management objective to reverse or stabilize declining trends in northern New England.

Roy (1996) analyzed MIS monitoring data from the GMNF, but did not detect significant population trends on the Forest. Based on results from breeding bird surveys (BBS) from 1966 through 2002, numbers of displaying woodcock declined in the Northeast in general, remained stable in northern New England, and increased in Vermont, although none of these trends is statistically significant (Sauer et al. 2003). Results of singing-ground surveys indicate significant declines in woodcock numbers in Vermont and in the Northeast in general from 1968 through 2005, significant decline in Vermont but not in the Northeast as a whole from 1995 through 2005, and non-significant increases from

2004 (Kelly and Rau 2005). PIF (2000a) listed the American woodcock to be a species of "high continental priority" and "high regional responsibility for Northern New England.

3. Ruffed Grouse

The ruffed grouse is selected as MIS for aspen/birch forest communities, which currently accounts for about three percent of the GMNF (Table 3.5-6 in Vegetation). The GMNF does not contain large tracts of inventoried aspen; however, small pockets and inclusions are distributed throughout lower elevations. A majority of the birch communities occur at higher elevations; these stands tend to be larger in size and more homogeneous than the aspen.

Because aspen-birch is a short-lived community, it is perhaps more sensitive than other forest communities to MA direction related to vegetation management. Existing stands are 89 percent mature and older (Table 3.5-7 in Vegetation), meaning that the abundance of aspen-birch is expected to decline across all alternatives by more than 50 percent over the short term. Mitigation of these anticipated losses requires regeneration and expansion of existing stands or creation of new stands, in the range of 2,200 to 18,500 acres, to meet long-term composition objectives. The existing condition of aspen-birch on the GMNF is described in detail in Section 3.5 Vegetation.

Ruffed grouse populations may fluctuate widely over a period of several years, but the species is widely distributed and secure on the GMNF. The Forest Service conducts drumming surveys along designated routes, but these surveys indicate no clear population trends on the GMNF (Toth 2000). Data collected for the BBS (PIF 2000a, Sauer et al. 2003) from 1966 through 2002 suggest no discernable population trend for ruffed grouse in Vermont, moderate increase for northern New England, but a significant decline for the Northeast as a whole. PIF (2000b) identified significant declines for ruffed grouse and listed the species as one of high priority for the eastern spruce-hardwood forest.

4. Gray Squirrel

The gray squirrel is proposed as MIS for oak and oak-pine forest habitat, which currently accounts for about one percent of the GMNF (Table 3.5-6 in Vegetation). The gray squirrel's relationship to oak communities, based on its preference for acorns, makes it a good indicator of management effects. Oak habitat is distributed more extensively in the lower elevation of the GMNF, along the escarpment on the western side of the Forest, and in the Taconic Mountains. Oak probably has never been abundant on the GMNF and existing oak and oak-pine forests on the GMNF are currently declining, although they are being augmented by land acquisition. The existing condition of oak-pine on the GMNF is described in detail in Section 3.5 Vegetation.

The GMNF has conducted nest surveys along pre-designated routes to determine relative changes in gray squirrel abundance based on leaf nest counts. The results from these surveys do not indicate any clear population trends (Toth 2000). The gray squirrel is a game species in Vermont and the population is considered viable, but trend data are not available at the State level.

5. Brook Trout

The brook trout is proposed as MIS for aquatic-riparian habitat. This species is a good indicator for changes in siltation, integrity of stream banks, or stability of water flow, water chemistry, and temperature regimes (Raleigh 1982). As upland forests on the GMNF mature, suitable habitat for brook trout will continue to persist and improve, as these older forest conditions provide better thermal protection and more woody material to maintain habitat quality (Toth 2000). Such improvement of stream habitat as a consequence of forest maturation should be considered a long-term outlook (for example, 100 years or greater). In the shorter term, management activities can substantially improve habitat for brook trout through bank stabilization, maintenance, and general enhancement of stream habitat. Elimination or limitation of riparian management activities probably would not affect the viability and sustainability of natural populations of brook trout on the GMNF, but it would prevent management of stream habitat toward the desired future condition, improvement of habitat

capability, and achievement of streams' full biological potential in the short-term.

On the GMNF, wild brook trout populations continue to sustain themselves through natural reproduction, although their numbers may fluctuate substantially from year to year. Kirn (2000) characterized brook trout populations in Vermont as having abundant natural reproduction and multiple age-classes, including the contribution of older, larger fish.

3.6.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Effects Common to All Indicators and All Alternatives

For the purpose of this analysis, effects over the short-term are defined as 20 years, and long-term effects are defined as 150 years.

Short-term objectives for tree-species composition (which apply Forest-wide) and age-structure (which apply only to the suitable landbase) are the same for all alternatives. The effects that these and other aspects of management direction have on forest structure are presented in detail in Section 3.5 Vegetation. Features of particular importance to wildlife habitat are summarized below.

Mature forest with continuous, closed canopy will predominate on the GMNF, providing ample and well-distributed habitat for species like the barred owl, pileated woodpecker (*Dryocopus pileatus*), ovenbird (*Seiurus aurocapillus*), flying squirrels (*Glaucomys* spp.), and fisher (*Martes pennanti*). This condition varies negligibly between the five alternatives. The projected proportion of the GMNF in mature or older forest after 20 years lies within a range of 75 to 82 percent for all five alternatives (Tables 3.5-16 through 3.5-20 in Section 3.5 Vegetation). After 150 years, the proportion is lower, 58 to 75 percent, but not appreciably different between alternatives. Canopy closure will be 70 percent or greater on mature and older forests, except in hardwood forests for the first decade after a shelterwood harvest and between entries in a delayed shelterwood system (A. Reger, personal communication, January 2005). The major difference between the age structure after the short and long-term is a reduction in the mature age class with increases in young and old age classes. Regeneration (0-9 year age class) consistently accounts for five to seven percent of the GMNF across all alternatives, for both the short and long-term (Tables 3.5-16 through 3.5-20 in Section 3.5 Vegetation).

Wilderness (Table 2.1-6: 59,001 acres, 15%) and the White Rocks NRA (22,758 acres, 6%) are congressionally designated areas that do not change by alternatives. White Rocks NRA allows limited opportunity for creation and maintenance of wildlife habitat; Wilderness does not. Differences between alternatives are created by the relative allocation of GMNF land to other MAs that do or do not allow timber or vegetation management.

Timber and vegetation management are allowed in the following MAs: Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Green Mountain Escarpment, and Moosalamoo Recreation and Education Area. Although White Rocks NRA is not part of the suitable landbase, limited timber and vegetation management is permitted, particularly for creation, maintenance, or enhancement of wildlife habitat. On these lands, the most common wildlife habitat management actions will be the following:

- Maintenance and enhancement of deer wintering habitat
- Creation of temporary openings of early successional habitat
- Maintenance of permanent openings
- Regeneration of important forest stands (aspen, oak, beech)

Timber and vegetation management activities are subject to Forest-wide direction. For example, standards and guidelines address the desired condition of deer wintering habitat; size and distribution of openings; retention of snags and trees used for dens, nests, or roosts, and mast-

producing trees; and the protection of rare and unique biological features. This management direction is common to all alternatives.

Indicator 1 – Acres of White-tailed Deer Wintering Habitat Allocated to Management Areas Allowing Vegetation Management

The five alternatives provide a range for allocating State-recognized and mapped, potential deer wintering areas to MAs in which vegetation management is allowed at different levels of intensities. The Forest Service manages almost 20,000 acres of these deer yards on the GMNF (Table 3.6-7).

Effects Common to All Alternatives

Forest-wide management direction for deer wintering habitat, in the form of standards and guidelines, is designed to maximize improvements to deer wintering areas while minimizing adverse impacts to other wildlife using these wintering areas. These standards and guidelines address silvicultural practices that enhance the quality of cover and browse, as well as management to minimize potential disturbance from human activities such as trails use, other recreation, or other activities. This management direction applies to all alternatives.

Alternative A

Alternative A proposes the least acreage of deer wintering areas in which vegetation management is permitted (Table 3.6-7: 13,826 acres, 69% of deer wintering area acres on the GMNF). Alternative A thus affords the least opportunity to maintain or enhance deer wintering areas. Deer wintering areas in many of the MAs that prohibit vegetation management (such as Wilderness, Remote Backcountry, and various special areas) tend to be centrally located, in more remote and relatively higher elevations of the GMNF. Deer wintering habitat in higher (and colder) elevations may be occupied less frequently or by fewer deer than those at lower elevations.

More than 2,200 acres of deer wintering areas are included in Newly Acquired Land in Alternative A. Management direction for Newly Acquired Land allows maintenance of existing permanent upland openings, but does not permit vegetation management for habitat improvement, nor does it allow relocation of trails. Standards and guidelines for deer wintering areas specifically direct that trails avoid or be relocated out of deer wintering habitat. Consequently, management options for existing cross-country ski and snowmobile activity in deer wintering areas in Newly Acquired Land are closure of the trails or continued use without re-routing or re-structuring trails. Trail closure can cause disruption of the trail system; continued use can drive deer out of an occupied wintering area.

Deer wintering areas in Newly Acquired Land are distributed across the Forest, not necessarily located in central, more remote areas typical of the other MAs in which vegetation management is prohibited. Thus, Alternative A includes a greater likelihood than the other alternatives of removing “preferred” deer yards from active vegetation management.

For these reasons, Alternative A least serves the interest of well-distributed and well-maintained deer wintering areas on the GMNF.

Alternatives B, C, D, and E

Alternative B proposes the most acreage of deer wintering areas in MAs where vegetation management is permitted (Table 3.6-7: 15,586 acres, 78%). Alternatives C, D, and E are similar to each other, proposing more acres in these MAs than in Alternative A, but fewer than in Alternative B: range from 14,591 acres (73%) to 14,988 acres (75%).

The maximal difference in manageable deer wintering areas (1,760 acres) is between Alternatives A and B. The total number of acres may represent a negligible difference on a Forest-wide scale. A measurable difference is in the distribution of wintering areas removed from management. Deer wintering areas excluded from vegetation management in Alternatives B through E tend to be centrally located, remote, and at relatively higher elevations of the GMNF.

A greater proportion of the areas removed from management in Alternative A is located at lower elevations, and potentially preferred by deer.

Differences between Alternatives B through E represent a range of 995 acres of deer wintering areas that are allocated to MAs without opportunities for vegetation management. Additionally, most of these acres are remote, high-elevation sites in all four alternatives. Consequently, the differences between these alternatives are negligible.

The combined effect of similar acreage of deer wintering areas available for management and high-elevation distribution of deer wintering areas removed from management is that Alternatives B through E provide equivalent opportunity for well-distributed and well-maintained deer wintering areas on the GMNF, and better opportunity to provide desired deer wintering conditions than Alternative A.

Indicator 2 – Early Successional Habitat Provided and Opportunities for its Management

Early successional habitat includes young, regenerating forests (0-9 years after stand-replacing, natural disturbance or timber harvest) and permanent, shrubby openings, which typically occur in upland settings. Each of the five alternatives provides increased acreage of regenerating forest from the current condition, but there is little difference among alternatives with respect to temporary openings. The five alternatives do provide a range of opportunity for the creation and maintenance of permanent upland openings.

Effects Common to All Alternatives

Forest-wide management direction includes composition objectives that call for maintaining one to five percent of the GMNF in permanent upland openings (Table 3.5-4 in Vegetation). The intent for management of these upland openings is to prevent natural succession of these openings back to mature forest. Management direction as to whether upland openings are maintained or not varies by MA-specific direction, which in turn varies slightly by alternatives by the relative allocation of land to different MAs.

Standards and guidelines address the size and distribution of both temporary and permanent upland openings. In the Remote Wildlife Habitat MA, patches of early successional habitat should be at least two acres in size, but patches larger than five acres will be emphasized. Patches of early successional habitat smaller than five acres should be created only in close proximity to other patches of regeneration habitat. This direction applies to all five alternatives.

The expected proportion of regenerating forest (0-9 year age class) falls in the range of five to seven percent for all alternatives. This is in spite of the fact that the five alternatives varying in the number of acres allocated to MAs allowing timber and vegetation management, the number of acres in the suitable landbase, and the projected number of harvest acres of regeneration activity (Table 3.6-8). None of these harvest-related differences exerts sufficient influence to change the proportion of the regeneration age class below five percent or above seven percent, either over the short- or long-term (Table 3.6-8 and Table 3.5-16 through Table 3.5-20 in Vegetation). A “background level” of natural disturbance (such as windthrow, flooding, and ice damage) should create temporary openings and regeneration on between one and three percent of the GMNF, with a relatively higher proportion in conifer and aspen-birch stands (see detailed discussion in Section 3.5 Vegetation).

The proportional representation of different forest types (including permanent upland openings) and different age-class forests (including regeneration) on the GMNF, and how they are influenced by environmental conditions, land type associations, and the management direction in each alternative, are discussed in greater detail in Section 3.5 Vegetation.

Alternatives A and D

Alternatives A and D provide the least opportunity for creation and management of permanent upland openings, allocating 55 and 57 percent, respectively, of the GMNF to MAs with high to moderate opportunity for creating or maintaining them (Table 3.5-13 in Vegetation). Most existing permanent openings re-allocated to MAs that prohibit maintenance would revert to older forest conditions through natural succession. The Forest Service would need to create up to 14,500 acres of new permanent upland openings to reach the upper end of the composition objective range in the revised Forest Plan. Given the reduced opportunity to manage for permanent openings in Alternatives A and D, the GMNF likely would remain at the lower end of the desired range (Table 3.5-4 in Vegetation). This would mean a slightly lower overall contribution to structural diversity for wildlife habitat on the Forest. Although early successional species would receive less benefit from these alternatives, it is difficult to determine whether this difference would be measurable.

Alternative B

Alternative B provides the greatest opportunity for management of permanent upland openings, allocating the highest proportion of GMNF land (Table 3.5-13 in Vegetation: 72%) to MAs with high to moderate opportunity for creating or maintaining them. Alternative B also includes the lowest likelihood of re-allocating existing permanent openings to MAs that prevent their maintenance. Given this greater overall management opportunity, the GMNF should be able to fall at the higher end of the desired range for permanent upland openings, thus making a greater overall contribution to structural diversity for wildlife habitat on the Forest. Early successional species should receive the greatest benefit from this alternative, although it is difficult to determine whether this difference would be measurable.

Alternatives C and E

Alternatives C and E provide intermediate opportunity for management of permanent upland openings, allocating 64 and 61 percent, respectively, of GMNF land to MAs with high to moderate opportunity for creating or maintaining them (Table 3.5-13 in Vegetation). Management opportunity for permanent openings would be slightly lower under Alternative C, with its relatively greater emphasis on Wilderness Study Area compared to the greater emphasis on Remote Wildlife Habitat under Alternative E. The level of management opportunity under either alternative should allow the GMNF to be within the desired range for permanent upland openings. The relative contribution to structural diversity for wildlife habitat on the Forest would be less than under Alternative B but greater than under Alternatives A and D. Early successional species should receive an intermediate level of benefit from Alternatives C and E compared to the other alternatives, although it is difficult to determine whether this difference would be measurable.

Indicator 3 – Acres Available as Habitat for Reclusive Wildlife Species

Suitable conditions for reclusive wildlife are provided primarily by MAs that emphasize semi-primitive non-motorized recreational opportunities or otherwise limit sources of repeated disturbance. Table 3.6-9 provides the range of acres allocated to MAs that provide remote habitat for reclusive wildlife species. The alternatives offer a linear range in remote conditions and habitat for reclusive species in the following order from least to most: A, B, C, E, D.

Effects Common to All Alternatives

Wilderness and the White Rocks NRA represent almost 82,000 acres (20% of the GMNF) and a major component of the lands that are potentially available for reclusive species. Acreage of Wilderness and White Rocks NRA are the same for all alternatives.

Alternative A

Alternative A allocates the least amount of land to MAs that provide remote habitat for reclusive wildlife species (Table 3.6-9: 90,645 acres, 23%). Because Alternative A is the "no action" alternative, the newly developed Remote Wildlife Habitat MA is not available. Habitat for reclusive species is available for limited improvement management in the White Rocks NRA, but all other remote habitat for reclusive wildlife in Alternative A (67,887 acres) is in MAs that do not allow vegetation management, thus limiting the opportunity for maintaining or enhancing the structural diversity of wildlife habitat in the more remote settings.

Alternative A includes more than 92,000 acres in Newly Acquired Land, in which management options are restricted to protection and inventory of existing resources and facilities. Existing permanent upland openings maintained primarily for wildlife can be maintained, but habitat improvement cannot be initiated. Additionally, Newly Acquired Land includes no commitment to creating or preserving remote settings for reclusive species. Newly Acquired Land includes a wide range of recreational opportunities; some areas provide remote conditions, whereas others include roads, snowmobile trails, cross-country ski trails, or footpaths. As a general rule, existing roads and trails are maintained, and existing recreational opportunities continue in Newly Acquired Land. Thus, some parts of Newly Acquired Land may contribute to suitable habitat for reclusive species, but most do not.

Considering all factors, Alternative A results in the least opportunity to provide remote habitat for reclusive wildlife species and the least opportunity for the maintenance and enhancement of wildlife habitat in remote areas. For these reasons, species that benefit from remote habitats and minimal disturbance will receive the least benefit from Alternative A.

Alternative B

Alternative B provides slightly more remote habitat for reclusive wildlife species (119,604 acres, 30%) than Alternative A, but less than all other alternatives (Table 3.6-9). Approximately 29 percent of remote habitat (34,873 acres) is in Remote Wildlife Habitat or White Rocks NRA and available for vegetation management to enhance habitat diversity; this is more than in Alternatives A and C but less than for Alternatives D and E. The remaining 71 percent (84,731 acres) of remote habitat is unavailable for habitat management under Alternative B.

Considering all factors, Alternative B results in the second least opportunity to provide remote habitat for reclusive wildlife species and intermediate opportunity for the maintenance and enhancement of habitat diversity in remote areas. Species that benefit from remote habitats and minimal disturbance will receive greater benefit under this alternative than from Alternative A but less benefit than from the other alternatives.

Alternative C

Alternative C provides an intermediate allocation of land to MAs that provide remote habitat for reclusive wildlife species (Table 3.6-9: 141,338 acres, 35%), but only 20 percent (28,481 acres) would be available for vegetation management in Remote Wildlife Habitat or White Rocks NRA. The remaining 80 percent (112,857 acres) of remote habitat would be in MAs unavailable for habitat management.

Considering all factors, Alternative C creates an intermediate opportunity to provide remote habitat for reclusive wildlife species but a low opportunity to manage and enhancement the diversity of wildlife habitat in remote areas. Species that benefit from remote habitats and minimal disturbance will receive an intermediate benefit from Alternative C, more than under Alternatives A and B but less than Alternatives D and E.

Alternative D

Alternative D provides the greatest allocation of land to MAs that provide remote habitat for reclusive wildlife species (Table 3.6-9: 198,057

acres, 49%). Alternative D also places the greatest proportion (33%) of this habitat (64,945 acres) in MAs that allow vegetation management for habitat improvement.

Considering all factors, Alternative D results in the greatest opportunity to provide remote habitat for reclusive wildlife species. Alternative D also provides the greatest opportunity for the maintenance and enhancement of habitat diversity in those remote areas. Species that benefit from remote habitats and minimal disturbance likely will receive the greatest benefit from Alternative D.

Alternative E

The total amount of remote habitat for reclusive species in Alternative E (Table 3.6-9: 171,837 acres, 43%) is less than in Alternative D, but more than in Alternatives A, B, and C. The relative proportion (31%) and the amount (53,157 acres) of this habitat allocated to MAs that allow vegetation management (Remote Wildlife Habitat or White Rocks NRA) in Alternative E also is less than in Alternative D but greater than in Alternatives A, B, and C.

Considering all factors, Alternative E results in the second greatest opportunity to provide remote habitat for reclusive wildlife species. This alternative also provides the second greatest opportunity for the maintenance and enhancement of habitat diversity in remote areas. For these reasons, species that benefit from remote habitats and minimal disturbance will receive less benefit under this alternative than under Alternative D but greater benefit than under Alternatives A, B, and C.

Indicator 4 – Acres of Habitat Available for Management Indicator Species and Their Population Trends

Management indicator species (MIS) for the revised Forest Plan (Table 3.6-2) are linked to two of the major wildlife habitat resource issues (deer wintering habitat and early successional habitat) and to three other important habitat types (aspen-birch, oak-pine, and aquatic-riparian habitat). Each of these MIS address issues or conditions directly associated with active habitat manipulation. Effects analyses for deer wintering habitat and early successional habitat are provided separately under Indicators 1 and 2 of this effects analysis.

For the remaining MIS related habitat types, the five alternatives provide a range of management options for aspen-birch, oak-pine, and aquatic-riparian habitats. These options stem primarily from the relative allocation of land to different MAs, and what opportunities or limits for management are provided by the MA-specific standards and guidelines. Particular factors of importance include:

- Allocation of acreage to MAs that provide varying levels of opportunity for application of timber and vegetation management as tools for creation, enhancement, and maintenance of wildlife habitat diversity,
- Numbers of acres of aspen-birch and oak-pine allocated to MAs that provide varying levels of opportunity for regeneration through vegetation management, and
- Numbers of miles of aquatic-riparian habitat allocated to MAs that provide varying levels of opportunity for restoration and enhancement activities.

Due in large part to the varying opportunities for timber and vegetation management, and for enhancement and other management of aquatic habitat, the five alternatives ultimately provide a range in the amount and quality of habitat available for MIS.

Effects Common to All Alternatives

Forest-wide management direction includes maintenance of less common but important forest types like aspen-birch and oak-pine. Composition objectives specifically address desired proportions of the GMNF to be covered, as well as the proportional age distribution for each forest type. Standards and guidelines also provide for retention of oak as mast trees. Timber management guidelines specify the application of even-aged silviculture for regeneration of aspen, birch, and oak.

Approximately 32 percent of inventoried aspen-birch on the GMNF is in existing Wilderness areas (GMNF unpublished GIS data layers) and unavailable for vegetation management, which does not change by alternative. Much of the aspen-birch on the GMNF does not occur in inventoried stands, but rather it occurs as small-patch inclusions in other stands. At present, there are not sufficient data on these inclusions to analyze the amount or quality of aspen habitat that they provide, or include them in the analyses of aspen on the GMNF. Because aspen-birch is a short-lived community, it is perhaps more sensitive than other forest communities to MA direction related to vegetation management.

Regeneration of oak-pine is possible in all MAs that allow timber and vegetation management. The Green Mountain Escarpment MA places a high level of emphasis on management of oak and oak-pine forests. Oak or oak-pine do not occur in Remote Wildlife Habitat MA under any alternative, and only two acres of inventoried oak occur in the White Rocks NRA. Limited tree cutting is permitted in several MAs, including Recreation Special Area, Alpine Ski Areas, Appalachian Trail, and Long Trail, but specific management activity within these MAs emphasizes enhancing the desired future condition of the MA; regeneration of specific forest types may not be compatible with other resource priorities.

Perennial streams generally are fish-bearing, and therefore potential habitat for brook trout, the MIS for aquatic-riparian habitat on the GMNF. Riparian restoration activities are subject to some limitation in certain MAs, limited to few activities in Newly Acquired Land (Alternative A only), and prohibited entirely in Wilderness and Wilderness Study Areas. Miles of perennial streams in existing Wilderness do not change by alternative. Limitation of stream management in Newly Acquired Land, designated Wilderness, and Wilderness Study Areas should not affect the viability and sustainability of natural populations of brook trout, but it would prevent management of stream habitat toward the desired future condition and improved habitat capability

Alternative A

Alternative A includes the greatest acreage of inventoried aspen-birch in MAs that allow high or medium opportunity for vegetation management (Table 3.6-10: 5,044 acres). However, Alternative A allocates the lowest proportion (55%) of GMNF lands to MAs with moderate to high opportunities for enhancement or creation of aspen-birch forest, and the greatest proportion (45%) to MAs where this management is prohibited (Table 3.6-10). Alternative A also includes slightly lower average annual harvest acres for silvicultural techniques that promote regeneration than do the other alternatives (Table 3.6-8 and SPECTRUM forest model results). Wildlife habitat projects, partnerships, and volunteer activities would take on a greater importance in lieu of commercial harvesting for encouraging regeneration of aspen. For these reasons, increasing the amount and quality of aspen or aspen-birch habitat on the GMNF will be most difficult under Alternative A. This alternative provides the least benefit to ruffed grouse and other species that depend on or frequent aspen-birch forests.

Alternative A does not allocate any acres of oak or oak-pine to the Green Mountain Escarpment MA, which provides the highest opportunity for maintenance of this habitat type, but it does allocate the greatest acreage (Table 3.6-11: 2,936 acres) to MAs that provide moderate maintenance opportunity. The relative ability to maintain or enhance oak and oak-pine forests depends on many factors, including but not limited to, land type associations and ecological tendencies of the land, the silvicultural tools available to managers (including prescribed fire), and harvest acres for particular applications, particularly for regeneration. [For a more detailed discussion of oak and oak-pine forest habitats, see Section 3.5.1.2 Environmental Consequences, in Vegetation.] Considering all factors together, Alternative A provides the least effective opportunity for the maintenance and enhancement of oak and oak-pine forests on the GMNF. The projected trend for amount and quality of oak and oak-pine habitat on the GMNF

is stable for the short-term, due to the longevity of the dominant species. Over the long-term, however, oak and oak-pine likely would decline under Alternative A (Table 3.6-11). Potential benefits to gray squirrels and other species that exploit oak-pine forests, such as wild turkeys, red-headed woodpeckers, black bears, and white-tailed deer would be lowest under Alternative A.

Alternative A does not include any land in Wilderness Study Areas (Table 2.1-6). Accordingly, no miles of perennial stream are lost to management opportunity in addition to the 58 miles in existing Wilderness areas (Table 3.6-12). Guidance for Newly Acquired Land allows management in streams to prevent erosion and siltation, but prevents other enhancement, restoration, and protection activities. These limitations should not affect the viability and sustainability of natural populations of brook trout, but they would prevent management of stream habitat toward the desired future condition, improvement of habitat capability, and achievement of full biological potential in the short term. In all other alternatives, Newly Acquired Land is allocated to other MAs, depending on the emphasis of each alternative.

Alternative B

Alternative B includes 4,689 acres of inventoried aspen-birch (Table 3.6-10) in MAs that allow high or medium opportunity for vegetation management. This is less than in Alternatives A and C and similar to the acreage in Alternatives D and E. Alternative B provides the highest potential for enhancement of aspen-birch on the GMNF by allocating the greatest proportion of land (73%) to MAs with moderate to high opportunities for vegetation management (Table 3.6-10). Overall, this alternative is more likely than the other alternatives to increase the abundance of aspen-birch forest toward the upper end of the desired long-term composition objective range for the Forest of five percent. This alternative would provide the greatest benefit to ruffed grouse and other species that exploit aspen-birch.

Alternative B allocates more acres of oak and oak-pine to the Green Mountain Escarpment MA (Table 3.6-11: 1,077 acres) than Alternative A but less than Alternatives C, D, and E. The combined acreage of existing oak and oak-pine allocated to high or moderate opportunity for maintenance of oak is 2,426 acres, which places it about 200 acres less than Alternatives C, D, and E, and about 500 acres less than in Alternative A. Considering all factors that affect management of oak and oak-pine, Alternative B provides a moderately effective opportunity for the maintenance and enhancement of these forest communities on the GMNF. The projected trend for amount and quality of oak and oak-pine habitat on the GMNF under Alternative B is stable for the short and long-term (Table 3.6-11). Alternative B provides low potential benefits to gray squirrels and other species that exploit oak-pine forests, such as wild turkeys, red-headed woodpeckers, black bears, and white-tailed deer.

Alternative B allocates 2,291 acres to Wilderness Study Area, more than Alternative A but substantially less than Alternatives C, D, and E (Table 2.1-6). These acres of Wilderness Study Area include only five miles of perennial streams (Table 3.6-12), slightly more than Alternative A but less than all other alternatives. The small amount of perennial stream removed from management under this alternative represents a negligible impact on the overall amount and quality of brook trout habitat on the GMNF.

Alternatives C

Alternative C includes about 5,000 acres of inventoried aspen-birch in MAs that allow high or medium opportunity for vegetation management (Table 3.6-10). This is similar to the acreage in Alternative A and greater than for Alternatives B, D, and E. Alternatives C and E are alike in allocating 66 to 65 percent (respectively) of the Forest to MAs that permit the creation of new stands of aspen-birch forest (Table 3.6-10). This proportion, while higher than Alternatives A and D, is lower than Alternative B. Overall, Alternative C would be expected to increase the abundance of aspen-birch forest more than Alternatives A and D, about the same as Alternative E, and less than Alternative B. Alternatives C and E are likely to increase aspen-

birch abundance toward the lower to middle portion of the desired long-term composition objective range. This alternative would provide an intermediate level of benefit to ruffed grouse and other species that exploit aspen-birch.

Alternative C allocates 1,742 acres of oak and oak-pine to the Green Mountain Escarpment MA (Table 3.6-11), which is more than Alternatives A and B, but less than Alternatives D and E. The combined acreage of existing oak and oak-pine allocated to high or moderate opportunity for their maintenance is 2,653 acres, identical to Alternatives C and D, about 200 acres more than Alternative B, and 300 acres less than in Alternative A. Considering all factors that affect management of oak and oak-pine, Alternative C provides a moderately effective opportunity for the maintenance and enhancement of these forests on the GMNF. The projected trend for amount and quality of oak and oak-pine habitat on the GMNF under Alternative C is stable for the short-term and a slight increase for the long-term, due primarily to the increased management opportunity provided by the Green Mountain Escarpment MA (Table 3.6-11). Thus, Alternative C provides moderate potential benefits to gray squirrels and other species that exploit oak-pine forests, such as wild turkeys, red-headed woodpeckers, black bears, and white-tailed deer.

Alternative C allocates more than 29,000 acres to Wilderness Study Area (Table 2.1-6), which is second only to Alternative D. These acres of Wilderness Study Area include 40 miles of perennial streams (Table 3.6-12). Combined with the streams in existing Wilderness, a total of 98 miles of perennial streams, or 21 percent of all those on the GMNF, would be removed from management under this alternative. Wilderness and Wilderness Study Area offer some level of protection to watersheds and stream habitat, but they also restrict the opportunity to restore stream habitat after natural disturbance or to enhance it by increasing the amount of large woody debris or through other activities (see discussion under Alternative D). Alternative C represents a greater potential for short-term adverse impact on the quantity and quality of brook trout habitat than Alternatives A and B, similar potential to Alternative E, but less than in Alternative D. Similarly, this alternative provides similar potential resource and human-use benefits as Alternative E, lower than with Alternatives A and B, but greater than in Alternative D.

Alternative D

Alternative D includes 4,479 acres of inventoried aspen-birch (Table 3.6-10) in MAs that allow high or medium management opportunity. This is less than in Alternatives A and C and similar to that in Alternatives B and E. Alternative D allocates 61 percent of Forest lands to MAs that allow moderate to high opportunity for the creation or enhancement of aspen-birch stands, six percent more than Alternative A, five and four percent (respectively) less than Alternatives C and E, and 12 percent less than under Alternative B (Table 3.6-10). Alternative D would likely create enough new aspen-birch forest to maintain this community at the low end of the desired long-term composition objective range. This alternative would provide a greater level of benefit to ruffed grouse and other species that exploit aspen-birch than Alternative A, but less than all other alternatives.

Alternative D allocates the greatest acreage of oak and oak-pine to the Green Mountain Escarpment MA (Table 3.6-11: 2,196 acres). The combined acreage of existing oak and oak-pine allocated to high or moderate opportunity for maintenance of oak (2,652 acres) is identical for Alternatives C, D, and E, about 200 acres more than Alternative B and 300 acres less than in Alternative A. Considering all factors that affect management of oak and oak-pine, Alternative D (along with Alternative E) provides the most effective opportunity for the maintenance and enhancement of these forests on the GMNF. The projected trend for amount and quality of oak and oak-pine habitat on the GMNF under Alternative D is increase for both the short- and long-term (Table 3.6-11). Alternative D, along with Alternative E, provides the highest potential benefits to gray squirrels and other species that exploit oak-pine forests, such as wild turkeys,

red-headed woodpeckers, black bears, and white-tailed deer.

Alternative D allocates almost 50,000 acres to Wilderness Study Area (Table 2.1-6), more than any other alternative. These acres of Wilderness Study Area include 60 miles of perennial streams (Table 3.6-12), which also is more than in any other alternative. This alternative doubles the amount of perennial stream that is removed from management to 118 miles, or about 25 percent of all perennial stream miles on the GMNF. Wilderness and Wilderness Study Area restrict the opportunity to restore stream habitat after natural disturbance or to enhance it by increasing the amount of large woody debris or through other activities. Management restrictions of this magnitude may diminish the overall quality of brook trout habitat on the GMNF.

Barring significant natural disturbance in Wilderness or Wilderness Study Areas (such as windthrow, fire, or land slide), lack of management opportunity may not have a great effect on the quality of brook trout habitat on the GMNF. Should such disturbances occur, they may cause erosion and siltation, blockage of stream flow, changes in temperature regimes, instability of stream banks, or alteration of channels. Additionally, many of the streams on the GMNF fall below Forest-wide objectives for quantity and distribution of large woody debris, an important structural component of stream habitat. Management restrictions in Wilderness and Wilderness Study Area should not affect the viability and sustainability of natural populations of brook trout, but they would prevent management of stream habitat toward the desired future condition, improvement of habitat capability, and achievement of full biological potential in the short term. Accordingly, Alternative D carries the greatest potential to adversely impact quantity and quality of brook trout habitat and the lowest potential resource or human-use benefits.

Alternative E

Alternative E includes 4,542 acres of inventoried aspen-birch (Table 3.6-10) in MAs that allow high or medium opportunity for vegetation management. This is less than in Alternatives A and C and similar to that in Alternatives B and D. Alternatives C and E are alike in allocating 66 and 65 percent (respectively) of the Forest to MAs that permit the creation of new stands of aspen-birch forest (Table 3.6-10). This proportion, while higher than Alternatives A and D, is lower than Alternative B. Overall, Alternative E would be expected to increase the abundance of aspen-birch forest more than Alternatives A and D, about the same as Alternative C, and less than Alternative B. Alternatives C and E are likely to increase aspen-birch abundance toward the lower to middle portion of the desired long-term composition objective range. SPECTRUM modeling predicts a lower proportion of hardwood clearcutting for this alternative than other alternatives except Alternative A, which translates to lower conversion of hardwoods to aspen-birch. (See the discussion of “Aspen and Birch Communities” under Alternative E in Environmental Consequences, Direct and Indirect Effects by Alternative, section 3.5.1.2 in Vegetation.) Overall, Alternative E would provide an intermediate level of benefit to ruffed grouse and other species that exploit aspen-birch.

Alternative E allocates 1,914 acres of oak and oak-pine to the Green Mountain Escarpment MA,, about 280 fewer acres than in Alternative D, about 170 more acres than in Alternative C, 800 more acres than in Alternatives B, and about 1,900 more acres more than Alternative A (Table 3.6-11). The combined acreage allocated to high or moderate opportunity for maintenance of oak (2,652 acres) is identical for Alternatives C, D, and E, about 200 acres more than Alternative B and 300 acres less than in Alternative A. Considering all factors that affect management of oak and oak-pine, Alternative E (along with Alternative D) provides the most effective opportunity for the maintenance and enhancement of these forests on the GMNF. The projected trend for amount and quality of oak and oak-pine habitat on the GMNF under Alternative E is increase for both the short- and long-term (Table 3.6-11). Alternative E, along with

Alternative D, provides the highest potential benefits to gray squirrels and other species that exploit oak-pine forests, such as wild turkeys, red-headed woodpeckers, black bears, and white-tailed deer.

Alternative E allocates more than 27,000 acres to Wilderness Study Area (Table 2.1-6), which is more than Alternatives A and B but less than Alternatives C and D. These acres of Wilderness Study Area include 40 miles of perennial streams (Table 3.6-12). Combined with the streams in existing Wilderness, a total of 98 miles of perennial streams, or 21 percent of all those on the GMNF, would be removed from management under this alternative. Wilderness and Wilderness Study Area offer some level of protection to watersheds and stream habitat, but they also restrict the opportunity to restore stream habitat after natural disturbance or to enhance it by increasing the amount of large woody debris or through other activities (see discussion under Alternative D). Alternative E represents a greater potential for adverse impact on the quantity and quality of brook trout habitat than Alternatives A and B, similar potential as under Alternative C, but less than Alternative D. Similarly, this alternative provides similar potential resource and human-use benefits as Alternative C, lower than with Alternatives A and B, but greater than under Alternative D.

Cumulative Effects

Effects Common to All Alternatives

Wildlife species and their respective populations that occur on the GMNF are greatly influenced by the amount, distribution, and overall availability of different habitats on the Forest. They also are influenced by the species and populations that occur in the surrounding region of central and southern Vermont, in the New England-Adirondack Ecological Province, and beyond. Mobile or migratory species can move freely on and off the Forest throughout the year; some may be seasonal residents, migrating annually as far as Central or South America. Maintenance of continuity between suitable habitat on a regional scale is important to these species, as this provides the opportunity for them to disperse across the region (or onto or off of the GMNF) to reinforce depleted populations. Even amphibians and reptiles, which may live their entire lives on the Forest, are dependent on region-wide populations for their long-term viability. These species are not capable of dispersing very far, but extirpation of local genetic populations breaks the connectivity within the population and reduces the species' overall viability (SVE Herpetology Panel 2002).

The landscape and associated habitats on and immediately adjacent to the GMNF, in central and southern Vermont, and in northern New England in general, are dominated by wooded conditions. The GMNF differs from surrounding habitats in that more than 95 percent is forested (Table 3.5-1 in the Vegetation section), compared to approximately 78 percent for private and other public ownership in Vermont as a whole (Johnson 1998, Klyza and Trombulak 1999, Wharton et al. 2003). During the past several decades, the amount of abandoned farmland reverting to forest in Vermont has exceeded the amount of forest land removed for development and other non-forest uses. This is particularly true in southern and central Vermont (Wharton et al. 2003). During this same time, forest ownership patterns in Vermont also have changed; numbers of owners have increased as average parcel size has decreased. In general, landowners with smaller parcels are less inclined to manage their land for timber production (Wharton et al. 2003).

One repercussion of the long-term, regional changes in ownership, land uses, and timber production has been a continuing maturation of forest land and decline in the amount and availability of early successional habitat, which is a concern across the Northeast in general (Brooks 2003, Litvaitis 2003c). This is particularly problematic for privately owned land (Brooks 2003, Litvaitis 2003c, Wharton et al. 2003), elevating the importance of the GMNF for providing this important habitat. Forest modeling (SPECTRUM output) projects that five to seven percent of the GMNF will be in the regenerating (0 to 9 year) forest age class for both the short- and long-term (Table 3.5-16 through Table 3.5-20 in Vegetation), assuming full implementation of

the revised Forest Plan. This does not change by alternative, but it is greater than the current condition. Regenerating forest is a major component of early successional habitat.

Mature forest with continuous canopy will predominate on the GMNF, varying negligibly under the five alternatives. The projected proportion of the GMNF in both mature and old forest for all forest types combined over the long-term will be within the range of about 60 to 70 percent for each alternative; ranges vary slightly by alternative but largely overlay (Table 3.5-16 through Table 3.5-20 in Vegetation). Crown closure of will be 70 percent or greater in all mature and older stands except during the first decade after shelterwood harvest, and for the interval between first and second entries with delayed shelterwood harvests (A. Reger, personal communication, January 2005). Combined, these shelterwood acres would affect five percent or less of the GMNF at any given time over 150 years, representing a negligible reduction in canopy closure.

Populations of game species on and adjacent to the GMNF are influenced significantly by game laws, seasons, and bag limits set by the Vermont Fish and Wildlife Department, as well as by weather and other factors. The GMNF can maintain and enhance deer wintering habitat on the Forest equally well under all alternatives, but events and conditions off-Forest likely will have much greater influence on the size and condition of the deer herd in Vermont. These off-Forest events and conditions are not affected by alternatives.

As human populations grow in the Northeast, land use will intensify over the long-term on privately owned lands. These changes include development of residential areas, vacation homes, and recreation areas. Public lands also will experience increased recreational use. Lands on the GMNF managed as remote habitat will become increasingly important to Vermont's reclusive wildlife species. Public lands, particularly those of the GMNF may become a refugium for species seeking seclusion from human activity.

Alternative A

Strengths of Alternative A relative to wildlife and wildlife habitats are limited. Assuming long-term continuation of regional habitat and land-use trends and of the direct and indirect effects of Forest Service management as described above, Alternative A likely would result in less well-distributed and well-maintained deer wintering areas on the GMNF than would the other alternatives. Regenerating forest habitat would be within a range of five to six percent of the GMNF (Table 3.5-16 in Vegetation), but the abundance of permanent upland openings, aspen-birch forests, and oak-pine forests would be at the low end of the range for each in Forest Plan objectives (Table 3.5-4). The reduced emphasis on the management of these habitat types in this alternative would mean that management on the GMNF is not likely to alleviate the regional decline of these forest communities. A lower commitment to lands with semi-primitive non-motorized recreation would provide the least long-term advantage to reclusive species, due largely to the limited ability to control existing activity on Newly Acquired Land. The cumulative, long-term effects of managing perennial streams and brook trout habitat under Alternative A could be substantial. The Forest Service could take action to prevent erosion and siltation, but could not enhance or restore stream habitat. The Forest Service has surveyed approximately 300 miles of perennial streams on the GMNF; a high percentage of these streams do not fully meet the desired future condition. Management limitations on Newly Acquired Land should not affect the viability and sustainability of natural populations of brook trout, but they would prevent improvement of stream habitat toward the desired future condition

Alternative B

Strengths and weaknesses of Alternative B relative to wildlife and wildlife relate directly to increased opportunity for vegetation and timber management.

The cumulative effects of this alternative on oak-pine communities are similar to those discussed for Alternative A, with abundance of this forest type at the low end of the desired long-term range. The GMNF would not contribute substantially to the regional abundance of this forest community. With its increased emphasis on Diverse Forest Use and reduced recommendation for additional Wilderness, Remote Backcountry, and other MAs that emphasize remote recreational uses, Alternative A would provide the smallest long-term contribution to the region's remote wildlife habitat.

Alternative B would have positive long-term, cumulative effects on the Forest-wide and regional trends in condition and distribution of permanent upland openings and aspen-birch communities. This alternative provides the greatest opportunity of all the alternatives for mitigating the regional decline in the abundance or quality of these communities. As development pressures continue to lead to losses in open uplands and some forest land, the availability of these communities on the Forest will become increasingly important over time. Cumulative effects for perennial streams would be continued enhancement and improvement of this resource on the GMNF and in the region.

Alternatives C and E

Alternatives C and E represent balances between providing opportunities for vegetation and timber management as well as wilderness resources and remote settings. These alternatives would provide long-term increases in permanent upland openings, aspen-birch, and oak-pine communities on the GMNF. Alternative E would be slightly more effective in promoting oak-pine than Alternative C. These alternatives would provide large contiguous areas of remote habitat for reclusive wildlife species. Other alternatives may provide greater management opportunities for one or more of these factors, but Alternatives C and E provide balanced mixes of opportunities for each factor.

The primary difference between Alternatives C and E relates to the increased emphasis on Remote Wildlife Habitat MA in Alternative E. This provides an opportunity for creation and maintenance of early successional habitat, aspen-birch or oak-pine communities, or mast-producing vegetation in remote settings. With anticipated long-term increases in development pressure and recreational use of public forest land, the availability of remote habitat will become increasingly important on the Forest and in the region. The ability to apply vegetation management to increase habitat diversity in some of these remote settings can potentially provide substantial benefit to the region's wildlife. The cumulative effect of Alternatives C and E would be well-distributed and diverse wildlife and wildlife habitats on the GMNF that contribute to the regional fauna.

By removing 40 miles (Alternatives C and E) of perennial streams from management, these alternatives could result in adverse, long-term, cumulative effects on riparian habitat. Many fish-bearing streams in the region are below optimal ranges for various parameters, particularly large woody debris (LWD). Natural forest-disturbance processes may gradually increase the introduction of LWD, but this may not reach substantial levels for 80 to 150 years (S. Roy, personal communication, January 2005).

Alternative D

This alternative provides the greatest development of habitat for reclusive species, and provides strong positive effects for enhancing the oak-pine forest community. Conversely, the cumulative effects for permanent upland openings and for aspen-birch would maintain these communities at the low end of the range for each in Forest Plan objectives. The long-term, cumulative effects of removing perennial streams from management under Alternative D are difficult to assess. Many fish-bearing streams in the region are below optimal ranges for various parameters, particularly large woody debris (LWD). Natural forest-disturbance processes may gradually increase the introduction of LWD, but this may not reach substantial levels for 80 to 150 years (S. Roy, personal communication, January 2005). The cumulative effects of

Alternative D would need to encompass effects of delayed attainment of desired future condition for perennial streams, as well as effects of future short-term effects that could not be mitigated through restoration and enhancement activities. These effects, particularly the latter, are difficult or impossible to predict in a programmatic analysis.

The long-term, cumulative effects of Alternative D would be to provide relatively greater benefit to species that inhabit continuous, mature or remote forest habitats, and relatively less benefit to species that inhabit a more diverse range of habitats. In many respects, Alternative D is the converse of Alternative B.

Shagbark roost, photo courtesy of Michael Burbank

Table 3.6-7: Acreage of potential wintering habitat for white-tailed deer allocated to MAs that allow vegetation management, allow limited vegetation management, or do not allow vegetation management for maintenance or enhancement of wintering areas, by alternative

	Alt. A Current Mgt.	Alt. B	Alt. C	Alt. D	Alt. E
	(acres)	(acres)	(acres)	(acres)	(acres)
Acres of deer wintering areas in MAs allowing vegetation management [1]	12,661 (63%)	14,421 (72%)	13,823 (69%)	13,738 (69%)	13,426 (67%)
Acres of deer wintering areas in MAs allowing limited vegetation management [2]	1,165 (6%)	1,165 (6%)	1,165 (6%)	1,165 (6%)	1,165 (6%)
Acres of deer wintering areas in MAs not allowing vegetation management [3]	6,093 (31%)	4,333 (22%)	4,931 (25%)	5,016 (25%)	5,328 (27%)
Total acres of deer wintering areas	19,919 (100%)	19,919 (100%)	19,919 (100%)	19,919 (100%)	19,919 (100%)

Sources: GMNF GIS Alternative A, B, C, D, and E Management Area Layers.
Notes:
[1] Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Green Mountain Escarpment, and Moosalamoo Recreation and Education Area (Alternatives C and E only).
[2] White Rocks NRA allows management of wildlife habitat near existing roads.
[3] Wilderness, Wilderness Study Area, Remote Backcountry, existing and candidate Research Natural Area, Ecological Special Area, Alpine Ski Area, Alpine Ski Area Expansion, Appalachian Trail, Long Trail, Recreation Special Area, Newly Acquired Land (Alternative A only).

Table 3.6-8: Acreages in the suitable for timber production landbase allocated to MAs that allow timber management, allow limited cutting of trees, do not allow timber or vegetation management, do or do not allow creation of new permanent upland openings, and estimated average annual acreage of early successional habitat created by clearcut and shelterwood regeneration during 20 years and 150 years of management under the revised Forest Plan, by alternative.

	Alt. A Current Mgt.	Alt. B	Alt. C	Alt. D	Alt. E
	(acres)	(acres)	(acres)	(acres)	(acres)
Suitable acres for timber production	157,673 (39%)	216,430 (54%)	193,791 (48%)	180,381 (45%)	189,616 (47%)
Land allocated to MAs that allow timber and vegetation management[1]	195,410 (49%)	269,605 (67%)	242,188 (60%)	223,006 (56%)	235,592 (59%)
Land allocated to MAs that are not in the suitable land base but allow limited cutting of trees for wildlife habitat[2]	22,758 (6%)	22,758 (6%)	22,758 (6%)	22,758 (6%)	22,758 (6%)
Land allocated to MAs that do not allow timber/ vegetation management[3]	182,524 (45%)	108,329 (27%)	135,746 (34%)	154,928 (39%)	142,342 (35%)
Average annual 0-9 year (regeneration) age class acres achieved through shelterwood regeneration and clearcut, first 20 years[4]	1,362	1,773	1,843	1,677	1,713
Average annual 0-9 year (regeneration) age class acres achieved through and shelterwood regeneration and clearcut, 150 years[4]	1,283	1,651	1,622	1,536	1,561
Projected % of GMNF in 0-9 year (regeneration) age class after 20 years[5]	5-6%	6-7%	6-7%	5-7%	6-7%
Projected % of GMNF in 0-9 year (regeneration) age class after 150 years[5]	5-6%	6-7%	6-7%	5-6%	5-6%
Land allocated to MAs that allow high opportunity level for creation and maintenance of permanent upland openings[6]	195,410 (49%)	266,711 (66%)	233,700 (58%)	205,296 (51%)	221,156 (55%)
Land allocated to MAs that allow moderate opportunity for creation and maintenance of permanent upland openings[2]	22,758 (6%)	22,758 (6%)	22,758 (6%)	22,758 (6%)	22,758 (6%)
Land allocated to MAs that allow little or no opportunity for creation and maintenance of permanent upland openings[7]	182,524 (45%)	111,223 (28%)	144,234 (36%)	172,638 (43%)	156,778 (39%)

Sources: GMNF GIS Alternative A, B, C, D, and E Management Area Layers, FEIS Timber Management Section (Table 3.13-9) for suitable land acreage.

Notes:

[1] Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Green Mountain Escarpment, and Moosalamoo Recreation and Education Area (Alternatives C and E only).

[2] White Rocks NRA allows management of wildlife habitat near existing roads.

[3] Remote Backcountry, Wilderness, Wilderness Study Area, existing and candidate Research Natural Area, Ecological Special Area, Alpine/ Subalpine Special Area, Recreation Special Areas, Alpine Ski Areas, Ski Area Expansion, Appalachian Trail, Long Trail, and Newly Acquired Land (Alternative A only).

[4] Average annual harvest estimates over the first 20 years for clearcut and shelterwood regeneration from SPECTRUM modeling. Note: other FEIS Sections may present harvest average acres over different time intervals that are appropriate for different effects: e.g., over the first 10 years (Section 3.13 Timber) or over 150 years (Section 3.5 Vegetation).

[5] Projected % of GMNF in 0-9 year age class from SPECTRUM modeling and Vegetation section: Tables 3.5-16 through 3.5-20.

[6] Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, and Moosalamoo Recreation and Education Area (Alternatives C and E only)

[7] Remote Backcountry, Wilderness, Wilderness Study Area, existing and candidate Research Natural Area, Ecological Special Area, Alpine/Subalpine Special Area, Recreation Special Areas, Green Mountain Escarpment, Alpine Ski Areas, Ski Area Expansion, Appalachian Trail, Long Trail, Wild and Scenic Rivers, and Newly Acquired Land (Alternative A only).

Table 3.6-9: Approximate acreage allocated to management areas that provide potential habitat for reclusive species, by alternative.

	Alt. A Current Mgt.	Alt. B	Alt. C	Alt. D	Alt. E
	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)
Area available to reclusive species[1] (% of GMNF)	90,645 (23%)	119,604 (30%)	141,338 (35%)	198,057 (49%)	171,837 (43%)
Reclusive species habitat allowing vegetation management[2] (% reclusive habitat)	22,758 (25%)	34,873 (29%)	28,481 (20%)	64,945 (33%)	53,157 (31%)
Reclusive species habitat prohibiting vegetation management[3] (% reclusive habitat)	67,887 (75%)	84,731 (71%)	112,857 (80%)	133,112 (67%)	118,680 (69%)

Sources: GMNF GIS Alternative A, B, C, D, and E Management Area Layers.
Notes:
[1] Wilderness, Wilderness Study Area, Remote Backcountry, Remote Wildlife Habitat, White Rocks NRA, Brandon Gap Research Natural Area, Branch Pond Ecological Special Area, and Alpine/Subalpine Special Area.
[2] Remote Wildlife Habitat and White Rocks NRA.
[3] Wilderness, Wilderness Study Area, Remote Backcountry, Existing and Candidate Research Natural Area, Ecological Special Area, and Alpine/Subalpine Special Area.

Table 3.6-10: Management opportunity for aspen and aspen-birch and projected trends of each for 20 years and 150 years, by alternative. Acreages for current condition (e.g., 2004) are the same as under Alternative A.

	Alt. A Current Mgt.	Alt. B	Alt. C	Alt. D	Alt. E
	(acres)	(acres)	(acres)	(acres)	(acres)
Existing aspen and aspen-birch in MAs available for vegetation management[1] (% total aspen-birch)	4,009 (35%)	3,654 (32%)	3,967 (35%)	3,444 (30%)	3,468 (30%)
GMNF lands allocated to MAs with high levels of management opportunity[1] for creation or enhancement of aspen and aspen-birch[4]	195,410 (49%)	269,605 (67%)	242,188 (60%)	223,006 (55%)	235,592 (59%)
Existing aspen and aspen-birch in MAs available for limited vegetation management[2] (% total aspen-birch)	1,035 (9%)	1,035 (9%)	1,035 (9%)	1,035 (9%)	1,074 (9%)
GMNF lands allocated to MAs with medium levels of management opportunity[2] for creation or enhancement of aspen and aspen-birch[4]	22,758 (6%)	22,758 (6%)	22,758 (6%)	22,758 (6%)	22,758 (6%)
Existing aspen and aspen-birch in MAs unavailable for vegetation management [3] (% total aspen-birch)	6,449 (56%)	6,804 (59%)	6,491 (56%)	7,014 (61%)	6,990 (61%)
GMNF lands allocated to MAs with low levels or no management opportunity [3] for creation or enhancement of aspen and aspen-birch[4]	182,524 (45%)	108,329 (27%)	135,746 (34%)	154,928 (39%)	142,342 (35%)
Projected trend in aspen and aspen-birch for next 20 years	stable or decline	increase	slight increase	stable or decline	slight increase
Projected trend in aspen and aspen-birch for 100-150 years	stable or decline	increase	stable or increase	stable or decline	stable or increase

Sources: GMNF GIS Alternative A, B, C, D, and E Management Area Layers. Trends for aspen, aspen-birch, oak, and oak-pine from Section 3.5 Vegetation, Tables 3.5-9 and 3.5-14.

Notes:

[1] Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Green Mountain Escarpment, and Moosalamoo Recreation and Education Area (Alternatives C and E only).

[2] White Rocks NRA allows management of wildlife habitat near existing roads.

[3] Wilderness, Wilderness Study Area, Remote Backcountry, existing and candidate Research Natural Area, Ecological Special Area, Alpine Ski Area, Alpine Ski Area Expansion, Appalachian Trail, Long Trail, Recreation Special Area, and Newly Acquired Land (Alternative A only).

[4] From Table 3.5-14 in Vegetation.

Table 3.6-11: Management opportunity for oak and oak-pine and projected trends of each for 20 years and 100-150 years, by alternative. Acreages for current condition (e.g., 2004) are the same as under Alternative A.

	Alt. A Current Mgt.	Alt. B	Alt. C	Alt. D	Alt. E
	(acres)	(acres)	(acres)	(acres)	(acres)
Existing oak and oak-pine in MAs providing a high level of opportunity for maintenance[1] (% total oak)	0 (0%)	1,077 (28%)	1,742 (46%)	2,196 (58%)	1,914 (51%)
GMNF lands with suitable ecological tendencies and high levels of management opportunity for oak and oak-pine[4]	0 (0%)	2,604 (7%)	7,968 (20%)	16,486 (42%)	13,691 (35%)
Existing oak and oak-pine in MAs providing a moderate opportunity for maintenance[2] (% total oak)	2,936 (78%)	1,349 (36%)	911 (18%)	456 (12%)	738 (13%)
GMNF lands with suitable ecological tendencies and medium levels of management opportunity for oak and oak-pine [4]	23,283 (59%)	21,873 (56%)	16,346 (41%)	7,545 (19%)	10,325 (26%)
Existing oak and oak-pine in MAs unavailable for vegetation manage-ment[3] (% total oak)	846 (22%)	1,355 (36%)	1,130 (30%)	1,130 (30%)	1,130 (30%)
GMNF lands with suitable ecological tendencies but low-level or no management opportunity for oak and oak-pine [4]	16,118 (41%)	14,925 (38%)	15,282 (39%)	15,514 (39%)	15,529 (39%)
Projected trend in oak and oak-pine for next 20 years	stable	stable	stable	possible increase	possible increase
Projected trend in oak and oak-pine for 100-150 years	stable or decline	stable	stable or increase	increase	increase

Sources: GMNF GIS Alternative A, B, C, D, and E Management Area Layers. Trends for aspen, aspen-birch, oak, and oak-pine from Section 3.5 Vegetation, Tables 3.5-10 and 3.5-11.

Notes:

[1] Green Mountain Escarpment.

[2] Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, White Rocks NRA, and Moosalamoo Recreation and Education Area (Alternatives C and E only).

[3] Wilderness, Wilderness Study Area, Remote Backcountry, Alpine/Subalpine Special Area, existing and candidate Research Natural Area, Ecological Special Area, Appalachian Trail, Long Trail, Recreation Special Area, Alpine Ski Area, Ski Area Expansion, and Newly Acquired Land (Alternative A only).

[4] From Table 3.5-11 in Vegetation.

Table 3.6-12: Approximate lengths of perennial streams allocated to management areas that prohibit restoration, enhancement, and other riparian management activities, by alternative.

	Alt. A Current Mgt.	Alt. B	Alt. C	Alt. D	Alt. E
	(Miles)	(Miles)	(Miles)	(Miles)	(Miles)
Miles of perennial streams located within existing Wilderness areas (% of miles on GMNF)	58 (12%)	58 (12%)	58 (12%)	58 (12%)	58 (12%)
Miles of perennial streams located in Wilderness Study Areas (% of miles on GMNF)	0	5 (1%)	40 (9%)	60 (13%)	40 (9%)
Miles of perennial streams located in Newly Acquired Land	100 (21%)	0	0	0	0
Total miles of perennial streams on the GMNF	468	468	468	468	468

Sources: GMNF GIS Alternative A, B, C, D, and E Management Area Layers. Mileage of perennial streams from National Hydrography Dataset in high resolution, Geodatabase format (NHDinGeo).

3.7 FISHERIES

Issue Statement

Concern is focused on the extent to which forest management emphasis should be placed on maintenance, enhancement, and restoration of fisheries (aquatic) habitat to provide for viable fish populations.

Indicator 1 – Acres in Management Area Allocations Most Subject to Ground-Disturbing Management Activities that could Impact Fisheries Habitat

The indicator to be used in this effects analysis is the number of acres in management area (MA) allocations most subject to ground disturbance that have potential to affect fisheries habitat. The MAs that have the most potential for ground disturbance include Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Escarpment, Recreation Special Areas, Moosalamoo Recreation and Education Area, Alpine Ski Areas, and Alpine Ski Area Expansion. All other MAs are subject to low, or no, levels of ground disturbing activities and are therefore not considered in this analysis. The indicator is important because the higher the number of acres subject to ground disturbing activities, the greater the potential for fisheries habitat degradation and reductions in fish productivity. Ground disturbances, consisting of soil erosion, sedimentation of stream and pond bottoms, and removal of riparian vegetation that shades streams and ponds, are the most important risks to the quality and quantity of fisheries habitat. Ground disturbance can result from activities such as tree harvests, prescribed burns, recreation development and use, trail and road construction and maintenance, downhill ski trail development, and mineral exploration and extraction.

Analysis Area

The analysis area for direct and indirect effects includes all federal lands managed by the Green Mountain National Forest (GMNF). These are the lands where fisheries habitat conditions are potentially subject to effects resulting from ground disturbing activities. The analysis area for cumulative effects consists of GMNF lands and the lands administered by public and private owners within subwatersheds that overlay (partially or fully) federal lands on the GMNF. Forest Service activities in each subwatershed have the potential to affect fisheries conditions throughout the entire subwatershed.

3.7.1 Affected Environment

Introduction

Fisheries habitat throughout Vermont including GMNF streams and ponds has been affected by past land management. From the late 1700s to the mid-1900s, land clearing, logging, river log drives, road construction, dam construction, and agricultural practices all led to degradation of fisheries habitat. More specifically, there were significant increases in sedimentation from soil erosion and runoff, widespread stream bank instability, and extensive channel alterations that included gravel extractions, dredging, and channel straightening. There was also large-scale removal of streamside (riparian) vegetation. These actions resulted in degraded water quality, loss or degraded fish spawning and rearing habitats, reduced shading and increased water temperatures, and the loss of woody debris cover and habitat diversity in stream channels. Additionally, the construction of dams for hydropower and manufacturing resulted in barriers to fish migration, which led to habitat fragmentation and the loss or reduction of native fish species, most notably the Atlantic salmon.

By the 1960s, water quality had improved as more land near streams and lakes reforested, and as better soil erosion and sediment control practices began to be used during logging and agricultural operations. There was still large-scale river and stream channelization occurring

throughout Vermont, however, especially following major flood events. Despite the channelization, young riparian timber stands were again providing shade and canopy over most upland streams and some rivers, and maintaining cool water temperatures needed by native fish species and other aquatic organisms (USDA 2004g). Fisheries habitat in streams recovered at a slower rate, however, than water quality conditions. This is because the ecological function of riparian vegetation to provide large woody debris (LWD) into stream channels had not yet recovered from earlier deforestation and therefore, stream habitat did not have the structure, cover, and diverse habitats it once had.

Today, GMNF riparian timber stands have aged and grown to provide excellent canopy over streams. They are beginning to contribute LWD (mostly small trees, limbs, and branches) to stream channels and recover the ecological processes and functions such as storage of sediment and coarse organic matter in small tributary streams (first order streams less than six feet wide). It will take many more decades of careful riparian area stewardship before these ecological processes are fully affecting larger fish-bearing streams.

Although GMNF streams are recognizably not at optimum or reference conditions in most situations, they do provide abundant cold-water habitat for naturally reproducing populations of native fish species, desirable non-native fish species, and many other self-sustaining aquatic organisms such as insects and amphibians. These waters also provide an important recreational trout fishery for anglers, especially the native brook trout. This species is widely distributed throughout the Forest and is an important biological indicator of healthy stream conditions. In Vermont, present-day brook trout are characterized by abundant natural reproduction and multiple age-classes (Vermont Department of Fish and Wildlife 2000). On the GMNF, population viability will likely be maintained and populations, although quite variable, are expected to be secure. Habitat trends on the GMNF will continue to persist and improve as upland riparian forests increasingly provide necessary thermal protection and a source of LWD to maintain and enhance habitat quality.

Atlantic salmon restoration is an important component of the fisheries program on the GMNF. Many White River and West River watershed streams that drain into the Connecticut River Basin are important for Atlantic salmon restoration. Salmon fry are stocked annually into many streams, and juvenile salmon populations and their habitat are monitored on an annual basis. Since 1987, the GMNF has served as a member of the technical committee for the Connecticut River Atlantic Salmon Commission (CRASC), a multi-State, multi-agency cooperative for the restoration of Atlantic salmon and other anadromous fish species.

Most lakes and ponds on the GMNF are located at high elevations in the mountains. Fisheries habitat in these ponds is generally classified as cold-water habitat for native brook trout. Currently, there is little or no natural reproduction in these waters primarily due to the impacts of acid deposition and/or the lack of suitable spawning. As a result, the ponds are managed through annual trout stocking. Grout and Wallingford ponds provide suitable habitat for warm-water species such as smallmouth bass, chain pickerel, yellow perch, and brown bullhead. In addition, large reservoirs on or near the Forest, such as Chittenden, Somerset, and Harriman, support both cold and warm water fisheries. These water bodies provide a recreational fishery to anglers and families seeking a quality fishing experience in a mountain setting.

Existing Forest Plan Management Direction

The 1989 Forest Plan Fisheries Amendment (Amendment 6) provides comprehensive fisheries management direction and conservation measures, particularly for restoration of Atlantic salmon, and enhancement of brook trout and other native species. Special attention is given to riparian areas to promote the growth of large trees that would later fall into the stream channel and restore fish habitat over the long-term. There is

direction in the amendment to actively manage and restore fisheries habitat over the life of the Forest Plan on the Forest.

The 1989 Amendment directs the Forest Service to meet all federal, State, and local laws governing management of the National Forest, including the Clean Water Act and National Forest Management Act. The amendment also directs the Forest Service to determine existing habitat capability and identify limiting factors for fisheries resources in GMNF waters. The long-term direction is to maintain, enhance, and restore fish populations, fisheries spawning and rearing habitats, as well as other habitat used by native aquatic species such as insects and amphibians.

Amendment 6 also provides for protection, enhancement, and restoration of riparian habitat for improving stream temperatures, increasing quantities of LWD, and improving habitat quality and diversity. Since 1989, the Forest Service implemented this direction through activities such as fish stocking, riparian and stream habitat restoration, and in the field application of S&Gs, Acceptable Management Practices (AMPs), and other measures to protect fisheries and aquatic habitats where land management activities occurred.

Proposed Changes in Management Direction Common to All Alternatives

The revised Forest Plan will continue and improve upon direction in the 1987 Forest Plan and 1989 Fisheries Amendment. The revised Plan direction, such as Goal 4, emphasize the restoration of ecological processes in aquatic ecosystems, and the use of accepted geomorphic assessment and state-of-the-art stream habitat restoration techniques. This approach will benefit a wide range of native aquatic organisms and fish species. The Forest Service will accomplish many of the goals and objectives for the fisheries and aquatic resources program by maintaining and expanding cooperative agreements and formal partnerships.

Revised fisheries and riparian S&Gs will add additional protection to maintain stream bank stability and water temperatures through appropriate levels of shading along streams. New information from scientific literature and almost two decades of monitoring and evaluating stream habitats and restoration projects are being incorporated into the revised Plan for implementation in future projects. For example, the 1987 Plan contains a guideline for maintaining LWD quantities in streams to about 50 pieces of LWD per mile. Recent research and LWD recruitment modeling conducted by the Northeast Research Station (Lester 2003, Nislow 2003) indicates that northern New England streams could reasonably attain LWD loading levels in streams of up to 200 pieces of LWD per mile.

Existing Condition

Several major watersheds in Vermont originate in the GMNF. At higher elevations, these streams and their small tributaries generally support native brook trout populations. Slimy sculpin and Blacknose dace are often found with brook trout in these streams. Other common fish species found in larger streams at lower elevations include Longnose dace, White sucker, Creek chub, Common shiner, Tessellated darter, Fallfish, Rainbow trout, Brown trout, and Atlantic salmon. Macro-invertebrates, such as aquatic insects and crayfish, are also common in many streams.

Extensive fisheries surveys have been conducted Forest-wide since the mid-1980s. Approximately 300 miles of habitat in more than 50 streams have been inventoried and monitored for fish populations and habitat conditions. Evaluations of these data indicate the overall quality of fish habitat in streams on the GMNF is good (USDA 1987-2004). This means that of the streams surveyed on the Forest, many meet a majority of the fisheries and riparian S&Gs or desired future conditions (DFCs) described in the 1987 Forest Plan. This is especially true for water temperature, stream shading, and bank stability parameters. The streams that do not meet S&Gs or DFCs usually are deficient in the existing quantities of LWD, in-stream cover, pool quantity and

quality, or have high stream sedimentation levels in spawning or rearing habitat (USDA 2001b).

To address these deficiencies, the GMNF has implemented habitat restoration in streams that involve the placement of LWD (trees with and without root systems). Large woody debris greatly influences channel morphology and aquatic habitats. Using the stream's natural flow regime, woody debris stores, sorts, and distributes sediment, creates habitat features such as pools and riffles, adds diversity, and provides cover. LWD also traps and retains organic matter that is processed by aquatic organisms, and adds nutrients to the aquatic ecosystem. A large number of fish and insect species occupy the pools and riffles created by woody debris.

The GMNF is working cooperatively with other federal and State fisheries agencies to restore sea-run Atlantic salmon to the Connecticut River Basin. In recent years, approximately 5-10 million salmon fry have been stocked annually throughout the Connecticut River Basin. Of that total, GMNF personnel and partners stock approximately 600,000 to 1,000,000 salmon fry in 17 streams. Forest Service personnel also monitor juvenile salmon populations and habitat conditions in streams, and perform habitat restoration projects to improve salmon rearing habitat. The program is achieving results as adult sea-run Atlantic salmon are successfully returning to the Connecticut River each year. As of 2004, the sea-run Atlantic salmon have returned to the Connecticut River Basin for 31 consecutive years.

3.7.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Fisheries habitat restoration and enhancement are not considered in the analysis because these activities are permitted by standards and guidelines in all MAs. The effects of fisheries habitat restoration and enhancement would not vary by alternative.

Fisheries S&Gs, in-field methods, or other special measures for protecting fish and fisheries habitat are effective when implemented. Under all alternatives it is anticipated that fisheries habitat would be protected and the effects of implementing one alternative over another would be minimal because protection measures would minimize the impacts on this natural resource. This would be the case over the short and long-term. The opportunity for human error exists, however, so the discussion of direct and indirect effects considers the potential adverse effects management actions could have as a function of the amount of ground-disturbing activities permitted.

Indicator 1 – Acres in Management Area Allocations Most Subject to Ground-Disturbing Management Activities that could Impact Fisheries Habitat

Indicator 1 reveals differences between alternatives in the acreage of MA allocations most subject to ground disturbing activities that could negatively impact fisheries habitat. Ground disturbing activities have the potential to degrade fisheries habitat to varying degrees. Usually the greater the number of acres of ground disturbance, the greater the potential for degradation. If fisheries habitats are degraded, the productivity of streams and ponds would decrease.

Although there is opportunity for soil disturbance within the MAs discussed, only a relatively small portion of the MAs would actually be subject to ground-disturbing activities in any given alternative. The estimated acreage for various ground disturbing activities is provided in the Forest Plan Proposed and Probable Practices (revised Forest Plan, Appendix D). Although these acres are specific to Alternative E, they are not expected to vary by alternative except those associated with timber harvest activities. The Timber Management section of Chapter 3 (Table 3.13-6) provides the potential acres harvested under each alternative.

The direct and indirect effects of land management practices were considered in this analysis. The most common practices having potential negative effects on fisheries habitat are displayed in Table 3.3-1 (in the Water Section), along with their effects.

The potential direct effects include increased sedimentation, loss of riparian vegetation, loss of LWD in stream channels and ponds, and fish migration barriers at culverts. The potential indirect effects include increases in water temperature (thermal pollution), degradation of fish spawning and rearing habitat, and adverse changes in hydrology and geomorphology. Most of these effects, if they occur, can last for several years or decades. It is important to state that the fisheries effects described above and listed in Table 3.3-1 are expected if no resource protection measures, such as S&Gs, are implemented. This would not be the case on the GMNF because S&Gs and other protection measures are implemented on every project. These protection measures minimize the negative impacts to fisheries habitat.

Effects Common to all Alternatives

Despite the acreage difference of 74,475 acres (19%) between the alternatives with the most and least amount of land subject to ground disturbance, the actual variation between alternatives as they relate to the effects on fisheries habitat would be small. Also, the overall risk of degradation or loss of fisheries habitat would be low for all alternatives. Despite this indicator revealing differences in the acreage of MA allocations most subject to ground disturbance, the actual differences would be small because fisheries and riparian habitat protection measures in the Forest Plan would keep soil erosion and runoff, turbidity, sedimentation of fish spawning and rearing habitats, and loss of riparian vegetation at low levels.

Alternative A

As displayed in Table 3.7-1, Alternative A would have the lowest acreage of lands most subject to ground disturbance at 198,872 acres (50%). This indicates that the risk of ground disturbance resulting in sedimentation, loss of fish spawning and rearing habitats, and degradation of riparian habitat and water quality would be lowest for Alternative A.

Alternative B

Alternative B would have the highest acreage of lands most subject to ground disturbance at approximately 273,347 acres (68 %). This indicates that the risk of ground disturbance resulting in sedimentation, loss of fish spawning and rearing habitats, and degradation of riparian habitat and water quality would be highest for Alternative B.

Alternatives C, D, and E

Alternatives C, D, and E would be intermediate in acreage most subject to ground disturbance with a range of 226,748 (57 %) to 245,930 acres (61%). This indicates that the risk of ground disturbance resulting in sedimentation, loss of fish spawning and rearing habitats, and degradation of riparian habitat and water quality would be higher than Alternative A, but less than Alternative B.

Table 3.7-1: Acres in MA Allocations Most Subject to Ground Disturbing Activities

Alternative	Acres
A	198,872 (50%)
B	273,347 (68%)
C	245,930 (61%)
D	226,748 (57%)
E	239,156 (60%)

Source: GMNF GIS Alternative A-E MA Layers. MA Allocations most subject to disturbance are Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Escarpment, Recreation Special Areas, Moosalamoo Recreation and Education Area, Alpine Ski Areas, and Alpine Ski Area Expansion. Notes: Percents in parentheses indicate the percent out of the total GMNF GIS acreage (400,692 acres).

Cumulative Effects

The cumulative effects on fisheries and riparian habitat conditions from implementing any alternative of the revised Plan consist of the effects of land disturbing activities in the short-term and long-term. The analysis area for cumulative effects consists of all GMNF lands and all other lands in subwatersheds that overlay (partially or fully) federal lands on the GMNF.

The impacts on fisheries and riparian habitat conditions from implementing the revised Plan would be minor within the cumulative effects analysis area. This is because the past, present, and foreseeable future impacts of GMNF management activities are small. Over the next planning period, fisheries and riparian habitat on the GMNF should improve as a result of implementing restoration and improvement projects, and affect the analysis area in a positive manner. The cumulative effects to fisheries habitat conditions on privately owned lands could degrade due to increased public demands for new development and infrastructure. Over the long-term, fisheries habitat conditions on National Forest System lands are expected to improve due to increased emphasis on fish habitat protection and restoration.

At elevations above 2,500 feet, the effects to fisheries resources on non-federal lands are similar to those on the GMNF since similar land management occurs. The effect on fisheries on privately owned lands in lower elevations and in valley bottoms is markedly different. Continued agriculture, grazing practices, road construction and maintenance, and home and business development place a greater risk on stream sedimentation, loss of riparian vegetation, fish migration barriers, and fish habitat degradation occurring. Although important to consider, these activities are highly regulated by many federal and State laws and therefore, effects are normally of a limited extent.

Release of juvenile salmon

3.8 THREATENED AND ENDANGERED SPECIES

The Forest Service is required to comply with provisions of the Endangered Species Act of 1973 (ESA), as amended, which defines species that are "endangered" or "threatened." An endangered species is one in danger of extinction throughout all, or a significant portion of, its range. A threatened species is one that is likely to become endangered in the foreseeable future. The US Fish and Wildlife Service (USFWS) is responsible for administering the ESA.

This section addresses the current condition of federally listed, threatened and endangered species on the GMNF, and the potential effects that different Forest Plan alternatives may have on them. The Forest Service approaches issues related to biological diversity and species viability on two different scales. Coarse-scale indicators track general resource concerns and habitat conditions for wildlife and wildlife habitat (analyzed in Section 3.6 of this chapter). Fine-scale indicators catch species that "fall through the cracks" of the coarse filter. These include threatened or endangered (TE) species of plants and animals (this section), Regional Forester sensitive species (RFSS), and other species of plants and animals of potential viability concern (analyzed in Section 3.9 of this chapter). The Biological Evaluation (BE: Appendix E) also addresses potential effects of the revised Forest Plan on TE species and RFSS. Other sections of Chapter 3 include habitat-related discussions for plants and vegetation (Section 3.5) and fisheries (Section 3.7).

Five federally listed TE animal species are of concern for the GMNF: gray wolf (*Canis lupus*), eastern cougar (*Puma (=Felis) concolor cougar*), Canada lynx (*Lynx canadensis*), Indiana bat (*Myotis sodalis*), and bald eagle (*Haliaeetus leucocephalus*). There are no TE plant species of concern for the GMNF, nor are there any plant or animal species proposed for listing under the ESA that occur on the Forest. The BE presents the detailed analysis of the effects of the revised Forest Plan on TE animal species. The BE concludes that one of these species, the Indiana bat, may be present on the GMNF and may be affected by management actions authorized by the revised Forest Plan. Given current population trends, it is likely that numbers of Indiana bats in the Northeast will continue to increase in the future. The BE further concludes that implementation of the revised Forest Plan, under any of the proposed alternatives, may affect, but is not likely to adversely affect, the Indiana bat.

The BE also concludes that implementation of the revised Forest Plan, under any of the proposed alternatives, will have no effect on the other listed species. This conclusion is based on the fact that although some suitable habitat components may exist on the GMNF for the gray wolf, eastern cougar, and Canada lynx, these species are not known to occur on, or in the vicinity of, the GMNF. The bald eagle currently is a non-nesting, occasional, seasonal visitor to the GMNF. During a previous consultation, the USFWS (2000a, b) concluded that continued implementation of the 1987 Forest Plan would have no effect on the gray wolf, eastern cougar, and bald eagle, and was not likely to jeopardize the continued existence of Canada lynx. The likelihood that the status of any of these species will change during the next 20 years is low. Should the status of one of these species change, the Forest will reinitiate consultation with the USFWS. In light of their current status, however, the gray wolf, eastern cougar, Canada lynx, and bald eagle are not analyzed further in this section.

The GMNF does not include designated critical habitat or proposed critical habitat for any TE species, including Indiana bat.

Issue Statement

Public concern is focused on ensuring that federally listed, threatened and endangered species are considered during development of the revised Forest Plan and during project implementation. The Indiana bat is the one federally listed, endangered or threatened species analyzed in this section.

Indicator 1 – Acres Allowing Management Activities That May Affect Habitat or Population Trends of Indiana Bats

Indiana bats are at the edge of their range in Vermont, but they are known to occur on the GMNF and elsewhere within the Proclamation Boundary. Continuing surveys, monitoring, and other research have narrowed the focus for Indiana bats on the GMNF to limited areas on the western side of the Forest where this species is most likely to occur. Management activities on these lands that could affect Indiana bats primarily stem from timber or vegetation management. Potential adverse effects include direct affects from killing or injuring bats during removal of or damage to an occupied roost tree or snag, or indirect effects from reducing quantity or quality of potential roosting habitat by removing existing or potential roosting trees or snags. Potential beneficial effects include creation of openings or patches in which canopy closure is reduced, thereby enhancing the mosaic of suitable roosting and foraging habitats in close proximity to each other. This indicator differentiates between alternatives by comparing acreage of GMNF lands allocated to management areas that do or do not allow timber and vegetation management activities, and how these allocations might affect Indiana bats.

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the GMNF. Because the Indiana bat is highly mobile and capable of covering great distances between hibernacula and summer roosting and foraging habitats, the analysis area for cumulative effects is the Green, Taconic, and Berkshire Mountain ecological sections that encompass the GMNF. These sections are sufficiently large to encompass whole populations of this species, whereas ecological subsections may not be.

3.8.1 Affected Environment

Introduction

The Indiana bat is the one federally listed, threatened or endangered (TE) species discussed in this section. This section summarizes the analysis of direct, indirect, and cumulative effects and determinations made for the Indiana bat in the Biological Evaluation (BE).

The USFWS listed the Indiana bat as endangered under the ESA in 1967 (USFWS 1983). Censuses suggest a range-wide decline of about 60 percent from 1960 to 2000. Since the early 1980s, however, numbers of Indiana bats in New York and New England are stable and may be increasing (Clawson 2002, SVE Mammal Panel 2002, 2003). Indiana bats are known to use two hibernacula (Dorset Cave and Skinner Hollow Cave) within the GMNF Proclamation Boundary near Manchester, Vermont, and a third hibernaculum (Brandon Silver Mine) adjacent to the Proclamation Boundary in Brandon, Vermont. To date, there are only two recent, documented occurrences of Indiana bats on the GMNF (Kiser et al. 2001, Beverly et al. 2002, GMNF and Vermont Fish and Wildlife Department, unpublished data). The presence of this species on the Forest may become more likely if regional populations continue to grow.

The Forest Service prepared a Biological Assessment (USDA 1999a) for consultation with the USFWS on potential impacts that continued implementation of the 1987 Forest Plan might have on TE species, particularly the Indiana bat. The USFWS concluded in its Biological Opinion (USFWS 2000a, b) that continued implementation of the 1987 Plan would have no effect on the gray wolf, eastern cougar, and bald eagle, and was not likely to jeopardize the continued existence of the Indiana bat or the Canada lynx. The Biological Opinion included an incidental take statement that outlined reasonable and prudent measures to minimize potential adverse impacts of forest management actions on Indiana bats. The

Forest Service immediately incorporated these measures into the standards and guidelines for the 1987 Forest Plan (USDA 2001a, 2002d).

As part of the current Forest Plan revision process, the Forest Service analyzed the Indiana bat, and all other TE species, in the BE. The BE concludes that implementation of the revised Plan under any of the proposed alternatives will have no effect on the gray wolf, eastern cougar, Canada lynx, and bald eagle. The BE further concludes that the Indiana bat may be present on the GMNF, and given current regional population trends, it is likely that numbers of Indiana bats in the Northeast will increase during the life of the Plan. The BE also determines that implementation of the revised Plan under any of the proposed alternatives may affect, but is not likely to adversely affect, the Indiana bat.

The Forest Service also analyzed TE species, including the Indiana bat, Regional Forester sensitive species, and other species of potential viability concern as part of the Forest's Species Viability Evaluation process (see the Species of Potential Viability Concern section 3.9). This process evaluated species' status, distribution, trends, life history characteristics, habitat needs at various scales, threats, and important ecological processes to help identify limiting factors and management approaches that might contribute to species' viability. This analysis concluded that viability for the Indiana bat is of less concern on the GMNF than on a range-wide scale.

Existing Forest Plan Management Direction

The existing management direction for the Indiana bat and other TE species is based on the provisions of the Endangered Species Act (ESA). Section 7(a) (2) of the ESA states that no federal agency should authorize, carry out, or fund any action "likely to jeopardize the continued existence of a listed species…" Accordingly, the Forest Service evaluates the effects of ongoing management practices, including implementation or revision of the Forest Plan, on species of plants and animals that are threatened, endangered, or proposed for listing as threatened or endangered. Through formal consultation, the Forest Service and the USFWS determine whether any listed species is likely to be affected. If necessary, the USFWS can recommend reasonable and prudent alternatives or other measures to minimize potential impacts.

Section 7(a) (1) of the ESA states that all federal agencies "should participate in the conservation and recovery of listed threatened and endangered species." The Forest Service actively fosters constructive working relationships with other federal and State resource management agencies, academic researchers, and other partners to maintain active involvement in regional conservation efforts and to keep abreast of changes in the regional status, distribution, and population trends of Indiana bats and other TE species. Such regional involvement enhances the ability of the Forest Service to respond quickly with appropriate management actions.

Management direction in the 1987 Forest Plan that addresses conservation of TE species, both directly and indirectly, is provided in goals that:

- Preserve and enhance the diversity of plant and animal communities on the GMNF
- Maintain adequate quality, amount, and distribution of habitats to support viable populations of all existing native and desired non-native vertebrate species on the National Forest
- Protect all threatened, endangered, and sensitive species, as well as other species of concern on the National Forest

In 2002, the Forest Service amended the 1987 Plan to update objectives, standards, guidelines, and monitoring requirements. This amendment was primarily in response to a Biological Opinion from the USFWS (2000b) on Indiana bat, but also in recognition of necessary changes for Regional Forester sensitive species (RFSS). In the amendment, the Forest Service identified objectives for inventory, evaluation, mitigation, assessments, and agreements dealing with TE species and RFSS.

The amendment updated standards and guidelines for wildlife reserve trees to ensure that roost trees preferred by Indiana bats would be retained during management activities. The amendment reorganized and updated Forest-wide standards and guidelines for all TE species and RFSS, and updated monitoring requirements. The Forest Service based these changes on conservation measures and other terms and conditions provided in the Biological Opinion (USFWS 2000b) for protection and conservation of the Indiana bat.

The 1987 Plan, as amended, also includes standards to prevent disturbances and habitat modification near nests of bald eagles and peregrine falcons. The USFWS de-listed the peregrine falcon August 25, 1999, but Section 4(g) (1) of the ESA requires that the status of a species must be monitored for not less than five years after it is de-listed (64 FR 46541). The Forest Service participates in this monitoring effort in conjunction with the USFWS, the National Wildlife Federation, the Vermont Fish and Wildlife Department, and the Vermont Institute of Natural History (VINS).

Proposed Changes in Management Direction Common to All Alternatives

Some of the direction contained in the 1987 Plan is redundant to agency policy, as documented in Forest Service Manuals and Handbooks, including regional supplements. Other aspects of management direction in the 1987 Plan, including several standards and guidelines for Indiana bat and other TE species, provide operational rather than strategic direction. To reduce this redundancy, the Forest Service removed management direction documented in agency policy from the revised Plan. Operational direction also was removed from the revised Plan; it will be transferred to supplements of Forest Service Manuals and Handbooks.

The revised Forest Plan includes few proposed changes in management direction for TE species in general. Most of these changes do not represent substantive changes; rather they reflect changes in language for simplification and clarity. Goal 2 in the revised Plan directs the Forest Service to “Maintain and restore quality, amount, and distribution of habitats to produce viable and sustainable populations of native and desirable non-native plants and animals.” This goal encompasses general objectives addressing maintenance and enhancement of habitats and retention of wildlife reserve trees. This goal also includes an objective that explicitly identifies implementing established recovery or conservation strategies for TE species in accordance with USFWS guidelines.

Other than changes to standards and guidelines (S&Gs) for wildlife reserve trees (see below), the revised Plan includes no substantive changes to Forest-wide S&Gs that are relevant to TE species. The revised Plan reorganizes S&Gs so that those addressing wildlife, wildlife habitat, and rare and unique biological features, including threatened, endangered, proposed, and sensitive species, species of local interest, and rare and exemplary natural communities all appear together in one section. Other changes reflect revision of language for simplification and clarity.

Management activities on the GMNF with respect to Indiana bats focuses on two primary components: preventing or minimizing the likelihood of direct impacts to Indiana bats, and protecting potential roosting habitat for Indiana bats in areas where they are likely to occur. The first component is accomplished by restricting removal or damage to trees or snags when Indiana bats might be roosting in them, thus preventing death or injury of individual bats. The second component is accomplished by insuring the retention of existing, potential, and future roost trees in areas where Indiana bats are likely to occur.

The Forest Service revised S&Gs for wildlife reserve trees to emphasize retention of uncut patches of trees during even-aged management, to clarify language describing trees and snags to be retained, and to enhance identification and protection of potential roost trees and potential habitat for Indiana bats. During revision, the Forest Service consulted

with bat experts from the US Forest Service, the US Fish and Wildlife Service, the Vermont Fish and Wildlife Department, and the University of Vermont. The revised S&Gs place greater emphasis on the quality, or potential quality, of reserve trees (particularly as to bark condition, presence of dead limbs, cavities, etc.) than on numbers of trees of specific diameter classes. The major exception is the emphasis on retaining trees and snags of eight inch dbh and larger as potential roost sites for Indiana bats.

The revised Plan identifies those areas on the GMNF in which Indiana bat maternity roosting sites are most likely to occur as:

- Lands adjacent to the Champlain Valley or in the Valley of Vermont (adjacent to Route 7) that are below 800 feet elevation).
- Other areas specifically identified by the US Fish and Wildlife Service.

Standards and guidelines in the revised Forest Plan restrict timber harvest within potential Indiana bat maternity roosting habitat, within three miles of a known maternity roost site, and within five miles of known Indiana bat hibernacula from April 15 through October 30, to prevent, to the maximum extent possible, the likelihood of direct effects on Indiana bats.

The revised Forest Plan also clarifies and emphasizes management direction that Indiana bat hibernacula are designated as smoke-sensitive areas in order to avoid adversely affecting Indiana bats by prescribed burns conducted from October to May.

As one of the final steps in the Plan revision process, the Forest Service will consult with the US Fish and Wildlife Service on potential effects that implementation of the revised Forest Plan might have on individuals, populations, and habitat of federally listed threatened, endangered, and proposed species. This consultation will include thorough evaluation of protections afforded to Indiana bats and potential bat habitat.

Existing Condition

Analysis of potential habitat-related management effects relative to Indiana bats focuses on habitats essential to four major aspects of the species' natural history: summer roosts, especially maternity roosting areas; summer foraging habitat; roosting and foraging habitat near hibernacula where bats swarm immediately prior to hibernation; and the hibernacula themselves.

The Indiana bat occurs across most of the eastern half of the United States (Rommé et al. 1995). Despite a range-wide decline of about 60 percent from 1960 to 2000, numbers of Indiana bats in New York and New England apparently are stable or increasing (Clawson 2002, SVE Mammal Panel, 2002 and2003). Recent studies and survey results indicate that mature upland forest may provide important maternity habitat for female Indiana bats (Gardner et al. 1991a, 1991b). The apparent wide dispersal of Indiana bats emerging from hibernation has led biologists to consider any mature forests within the bat's known range as potential foraging and maternity roosting habitat (Widlak 1997).

Optimal summer habitat for Indiana bats includes a landscape-level patchwork of open and forested lands, ranging from 20 to 60 percent forest cover, that provides suitable roost trees, sources of flying insects for foraging, and access to open water (Rommé et al 1995, Farmer et al. 1997, Kurta et al. 2002). Crown closure around preferred maternal roost sites is variable, but rarely exceeds 80 percent (Rommé et al. 1995, SVE Mammal Panel 2002, 2003). Preferred maternal roost sites are standing trees or snags with loose bark; bats roost under the bark, or occasionally in cavities or hollow portions of tree boles and limbs (Gardner et al. 1991a, USFWS 1999). Preferred roost trees are often in the open, along the edge of a forest with an open canopy and open understory, or in or near sources of disturbance (such as residences, roads, livestock operations, and timber harvest), as roost trees in these sites are exposed to the warming effects of direct sunshine during all or

part of the day (USFWS 1999, Kurta et al. 2002).

Indiana bats are insectivorous and have the ability to feed opportunistically on whatever flying insects are prevalent in their foraging habitats (Kurta and Whitaker 1998, USFWS 1999). In some areas, they forage in or beneath the tree canopy, over clearings and farmland, and along forest edges (USFWS 1999, Menzel et al. 2001); in other areas they appear to avoid these areas (Humphrey et al. 1977). Openings and riparian habitat apparently are especially important for foraging habitat in northern New England (Rommé et al. 1995, SVE Mammal Panel 2002, 2003, USFS 2002b). Pre-hibernation swarming habitat also includes a patchwork or open foraging areas and suitable roost trees within about five miles of the hibernaculum. Mating takes place during the pre-hibernation swarming (Hall 1962, USFWS 2000b, Kiser et al. 2001).

Indiana bats are at the edge of their current range in Vermont (Rommé et al. 1995, Clawson 2002, BCI 2004a). Ambient temperature can be an important influence on a bat's metabolism and other physiological processes, thus affecting habitat suitability (Humphrey et al. 1977, Rommé et al. 1995, Belwood 1998, USFWS 1999). Air temperature may in fact be a limiting factor for Indiana bats on the GMNF. Much of the GMNF may be too cool (because of elevation) to provide suitable habitat for summer roosting and foraging (SVE 2002, 2003, Sanders et al., *in preparation*; M. Yamasaki, personal communication, May 2004, Scott Darling, personal communication, June 2004).

Indiana bats are known to use two hibernacula within the Proclamation Boundary near Manchester and Dorset, Vermont, and a third hibernaculum adjacent to the Proclamation Boundary in Brandon, Vermont. In 1999, four Indiana bats were reported from a hibernaculum on the GMNF near Stockbridge, Vermont (USDA 1999a). That identification was later discounted, however, and Indiana bats have not been reported from that site since (USDA 2001a; GMNF unpublished data).

During July 2001, one male Indiana bat was captured on the western edge of the GMNF near Middlebury, Vermont, and fitted with a radio transmitter. While its transmitter remained active, this bat continued roosting on the Forest (Kiser et al. 2001). A female Indiana bat was captured within the Proclamation Boundary immediately adjacent to the GMNF near Middlebury during the summer of 2002 (Beverly et al. 2002). This bat roosted in a known maternal colony near, but not on, the GMNF (Scott Darling, personal communication, January 2005). No other Indiana bats have been captured or observed on the GMNF during annual summer surveys through 2004 (GMNF and Vermont Fish and Wildlife Department, unpublished data).

Very little is known about Indiana bats in Vermont during the non-hibernation period (April through October). To date, this species has been found primarily at low elevations in the Lake Champlain Valley (Sanders et al., *in preparation*; Watrous et al., *in press*). Summer roost habitat can be found on the GMNF landscape, as an abundance of large trees, both live and dead, exists in all ecological land types. Temperature, however, likely is a key limiting factor. Most of the GMNF is located at higher elevations in the Green and Taconic Mountains where temperatures may be too cool for Indiana bats (SVE Mammal Panel 2002; Sanders et al., *in preparation*; S. Darling, personal communication, June 2004).

The Biological Evaluation (BE: Appendix E) provides greater detail on counts of wintering bats at the hibernacula near the GMNF and trapping and tracking efforts of Indiana bats on and near the GMNF.

The presence or absence of Indiana bats on the Forest also is governed by the abundance and overall status of the species in the region. Accordingly, the abundance of Indiana bats on the GMNF may increase in the future if regional population trends continue.

3.8.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Indicator 1 – Acres Allowing Management Activities That May Affect Habitat or Population Trends of Indiana Bats

Management activities on the GMNF most likely to affect Indiana bats stem from vegetation or timber management in areas where Indiana bats are likely to occur. Potential adverse effects include direct affects from killing or injuring bats during removal of or damage to an occupied roost tree or snag, or indirect effects from reducing quantity or quality of potential roosting habitat by removing existing or potential roosting trees or snags. Potential beneficial effects include creation of openings or patches in which canopy closure is reduced, thereby enhancing the mosaic of suitable roosting and foraging habitats in close proximity to each other.

Specific activities most likely to affect Indiana bats, directly or indirectly, are timber harvest, firewood cutting for commercial or personal use, or creation of permanent upland openings for wildlife habitat or other uses. Other activities, such as management and maintenance of recreational sites, construction and maintenance of roads and trails, removal of hazard trees, wildlife habitat management, prescribed burning, special uses, visual quality management, and protection of cultural resource may alter habitat over smaller areas. Extensive alteration of canopy closure or other forest structure around a hibernaculum can alter temperature, humidity, or other environmental conditions in the hibernaculum, which can in turn affect its suitability

The removal of some occupied or potential roost trees would be offset to some extent by the fact that roost trees are ephemeral, being suitable for only a limited time because they die, exfoliating bark falls off, and they fall over. New roost trees become available through tree growth and natural mortality (Humphrey et al. 1977, Gardner et al. 1991a, Callahan et al. 1997).

Effects Common to All Alternatives

The Forest Service's responsibilities pursuant to the Endangered Species Act (ESA) and compliance with ESA requirements are not affected by alternatives. These responsibilities and requirements include:

- Taking proactive conservation efforts on behalf of TE species
- Consulting with the USFWS to determine whether proposed management activities are likely to affect any listed TE species
- Developing and maintaining partnerships and cooperation with appropriate federal, State, and other agencies, conservation organizations, concerned landowners, and individuals in all appropriate aspects of wildlife, fish, and threatened, endangered, and sensitive species habitat management

Forest-wide management direction relative to the protection, conservation, and recovery of TE species is not affected by alternatives. This includes direction provided in the revised Forest Plan (goals, objectives, standards, and guidelines), as well as agency policy and operational direction contained in Forest Service Manuals and Handbooks. In particular, standards and guidelines for wildlife reserve tree in the revised Plan ensure that roost trees and snags suitable for use by Indiana bats will be retained during management activities, and suitable roost trees and snags will continue to be available on the Forest. The Forest Service derived these standards and guidelines from information provided in the Biological Opinion and Incidental Take Statement provided by the USFWS (2000b) specifically for protection and conservation of the Indiana bat, and in consultation with experts from the US Forest Service, the US Fish and Wildlife Service, the Vermont Fish and Wildlife Department, and the University of Vermont. These standards and guidelines are common to all alternatives.

Riparian corridors and openings are important foraging areas for Indiana bats in the northeastern United States (Rommé et al. 1995, SVE Mammal Panel 2002, 2003). Forest-wide management direction from goals, objectives, standards, and guidelines provides substantial protection to riparian areas on the GMNF. This protection is common to all alternatives.

Short-term objectives for tree-species composition (which apply Forest-wide) and age structure (which apply only to the suitable landbase) are the same for all alternatives. The Vegetation section in this chapter (Section 3.5) includes detailed discussion of vegetation composition and structure and how they vary across alternatives.

Areas on the GMNF in which Indiana bats are likely to occur are within five miles of known hibernacula, in forested habitats at or below 800 feet in elevation adjacent to the Champlain Valley or in the Valley of Vermont, or other areas as identified by the US Fish and Wildlife Service. These areas of concern for Indiana bats do not change by alternative. The allocation of these lands to management areas, and thus, the MA-specific management direction for these lands, does vary by alternative. Of greatest relevance are management directions that affect timber and vegetation management. These differences are the basis of the analyses presented, below.

Approximately 80 percent of the area within five miles of the three known hibernacula is privately owned or State-owned land. Each area is transected by highway corridors that include agricultural and other rural lands that provide suitable roosting and foraging habitat. Most of the management effects within these areas are beyond the scope of the GMNF Forest Plan and any of its alternatives.

Alternatives A, B, C, D, and E

The largest acreage of lands on the GMNF with management concerns relative to Indiana bats is that within five miles of known Indiana bat hibernacula. Of the total land area within these five-mile radii, approximately 20 percent (28,452 acres) is on the GMNF. The relative allocation of these acres to MA that allow timber harvest or vegetation management varies by alternative (Table 3.8-1) from the least in Alternative D (12,690 acres, 45%) to the most in Alternative B (19,114 acres, 67%).

Of much smaller acreage, but also of potential importance for Indiana bats, are those GMNF lands adjacent to the Champlain Valley or Valley of Vermont that are at or below 800 feet in elevation. Alternative A allocates slightly less (657 acres, 61%) to MAs that allow timber and vegetation management, compared to 790 acres (73%) for the other alternatives (Table 3.8-1). The difference between Alternative A and the other alternatives is that timber harvest or vegetation management are not allowed on Newly Acquired Land. All Newly Acquired Land in Alternative A is allocated to MAs that do (Diverse Forest Uses, Green Mountain Escarpment Special Area, and Moosalamoo Recreation and Education Area) or do not (candidate Research Natural Areas) allow timber harvest or vegetation management. Differences among Alternatives B, C, D, and E are in the relative allocation of land to MAs that allow timber harvest or vegetation management (Diverse Forest Uses, Green Mountain Escarpment, and Moosalamoo Recreation and Education Area).

Despite these differences in allocation of land to MAs that do or do not allow timber harvest or vegetation management, differences in direct and indirect effects between alternatives should be negligible. This conclusion is based on the limited area of the GMNF on which Indiana bats are likely to occur, the low number of Indiana bats likely to occur on the GMNF, and the protective measures included in the revised Forest Plan to prevent or minimize direct or indirect effects to Indiana bats as a consequence of management actions. As described in section 3.1.1 (see Proposed Changes in Management Direction Common to All Alternatives), Forest-wide standards and guidelines are designed to prevent or minimize (to levels approaching zero) the likelihood of direct impacts to Indiana bats, and to protect potential roosting habitat for Indiana bats in areas where they are likely to occur. This protection will be accomplished by restricting

removal or damage to trees or snags when Indiana bats might be roosting in them, and by insuring the retention of existing, potential, and future roost trees in areas where Indiana bats are likely to occur.

Cumulative Effects

Effects Common to All Alternatives

Through cooperative relationships with the USFWS, the Vermont Fish and Wildlife Department, other federal and State wildlife agencies, other resource managers, and researchers, the Forest Service will remain involved in conservation and protection efforts and keep abreast of changes in the regional and range-wide status, distribution, and population trends of Indiana bats. The Forest Service will continue to coordinate all efforts related to Indiana bats on the GMNF, including protection, conservation, census, and research, with parallel efforts taking place across the species' range. This high level of communication and coordination increases Forest Service knowledge of the status, distribution, ecology, and behavior of Indiana bats, as well as other species of bats, on the GMNF and adjacent lands and contributes to maintenance of an up-to-date, comprehensive knowledge of the status and population trends for the Indiana bat at both regional and range-wide scales. In this way, the Forest Service will be able to respond in a timely manner to any changes in status of Indiana bats on the GMNF and reinitiate consultation with the USFWS if, and when, appropriate.

The most likely long-term change relative to Indiana bats, assuming a continuation of current trends, is that the Indiana bat population in the northeastern United States will continue to increase, with a simultaneous expansion of the species onto previously unoccupied but suitable habitat. Changes in the GMNF land base that will be of concern to Indiana bats may occur through several means:

- acquisition of additional lands within five miles of known hibernacula
- acquisition of additional lands at or below 800 feet in elevation adjacent to the Champlain Valley or Valley of Vermont,
- identification of additional hibernacula inhabited by Indiana bats, or
- new information about the abundance, distribution, or general biology of Indiana bats in Vermont.

Management direction, particularly protection measures relevant to Indiana bats, do not vary by alternative. Therefore, differences in cumulative effects between alternatives stems from differences in relative allocation of Forest land into MAs. Within those GMNF lands where Indiana bats are likely to occur, long-term differences should be negligible. Potential adverse effects, either direct or indirect, should be mitigated equally across alternatives by Forest-wide management direction. Potential beneficial effects derived from creation of temporary or permanent openings that enhance the mosaic of suitable roosting and foraging habitats in close proximity to each other do not vary appreciably by alternative. On the Forest-wide scale, long-term differences between alternatives with respect to Indiana bats are diminished by the relatively small acreage on which Indiana bats are likely to occur. Under any of the alternatives, the Forest Service will afford substantial protection to Indiana bats and their habitat. Suitable roosting and foraging habitat will continue to be available on the GMNF.

On a regional scale, the Champlain Valley, to the north and west of the GMNF, represent the most suitable habitat for Indiana bats in Vermont (Sanders et al., *in preparation*). Situated between the Green and Adirondack Mountains, this area has perhaps the mildest climate in Vermont, combined with fertile soils. Accordingly, this area is highly agricultural, including large dairy farms and many acres in pasture, hay, and grain production (Johnson 1998). As a result of these land uses, the Champlain Lowlands has the lowest overall proportional forest cover (about 60%) in Vermont (Wharton et al. 2003). This combination of climate and forest cover means that the Champlain Lowlands currently are within the suitable range of summer roosting and foraging habitat conditions for Indiana bats. During recent decades, proportional forest cover in the Champlain Lowlands has been

decreasing (Wharton et al. 2003). The suitability of Indiana bat habitat in this region should remain high unless the area experiences dramatic changes in land use patterns. It is uncertain whether the lower-elevation portions of the GMNF can add significantly to the existing roosting and foraging conditions in the Northeast region.

The importance of GMNF-managed lands probably is greatest relative to hibernacula. Hibernacula used by Indiana bats and other species of bats in the Northeast are naturally occurring caves and abandoned mines. Hibernacula can be lost in several ways, such as natural cave-ins, being filled in or blocked off for public safety, flooding because of altered water channels or other activities, or reopening of mines. Structural composition of the forested landscape, and the resulting suitability of particular sites for Indiana bats, changes over time. Particular sites can be enhanced or degraded through management activities or natural processes. Caves and abandoned mines do not move, however, and they must be protected where they occur. Management direction relative to Indiana bats will continue to provide protection of hibernacula on the GMNF, and through cooperative efforts, on State and other federally managed lands. Many hibernacula in the Northeast, however, are located on privately owned land. Efforts are underway to secure adequate protection of these hibernacula, but the future security of these sites cannot be guaranteed.

The second important aspect of hibernacula is pre-hibernation swarming that occurs near the hibernaculum. For management purposes, the USFWS (2000b) advises protection of roost trees and other habitat features within a five-mile radius of the hibernaculum. This guidance provides some latitude as to where and how habitat enhancement activities might take place. The locations of the hibernacula are fixed, however, and suitable habitat must be available to support pre-hibernation swarming behavior, which include mating. The effects of increasing maturity and density of forest cover around hibernacula are not addressed in the literature, and the impact of such changes are uncertain beyond the fact that they represent movement away from the range of optimal conditions.

Table 3.8-1: Acreage of the GMNF within five miles of bat hibernacula where Indiana bats have been found[1] and acreage at or below 800 feet elevation adjacent to the Champlain Valley or Valley of Vermont allocated to MAs that allow or do not allow vegetation management activity that could affect Indiana bats or potential Indiana bat habitat, by alternative

	Alt. A Current Mgt.	Alt. B	Alt. C	Alt. D	Alt. E
	(acres)	(acres)	(acres)	(acres)	(acres)
Acres within 5 miles of hibernacula in MAs allowing vegetation management[2] (% of acres within 5 miles)	14,736 (52%)	19,114 (67%)	16,088 (57%)	12,690 (45%)	13,302 (47%)
Acres within 5 miles of hibernacula in MAs not allowing vegetation management[3] (% of acres within 5 miles)	13,716 (48%)	9,338 (33%)	12,364 (43%)	15,762 (55%)	15,150 (53%)
Total acres within five miles of hibernacula	28,452 (100%)	28,452 (100%)	28,452 (100%)	28,452 (100%)	28,452 (100%)
Acres at or below 800 feet elevation, within 5 miles, in MAs allowing vegetation management[2] (% of acres ≤ 800 ft. elev.)	657 (61%)	790 (73%)	790 (73%)	790 (73%)	790 (73%)
Acres at or below 800 feet elevation, within 5 miles, in MAs not allowing vegetation management[3] (% of acres ≤ 800 ft. elev.)	420 (39%)	287 (27%)	287 (27%)	287 (27%)	287 (27%)
Total acres at or below 800 feet elevation, within 5 miles	1,077 (100%)	1,077 (100%)	1,077 (100%)	1,077 (100%)	1,077 (100%)

Sources: GMNF GIS Alternative A, B, C, D, and E Management Area Layers.
Notes:
[1] Brandon Silver Mine, Dorset (Mt. Aeolus) Cave, Skinner Hollow Cave.
[2] Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Green Mountain Escarpment, and Moosalamoo Recreation and Education Area (Alternatives C and E only).
[3] Wilderness, Wilderness Study Area, Remote Backcountry Forest, White Rocks NRA, existing and candidate Research Natural Area, Ecological Special Area, Appalachian Trail, Long Trail, Recreation Special Area, Newly Acquired Land (Alternative A only).

3.9 SPECIES OF POTENTIAL VIABILITY CONCERN

This section, along with the Threatened and Endangered Species section (3.8), and the Biological Evaluation (BE; Appendix E), addresses the fine filter component of the Forest Service's approach to maintaining biological diversity and viability, as discussed in the Ecosystem Management Introduction section (3.1.4). Species evaluated here include federally listed threatened and endangered species, Regional Forester sensitive species (RFSS), and other species of potential viability concern identified during the Species Viability Evaluation (SVE) process. The evaluation of effects to sensitive species is conducted in detail in the BE (Appendix E). This section summarizes key findings for RFSS, as well as the current condition of, and the potential effects to, other species of viability concern identified during the SVE process.

Other sections of the FEIS also present coarse-filter habitat analysis that is applicable to species of viability concern. Discussions of vegetation (Section 3.5) and wildlife and wildlife habitat (Section 3.6) include analyses for forest, woodland, and upland opening habitats and species associated with them. Discussions of water (Section 3.3) and fisheries (Section 3.7) include some analyses of aquatic, shoreline, and wetland habitat.

Issue Statement

Public concern is focused on ensuring the conservation of biological diversity at the species, community, and regional levels. There is public debate regarding the quantity and quality of habitat that the Forest will provide and maintain. There is also public concern that Forest Service management and Green Mountain National Forest (GMNF) habitats provide for viable well-distributed populations of plants and wildlife, particularly those that are threatened, endangered, or sensitive.

Indicator 1 – Viability Outcomes

The first indicator to be used in this effects analysis is outcomes from viability evaluation for each plant and animal species of potential viability concern, for both present and future conditions. Viability evaluation uses professional judgment to assess risk to the current and continued viability of a species range-wide or within the analysis area. This indicator highlights the differences between alternatives because it systematically evaluates abundance, quality, and distribution of habitats, as well as threats to each species.

Indicator 2 – Sensitive Species Determinations

The second indicator to be used in this effects analysis is sensitive species determinations. Direction contained in the Forest Service Manual (FSM 2670) requires a determination of effects of the alternatives on Regional Forester sensitive species (RFSS or sensitive species). The analyses and final determinations are included in the Biological Evaluation (Appendix E). This indicator highlights the differences among alternatives because it represents a synthesis of all the information gathered on sensitive species, including viability outcomes, with which Forest Service biologists make judgments pertaining to the likelihood that an alternative will maintain species viability or prevent a trend toward listing under the Endangered Species Act over the short-term (the next 15 to 20 years).

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the GMNF. Unless otherwise noted in the Biological Evaluation (Appendix E), the analysis area for cumulative effects includes all lands administered by the GMNF and other owners, both public and private, within the ecological sections of the GMNF, primarily the Green,

Taconic, and Berkshire Mountain Section. This area encompasses the entire GMNF plus surrounding areas with similar environmental and biological traits, and so is connected to the GMNF by ecological processes and movements of species. These connections and relationships make ecological sections a reasonable context within which to analyze cumulative effects. These ecological sections are presumed to include the bulk of suitable habitats for species of viability concern found on the Forest, and are most likely to provide sources for populations of these species on the GMNF. Species ranges were considered and therefore, some cumulative effects areas were enlarged or narrowed as appropriate to address effects.

3.9.1 Affected Environment

Introduction

Context for Species Viability Evaluation

The National Forest Management Act of 1976 (NFMA), the Code of Federal Regulations, USDA Departmental Regulations, the Forest Service Manual, and the Forest Service Handbook provide specific statutory, regulatory, and administrative guidance for management of sensitive species and species of potential viability concern. Under the NFMA, the Forest Service is charged with responsibility to maintain the viability of species in the planning area and to avoid trends that result in listing a species as threatened or endangered under the Endangered Species Act (ESA). The 1982 NFMA planning rule defines viability as the estimated numbers and distribution of reproductive individuals to ensure the continued existence of a species throughout its existing range within the planning area. The planning area is all National Forest System lands within the proclamation boundary of a National Forest.

One of the tools the Forest Service uses to address species viability is designation of Regional Forester sensitive species (RFSS). The process for designating RFSS involves periodic screening of species found on the Forest in order to identify those that may need special conservation measures. RFSS are then given special consideration during project development and implementation.

The analysis of potential impacts to threatened and endangered (TE) species and to RFSS is contained within the Biological Evaluation (BE), which is part of the record for every environmental assessment or environmental impact statement prepared by the Forest Service in accordance with Forest Service Manual (FSM 2672.42). The BE for revision of the GMNF Forest Plan is contained in Appendix E. In particular, the BE evaluates specific habitat needs and potential impacts that management activities might have on individual organisms, populations, and habitats. This analysis of habitats and populations on the Forest provides the context for reaching a determination of effects for each TE species and RFSS.

The Forest Service conducted the most recent revision of RFSS list for Region 9 (northeastern United States) in 2000. The revised Forest Plan, however, is a comprehensive document designed to set strategic direction for the next 15 to 20 years. Accordingly, the Forest Service deemed it appropriate to expand viability evaluation beyond TE species and RFSS. Biologists from the GMNF, the Finger Lakes National Forest (FLNF), and White Mountain National Forest (WMNF) worked together on developing a process for conducting a Species Viability Evaluation or SVE (USDA 2004b). The SVE process led to the addition of a few new species to the RFSS list for the GMNF in 2003, but it also identified other species that might be of potential viability concern, depending upon the alternative chosen for the revision of the Forest Plan.

Species Viability Evaluation (SVE) Process

SVE is a qualitative process developed to identify and gather information about vertebrate, invertebrate, and plant species of potential viability concern and for existing TE species and RFSS.

The Forest Service conducted the SVE in cooperation with scientists qualified for each taxon (plants, insects, amphibians and reptiles, birds, and mammals) and knowledgeable about local flora and fauna. Scientists included local wildlife and botanical experts from State agencies, faculty at local universities, Forest Service researchers, and other knowledgeable individuals. Forest Service staff and the consulted scientists reviewed available literature, provided unpublished information and insights, and discussed viability issues, factors, risks, and potential outcomes for each species. The Forest Service used this information to evaluate the short-term, long-term, and cumulative effects of alternatives on species viability.

The final result of the SVE process is an estimated outcome assigned to each species for current conditions and for the next 15 to 20 years, both range-wide and for the GMNF. Future outcomes for the GMNF include a separate outcome for each alternative. Each viability outcome is an index or relative measure of the environment's capability to support population abundance and distribution. It is not a prediction of population occurrence, size, density, or other demographic characteristics (Schenk et al. 2002).

Outcomes display a range of increasing risk to viable, well-distributed populations from "A" (lowest viability concern) through "E" (greatest viability concern). In assigning these outcomes, a taxon's historical range is equated to its range prior to European settlement of northeastern North America. Each outcome integrates many features, including habitat quantity and quality, local demes, metapopulation interactions, and geographic extent. A ***deme*** is a locally interbreeding population. ***Intrademe*** interactions include breeding, dispersal, or other interactions occurring within a deme; ***metapopulation*** interactions involve those occurring between demes.

The outcomes are defined as follows:

Outcome A: Suitable ecological conditions are distributed broadly across the taxon's historical range, and they are of sufficient quantity and quality to support the type and degree of intrademe and metapopulation interactions that the taxon would characteristically engage in if it were not habitat limited.

Outcome B: Suitable ecological conditions across the taxon's historical range are either reduced in quality or quantity, or are naturally limited. Local demes may be extirpated. Metapopulation interactions may be adversely altered in some parts of the taxon's historical range due to lack of suitable habitat or local extirpations, but the taxon generally retains the geographic extent typical of the historical distribution.

Outcome C: Suitable ecological conditions across the taxon's historical range are either reduced in quality or quantity, or are naturally distributed as patches and/or exist at low abundance. Local demes have been extirpated. Metapopulation interactions are adversely altered throughout most or in significant portions of the taxon's range, due to habitat or population isolation, or local extirpations. The geographic extent of the taxon is reduced.

Outcome D: Suitable ecological conditions across the taxon's historical range are much reduced in quality or quantity, or are naturally isolated or rare. A majority of the historical populations have been extirpated. While some subpopulations associated with these ecological conditions may be self-sustaining, there are limited opportunities for metapopulation interactions among habitat patches. The geographic extent of the taxon is significantly reduced.

Outcome E: Suitable ecological conditions across the taxon's historical range are so reduced in quantity and quality that they are highly isolated or exist at very low abundance, with little or no possibility of metapopulation interactions among suitable

patches of habitat, resulting in strong potential for extirpations within many of the patches, and little likelihood of recolonization of such patches. The geographic extent of the taxon is significantly reduced, except for some rare, local endemics that may have persisted in these conditions since the historical period.

In summary, outcome A indicates that habitats are similar, or only slightly degraded from, historical conditions and risks are relatively low. For outcome C, suitable ecological conditions and/or populations are not well distributed, are uncommon, or have been lost, and risk to viability is moderate. Under outcomes D and E, conditions have been so altered that habitats and/or populations are not well distributed, or are at great risk, and therefore the likelihood of loss of viability is high. A taxon may meet some conditions of one outcome and other conditions for a different outcome. In this situation, a range of outcomes (such as B/C) may be identified. In other instances, while a species or its habitat may have had a small downward or upward trend, it was not enough to switch the outcome, and so such cases were identified with a "+" or "-" added to the outcome.

Species carried forward during the SVE process for detailed analysis in this section of the FEIS include all federally listed, threatened or endangered species, all RFSS, and additional species identified through the SVE process as being of potential viability concern. Upon issuance of the Record of Decision for the revised Plan, the Forest Service will add to the RFSS list those species that continue to be of viability concern but not currently listed as sensitive.

The Forest Service identified 27 animals and 83 plants as species of viability concern for the GMNF (Tables 3.9-1 and 3.9-2). These species can be grouped according to the broad habitat types in which they occur (for example, wetlands or rich northern hardwood forests). These habitat types are identified in Tables 3.9-1 and 3.9-2. These habitats are described in detail in Chapter 5 of the Biological Evaluation (BE; Appendix E), as the analysis for sensitive plants contained therein is organized by these habitat groups. Those habitat descriptions and the analysis of the affected environment contained in the BE is incorporated here by reference, and is summarized and supplemented as necessary under the Existing Condition subsection for species that are of viability concern, but are not currently designated as RFSS.

Sensitive Species Determinations

Determinations for sensitive species are expressed as a "likelihood" or "risk" because of uncertainty inherent in evaluating future scenarios. This uncertainty is amplified by limited knowledge of the environmental requirements of many sensitive species. The range of determinations includes the following:

1. No impact
2. Beneficial impact
   (an alternative is determined to be wholly beneficial without potential negative impacts)
3. May impact individuals but not likely to result in a trend to federal listing or loss of viability (an alternative may cause some negative impacts, even if overall impacts to species may be beneficial)

3a. May impact individuals but not likely to result in a trend to federal listing or loss of viability, although species is at high risk of loss of viability in the planning area

4. May impact individuals and is likely to result in a loss of viability or a trend toward federal listing

Existing Forest Plan Management Direction

The NFMA and Forest Service policy provide substantial management direction for species of viability concern. In addition to the development of management objectives and practices for RFSS, and the analysis of impacts to avoid loss of viability for RFSS, Forest Service policy also directs its staff to cooperate with State agencies in inventory, protection, management, and planning for threatened, endangered, and sensitive species. In Region 9, the Forest Service has provided supplemental manual direction for evaluating

and listing sensitive species, and for development of conservation assessments, strategies, and agreements for these species.

Goals, Objectives, Standards, and Guidelines

The 1987 Forest Plan management direction that conserves species of viability concern can be found in the following goals:

- Preserve and enhance the diversity of plant and animal communities on the GMNF so that it is at least as great as that which would be expected in a natural forest
- Maintain adequate quality, amount and distribution of habitats to support viable populations of all existing native and desired non-native vertebrate species on the National Forest
- Protect all threatened, endangered and sensitive species, as well as other species of concern on the National Forest

In 2002, the Forest Service amended the 1987 Plan to update objectives, standards, guidelines, and monitoring requirements relative to TES. This amendment was primarily in response to a Biological Opinion from the US Fish and Wildlife Service (USFWS 2000) on Indiana bat, but also in recognition of necessary changes for RFSS. In the amendment, the Forest Service identified objectives for inventory, evaluation, mitigation, assessments, and agreements dealing with TES species. The amendment updated standards and guidelines for wildlife reserve trees to ensure that roost trees preferred by Indiana bats would be retained during management activities. The amendment also reorganized and updated Forest-wide standards and guidelines for all TES species to include conservation measures identified by the USFWS for Indiana bat, and to group all species-specific standards and guidelines in one section of the Plan (some had previously been included in Appendix E of the 1987 Plan). The amendment included additional standards and guidelines for RFSS to emphasize direction and agency policy. Additionally, the amendment updated monitoring requirements to reflect terms and conditions provided in the Biological Opinion (USFWS 2000) for protection of Indiana bat, and to reflect the larger number of sensitive species identified on the GMNF. The Forest Service also updated Appendix E to provide more-detailed background information on TES species.

General standards and guidelines for plants that are sensitive or of concern require that the GMNF:

- Develop individual site plans on a case-by-case basis to provide specific habitat needs for each rare plant community
- Limit use of an area with rare plants until a site plan is developed
- Investigate sites prior to beginning any new activity

General standards and guidelines for species of concern require that species included on State threatened and endangered species lists, or species that are of particular interest to the public, receive special attention in management of the Forest. They require that the Forest Service develop management guidelines for habitats and reproduction sites on a species by species basis, if monitoring shows management activities are negatively impacting a population. Species-specific standards and guidelines exist in the 1987 Plan for pine marten, heron rookeries, and osprey nesting areas.

Because the analysis in this section focuses on habitat groups, management direction in the 1987 Plan governing management of these habitats is also relevant. Standards and guidelines identify objectives for vegetation composition, and require maintenance of important habitats and features, such as uncommon vegetation, mast trees, aspen, stands of aging forest, snags and den trees, wetlands, and ponds.

Management Area Direction

Management area (MA) direction establishes the desired condition of the forest in that MA, thus playing a major role in protection, maintenance, or enhancement of habitats that are important to SVE species. Several MAs (3.1, 4.1, 4.2, and 6.2) emphasize even-aged

harvest systems with varying rotation ages to maintain desired conditions. Other MAs emphasize limited timber harvest, using uneven-aged techniques to maintain a continuous forest canopy (MAs 2.1A, 2.1B, 2.2A, and 2.2B). MAs that emphasize Wilderness (MA 5.1) and primitive recreation (MA 6.1) prohibit timber and vegetation management, and changes to forest composition and structure change through natural processes. MAs that protect areas with uncommon or outstanding biological, geological, recreational, cultural, or historical significance (MA 8.1) and Significant Streams (MA 9.4) allow limited vegetation management, but only to enhance the values associated with those areas. These differences in MA direction help maintain diverse habitats on the GMNF, which in turn support diverse assemblages of plants and animals. Each set of forest conditions, ranging from openings to old forest includes suites of species that receive greater or lesser benefit from those conditions.

Proposed Changes in Management Direction Common to All Alternatives

Some of the direction contained in the 1987 Plan is redundant to agency policy, as documented in Forest Service Manuals and Handbooks, including regional supplements. Other aspects of management direction in the 1987 Plan, including several standards and guidelines for Indiana bat and other species, and the general direction for rare plants and species of concern, provide operational rather than strategic direction. To reduce redundancy, management direction documented in agency policy was removed from the revised Forest Plan. Operational direction was removed from the Plan and will be transferred to supplements of Forest Service Manuals and Handbooks.

Goals, Objectives, Standards, and Guidelines

Revised Plan direction for maintaining viable populations of species on the Forest is primarily covered under Goal 2, which requires the Forest to maintain and restore quality, amount, and distribution of habitats to produce viable and sustainable populations of native and desirable non-native plants and animals. Objectives under this goal include those for species and age-class composition of forest habitat and other habitat features important to wildlife. Composition objectives are updated to reflect long-term (many decades to a century or more) ecological tendencies of the Forest toward a higher proportion of softwood and mixedwood forest types. The revised Plan simplifies age-class objectives by providing a desired age-class distribution range for each forest type, regardless of rotation age, and by rounding the figures to the nearest half-decade. The ranges also provide managers the flexibility to adapt to conditions found in the field. These objectives are discussed in greater detail in the Vegetation Section of this Chapter (3.5).

Other objectives for this goal include those that require the Forest to work toward recovery of federally listed threatened or endangered species; maintain or enhance habitats for sensitive species; maintain fish populations through habitat restoration, and minimize the effects of non-native invasive species that can compete with and overcome native species. Goals 3 through 7 and associated objectives provide additional direction for maintaining and restoring terrestrial and aquatic ecological systems and habitats, which support the viability of species associated with those habitats.

Forest-wide standards and guidelines for species of viability concern as a group are generally limited in the revised Plan, as there is substantial direction contained within agency manuals and supplements. The standard requiring regular review and updating of the TES list has been retained. Many species-specific standards and guidelines are retained in the revised Forest Plan:

- Standards and guidelines for Indiana bat include standards that protect hibernacula and roost trees, a guideline for gathering habitat-use information, and a guideline defining where monitoring should occur.

- Standards and guidelines for nesting sites of bald eagle, peregrine falcon, great blue heron, and osprey are similar to the 1987 Plan, as amended.
- Standards and guidelines for management of deer wintering areas are Forest-wide in the revised Forest Plan, rather than specific to two MAs that emphasize deer wintering habitat.
- Standards have been added for protection of northern goshawk nesting sites and for protection of roadside populations of Appalachian Jacob's ladder.
- Standards and guidelines addressing common loon nests were removed from the revised Plan. Site-specific conditions at individual loon nests vary considerably, making uniform guidelines inappropriate. The GMNF will continue to work in close cooperation with the Vermont Fish and Wildlife Department and the Vermont Institute of Natural Science to monitor loon nesting activity throughout Vermont, including on the GMNF, and immediately provide protection where and when warranted.
- Standards and guidelines for pine marten, sedge wren, and timber rattlesnake also are removed from the revised Plan, as these species do not occur on the Forest.

Management Area Direction

Broad management area direction in the revised Forest Plan is similar to that of the 1987 Plan. Several MAs are renamed to reflect their emphasis and desired future condition more clearly. Other MAs are combined and several new MAs are included to increase flexibility and improve opportunities for resource management and protection. The most important feature of MA direction in the revised Plan, relative to species of potential viability concern, is that the GMNF retains a full range of management opportunities that will continue to provide diverse habitat conditions on the GMNF. These diverse habitats will continue to support diverse assemblages of plants and animals on the Forest.

The Newly Acquired Lands MA is retained in the revised Forest Plan unchanged from the 1987 Plan, but only in Alternative A. For the remaining alternatives, all Newly Acquired Lands are allocated to one of the other MAs. The relative allocation of these lands varies depending on the emphasis of each alternative.

Existing Condition

Species of viability concern occur on the GMNF in a wide variety of environmental conditions ranging from isolated sites and low abundance to broad distribution and relatively high abundance. For some species, these conditions result from effects of past or current management practices that have led to diminished habitat or reduced opportunities for population interactions across the landscape. For other species, suitable environmental conditions may not be greatly influenced by management; availability of suitable habitat and conditions has always been limited, or abundance has historically been low.

The affected environment for sensitive species is described in the Biological Evaluation (BE; Appendix E). In particular, Chapters 3 through 5 of the BE provide detailed descriptions of sensitive species and their habitats, as well as discussion of factors that may affect species viability. Chapter 5 of the BE provides detailed descriptions of general habitat conditions on the GMNF, which also apply to species of viability concern not currently designated as sensitive. These habitat conditions are combined into the following groups for analysis in the BE and for this analysis:

- Alpine and subalpine habitats
- Cliffs, talus, and exposed rock
- Barrens and open uplands
- Aquatic habitats
- Shore habitats
- Open wetlands
- Forested wetlands
- Rich northern hardwood forests
- Dry, low-elevation forests and woodlands
- Conifer forests
- Landscape-level habitat

Landscape-level habitat is included in recognition of those species that use a variety of habitat types across a large landscape. This includes predators with large home ranges and other highly mobile species capable of covering great distances between hibernating, roosting, and foraging habitats.

Even though the BE includes discussion of existing conditions and environmental consequences for general habitat types, it is important to note that this is not a site-specific analysis because the revised Forest Plan is a programmatic document. Consequently, the BE analysis for each habitat group is a tool for identifying and evaluating potential impacts on habitats and existing species. Site-specific detail and analysis is conducted at the project level, depending upon project-specific goals and objectives.

The Forest Service identified 27 animals and 83 plants as species of viability concern for the GMNF (Tables 3.9-1 and 3.9-2). Of the animal species, five are federally listed as endangered or threatened, 13 are Regional Forester sensitive species (RFSS), and nine are other species of potential viability concern. No federally listed plants are of concern on the GMNF; 65 plant species are RFSS and 18 are other species of potential viability concern.

Tables 3.9-3 and 3.9-4 provide supplementary information regarding habitat requirements, non-habitat factors, and occurrences for animal and plant species of viability concern that are not currently designated as RFSS.

Species of particular concern are those with current viability outcomes that are approaching D or E. Tables 3.9-5 and 3.9-6 provide viability outcomes for all animal and plant species of viability concern on the GMNF, both for the current condition and over the short-term under implementation of each alternative. Current outcomes for four animal species and two plant species are D or E. Another four animal species and four plant species have outcomes of “C/D” which indicates some degree of uncertainty with the outcome, but of viability concern nonetheless. Current outcomes are unknown for eight species of dragonflies.

Species of viability concern occur across a wide variety of habitats that may be influenced by the full array of potential management activities and multiple uses provided on the GMNF. These influences can alter habitat and may result in either negative or positive impacts on species. These impacts, in turn, can affect species’ viability and the availability of well-distributed habitats on the GMNF. Additionally, factors outside the control of the GMNF may affect the likelihood that rare species may remain viable within the planning area.

3.9.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Effects Common to All Indicators and Alternatives

Each of the five alternatives for implementing the revised Forest Plan promote the protection, enhancement, or maintenance of threatened and endangered (TE) species, Regional Forester sensitive species (RFSS),and other species of viability concern, as well as the habitats on which these species depend. Although the role that the GMNF plays in contributing to the conservation of these species varies by alternative (for example by providing differing amounts and quality of suitable habitat conditions), the Forest Service developed each alternative with the premise that viability risks will be minimized. Management activities can still have positive or negative effects on particular species without resulting in a trend toward federal listing or overall loss of viability.

Direction contained in agency and departmental policies and regulations, federal regulation, and federal law set a high standard for ensuring limited negative effects of management activities on TE species, RFSS, and other species of viability concern. Management direction appears in the revised Plan in the form of goals, objectives, standards, guidelines, and

MA-specific direction. This direction will be applied when developing and implementing any management activity on the GMNF. This direction does not vary by alternative. Management activities that result from implementation of the alternatives may have a wide variety of predictable effects on species of viability concern. The amount, timing, location, and intensity of activities can influence the degree to which they may impact species and their habitats, and represent potential threats to species. These activities and risks can all cause effects to species through the alteration of habitat composition, structure, and function. These effects are detailed in the BE (Appendix E), as well as in other sections of the FEIS as noted.

Vegetation management, including timber harvesting, forest regeneration, prescribed fire, as well as natural processes, can alter the structure, composition, and function of ecosystems. Depending upon the species and habitat, these effects may be positive, negative, or of negligible consequence. The most common alterations of habitat include changes in canopy cover and light regimes, removal of certain vegetation layers (such as through overstory removal), ground disturbance, trampling by skidders and dragging logs, changes in hydrology and productivity status, non-native invasive species (NNIS) risks associated with ground disturbance, and increased risk of herbivory, particularly of orchids, from deer.

Recreation also alters habitat through various ground-disturbing activities: trampling or erosion caused by foot traffic on trails and shorelines; vehicle traffic along trails and roads; campsites; rock climbing; introduction of NNIS; and illegal use by off-road vehicles. Development of recreational sites and facilities can lead to loss or conversion of habitats as well.

Road and trail construction can have both positive and negative impacts related to ground disturbance as well. These include erosion and sedimentation, soil compaction, alteration of hydrology, creation of new habitat for species of disturbed edges, habitat fragmentation, increased risk of NNIS infestation and access by predators, and increased human access with potential impacts to species from trampling, poaching, and collection.

Special uses associated with development for energy and communication, as well as for alpine skiing and associated resort activities, can also have effects similar to both vegetation management and recreation. In these circumstances, effects tend to also be associated with habitat loss or conversion.

It should be noted that the revised Forest Plan is programmatic in scope. Habitat requirements and the geographical range of possible locations of occurrence for many species of potential viability concern may be very narrow. Potential impacts, whether beneficial or adverse, likely will depend on site-specific and project-level details. The revised Forest Plan can and should anticipate that such details must be investigated for individual projects, but the revised Plan cannot analyze and address every specific possibility.

Finally, many other factors that are not directly under the control or authority of the GMNF from a cumulative effects standpoint may also impact species of viability concern. These are discussed under the Cumulative Effects subsection. Further analysis of effects common to all alternatives is found for each species and habitat group in the BE (Appendix E).

Indicator 1 – Viability Outcomes

Through the SVE process, the Forest Service calculated current and future viability outcomes for 27 animal and 83 plant species of viability concern on the GMNF. Viability outcomes for each alternative were estimated for the short-term, primarily over the next 15 to 20 years. When long-term effects are discussed, this generally refers to several decades to a century, or longer.

For 18 species of animals and 65 species of plants that are endangered, threatened, or sensitive, this evaluation is an extension of the analysis of direct and indirect effects of the five revised Forest Plan alternatives presented in

the Biological Evaluation (BE; Appendix E). Those results are summarized in the outcomes and rationales provided for each of these species in Tables 3.9-5 and 3.9-6. This section also evaluates direct and indirect effects of the revised Plan alternatives on an additional nine animal and 18 plant species of viability concern. Analysis for TE species is in Section 3.8 of this chapter.

Effects Common to all Alternatives

The species viability evaluations revealed only minor differences between alternatives over the short-term for four animal species: wood turtle, Jefferson, blue-spotted, and four-toed salamanders (Table 3.9-5). Each of these species may benefit from large, unfragmented tracts of mature forest. Alternatives A and D provide a greater potential for this habitat because of the prohibition of timber and vegetation management in Newly Acquired Land in Alternative A, and in Wilderness Study Areas, which are emphasized in Alternative D. The three salamander species also should benefit from the Green Mountain Escarpment MA, which includes much of their potential habitat and which emphasizes maintaining or enhancing populations of rare or uncommon species. Alternative D allocated the greatest acreage to the Escarpment MA. Alternative C places the greatest emphasis on forest management using long rotations, which could benefit the Jefferson and four-toed salamanders. Conversely, Alternative B provides the greatest opportunity for motorized and developed recreation, which could be detrimental to wood turtles if they are exposed to higher levels of encounter with recreationists, These potential benefits or adverse effects were only slight and would not change the species' viability outcomes under any alternative beyond appending "+" or "-," Potential on-Forest effects also are judged small in comparison to other threats faced by these species that are unrelated to GMNF management activities. For the other 23 animal species there are no differences in effects across alternatives over the short-term.

The analysis presented in the BE, and a review of other resource assessments and analyses in the FEIS, indicate that there are no differences in effects on plant species of viability concern across alternatives over the short-term (Table 3.9-6). For several species, there are differences between the current condition and the projected viability outcomes, but not between outcomes by alternative.

Plant species of viability concern that are not currently designated RFSS were evaluated in the context of the habitat and population analyses found in Chapter 5 of the BE. Based on this evaluation, there are no differences in outcomes for these species across alternatives, nor are there differences between the alternatives and the current condition for these species. The primary factors affecting the viability of these species are the natural limitations on the abundance and distribution of their habitat in the GMNF, particularly calcareous substrates and warm low-elevation environments, and the isolation of populations for several of these species. Three plant species currently are known only from historical records, but populations are still likely to occur on the Forest.

The analysis of direct and indirect effects focuses on species that demonstrate improving outcomes, declining outcomes, and outcomes that indicate a high risk or high potential risk for loss of viability. Because each species of viability concern has unique and often complex habitat requirements and associations, and because each is affected differently by the array of management activities and multiple uses that could occur, this section provides brief summaries of the main reasons for changes in viability outcomes or risks to viability outcomes. For this purpose, broad and simplified groups of habitats, risks, or benefits are highlighted. As noted, more detailed analysis is provided in the BE (Appendix E).

For the purposes of this analysis, the Forest Service assumes that if the outcome for a species is the same for all alternatives and the species is not at high risk for loss of viability, the alternatives have no impact on viability outcome. For many of the species of viability concern, expected changes to habitat conditions would have either negative or

positive impacts (or both) on individuals and populations from the array of possible management activities and programs. These impacts, however, would not be great enough to result in changed outcomes. For some species this may be because revised Plan management objectives, standards, and guidelines would ensure management emphasis on maintaining and/or improving habitats, or because mitigation measures would be adopted to eliminate or reduce potential negative impacts.

For other species with unchanged outcomes, revised Plan management activities may have very minor impacts on species and their habitats. Management activities often have very minor potential for direct and indirect effects on some habitats and the species they harbor. These would include habitats such as cliffs, many of the wetlands and high-elevation ponds on the Forest, and habitats of rare isolated species that are fully protected. In other cases, management activities may have the potential for effects, but the species may tolerate a wide range of disturbed and undisturbed conditions. Some of these species are true habitat generalists, while others may simply be persistent where their abundance and distribution have probably not changed dramatically since historical times and would not likely change in response to alternatives.

Improving Outcomes

The Forest Service identified three animal species (peregrine falcon, Canada lynx, and gray wolf) and four plant species (*Conopholis americana*, *Phegopteris hexagonoptera*, *Uvularia perfoliata*, and *Vaccinium uliginosum*) with outcomes expected to improve from their current condition over the short-term (Tables 3.9-5 and 3.9-6). The three animals are landscape-level species, implying that improving conditions are a region-wide phenomenon, not solely in response to improvements on the GMNF.

Animal Species

The predicted outcome for the peregrine falcon improves from B to A. From the 1950s through the 1970s, the peregrine falcon was extirpated from large portions of its former range, particularly along the eastern coast of the United States, primarily because of pesticide and PCB poisoning. Extensive reintroduction efforts have been so successful that the USFWS removed the peregrine falcon from its list of endangered species in 1999 (64 FR 46541) in response to range-wide recovery of the species. Peregrine falcons in Vermont and on the GMNF appear to be well-established and nesting successfully in increasing numbers (SVE Bird Panel 2002).

The Canada lynx and gray wolf were both extirpated from much of their former range in the Northeast, including Vermont, by 1900. The predicted outcome for Canada lynx improved from E to C, because Vermont now provides suitable habitat for the Canada lynx. The species is disjunct from extant, viable populations to the north and east, however, making natural reestablishment unlikely. In addition, Canada lynx might not be able to compete with bobcats on the GMNF (SVE Mammal Panel 2002, VFWD 2005).

The future outcome for the gray wolf on the GMNF is listed as both “C” and “E” (Table 3.9-5). E is the more likely outcome over the short-term, as central and southern Vermont are disjunct from extant, viable populations of wolves, making natural reestablishment unlikely (see discussion under *High Risk Outcomes*). An improved outcome of C is dependent on reintroduction. It is not clear how well wolves could compete with coyotes, if the prey base is adequate, or if having wolves in Vermont would be compatible with the interests of farmers, hunters, and other residents (SVE Mammal Panel 2002, VFWD 2005).

Plant Species

In the case of three of the four plant species, *Conopholis americana*, *Phegopteris hexagonoptera*, and *Uvularia perfoliata*, improvement in outcome (from outcome C to B/C) was related to the general maturing of their forested habitats, generally dry oak forests and/or rich northern hardwood forests, as these three species are associated with either older

trees or older forests. This maturation process is expected to continue under all alternatives because the overall Forest is recovering from heavy cutting in the 19th and early 20th centuries, and all forest types will continue to provide a range of age classes, including mature age classes, under all alternatives.

The improvement in outcome for the fourth plant, *Vaccinium uliginosum* (from outcome D to C/D), is related to conservation measures that have been implemented over the past several years within the alpine zone to help this species recover from trampling. Under all alternatives, these conservation measures will continue and are expected to improve ecological conditions for this species, although its habitat will always be very limited and vulnerable to trampling.

Declining Outcomes

The Forest Service identified three animal species (Bicknell's thrush, wood turtle, and Jefferson salamander) and ten plant species with outcomes expected to decline from their current condition over the short-term across all alternatives (Tables 3.9-5 and 3.9-6). The ten plant species include:

- *Aureolaria pedicularia* var. *pedicularia*
- *Carex argyrantha*
- *Carex schweinitzii*
- *Cypripedium parviflorum var. pubescens*
- *Juglans cinerea*
- *Nabalus trifoliolatus*
- *Panax quinquefolius*
- *Peltandra virginica*
- *Pinus rigida*
- *Platanthera orbiculata*

These outcomes are based on existing environmental conditions that restrict species distribution within the planning area and that cannot be improved through management actions, as well as problems that are not related to habitat and are therefore in large part beyond the control of the Forest Service.

Animal Species

For the animal species, the major factors associated with the declining outcome operate primarily beyond the control of the GMNF, assuming that important habitat is not degraded on the GMNF (SVE Bird Panel 2002). Vermont, in general, and on the GMNF in particular, provide suitable high-elevation, breeding habitat for Bicknell's thrush that is preserved and protected. Bicknell's thrush, however, is currently recognized as one of the most at-risk passerine birds in eastern North America (Rosenberg and Wells 1995, Pashley et al. 2000, Rimmer 2001a). Future outcomes for Bicknell's thrush decline from B (current) to C because of threats of deforestation in the wintering range and because of the restricted and highly fragmented nature of the breeding habitat (SVE Bird Panel 2002). Suitable habitat for Bicknell's thrush on the GMNF is preserved and protected equally and to the maximal extent possible under all five alternatives for the revised Forest Plan.

The wood turtle and Jefferson salamander both exhibit outcomes declining from "C" to "D" on the GMNF. These species are included and discussed under *High Risk Outcomes*.

Plant Species

The decline associated with *Juglans cinerea* is due to a disease that is outside the control of the Forest Service. The Forest Service does maintain existing individuals and populations that show signs of resistance, and cooperates with other agencies to test and develop disease-resistant stock. More detailed discussion of this species is included under Indicator 2.

For some species, particularly those of the dry, low elevation forests and woodlands like *Aureolaria pedicularia*, *Nabalus trifoliolatus*, and *Pinus rigida*, loss of historical disturbance regimes, such as fire, has led to declines. Now, because populations are at such low numbers, or are starting to lose reproductive capacity, they may continue to decline in spite of management actions to improve their habitat conditions.

Other species with single isolated populations on the GMNF and very limited habitat, like *Carex argyrantha*, *Carex schweintizii*, and *Peltandra virginica*, may decline simply due to a

stochastic (random or unpredictable) event that destroys the only population on the Forest. In addition, *Carex argyrantha* is noted as vulnerable to recreational pressures that are expected to increase regardless of alternative, and *Peltandra virginica* is associated with habitat that is partially on private land, and is vulnerable to impacts from development there such as degradation of water quality.

Carex schweinitzii, *Cypripedium parviflorum* var. *pubescens*, and *Panax quinquefolius* are also expected to decline due to loss of habitat and populations off the Forest as well as habitat limitations on the Forest. Both *Cypripedium parviflorum* var. *pubescens* and *Panax quinquefolius* are suffering range-wide declines related to loss of habitat and collection, respectively. *Carex schweinitzii* is known in Vermont mainly from private lands off the Forest where it is vulnerable to loss of habitat from development. Reductions in populations off the Forest combined with limited habitat and few populations on the Forest means that metapopulation interactions will become more limited or may be precluded over the next 20 years.

Finally, *Platanthera orbiculata* is expected to decline primarily because it is vulnerable to timber harvesting and recreational activities on the Forest. This is mainly due to the fact that it tends to occur as single, isolated individuals in upland forests, does not always flower, is quite easy to overlook, does not compete well with understory vegetation, is heavily browsed by herbivores, and relies on a particular fungal symbiont to complete its life cycle. Most of these factors can be mitigated when populations are located; however populations that are overlooked or do not consistently appear from year to year may be impacted, and life cycle factors, as well as vulnerability of small isolated populations to stochastic disturbance events may lead to declines in spite of mitigation measures.

Although the potential negative impacts described for these species may lead to decreased viability outcomes, revised Plan objectives, standards, and guidelines are likely to mitigate these impacts to ensure that implementation of the revised Plan is not the cause of a loss of viability.

High-Risk Outcomes

High-risk outcomes are those predicted to be “D” or “E.” Under these outcomes, conditions have been altered so much that habitats and/or populations are not well distributed or are at great risk, and the likelihood for loss of viability is high. The Forest Service identified five animal species (gray wolf, eastern cougar, red-headed woodpecker, wood turtle, and Jefferson salamander) and two plant species (*Juglans cinerea* and *Cynoglossum virginianum* var. *boreale*) with high-risk outcomes.

Animal Species

Outcomes for the gray wolf and eastern cougar are “E” (Table 3.9-5). The GMNF is not in danger of losing either species, however, as they currently do not exist on the Forest. For these species, the high-risk outcomes refer to the low likelihood of their returning to the Forest through natural dispersal and re-expansion into former range. Both species were effectively extirpated from the Northeast by 1900 due to loss of habitat, loss of prey base, and directed killing as predator control. Habitat conditions have improved to the point of providing suitable cover for both species. Uncertainty still exists about the adequacy of the prey base, particularly in light of competition from well-established populations of coyotes and bobcats (SVE Mammal Panel 2002, VFWD 2005). For the foreseeable future, any gray wolves or eastern cougars in Vermont, and particularly in the GMNF vicinity, would be isolated from established and viable populations. Neither species appears able to persist under such conditions (USFWS 1990, 1992; Kitchell 1999, SVE Mammal Panel 2002, VFWD 2005). The gray wolf has an alternate outcome of “C” that is dependent on reintroduction (see *Improving Outcomes*).

The current condition and all future outcomes for the red-headed woodpecker are “≤D” (Table 3.9-5). These birds probably were more abundant regionally and in Vermont before 1900 than at any time since (Fichtel, 1985,

DeGraaf and Yamasaki, 2001 - BNA?). This species is declining range-wide due to decreasing abundance and distribution of suitable habitat (large snags in open forest, forest edges, and open savannah-like areas) combined with increasing competition from introduced starlings for nest sites. Vermont is on the eastern edge of their range (Smith et al. 2000), which may explain why there are few records for this species in the Champlain Valley, even though it could be argued that suitable habitat is available (R. Renfrew, personal communication, 28 June 2005). Suitable habitat is not abundant on the GMNF, and probably never has been (SVE Bird Panel 2002).

The wood turtle and Jefferson salamander both decline from a current condition of "C" or less to a range of "D-" to "D+" (Table 3.9-5). A common threat for these species is habitat loss at the region- or range-wide scale. Suitable habitat is ample and secure on the GMNF (SVE Herpetology Panel 2002). The major threats facing wood turtles are their collection as pets (Hunter et al. 1999) and mortality on roads during migration (J. Andrews, personal communication, July 2005). Jefferson salamanders are threatened by hybridization with blue-spotted salamanders; hybrid progeny are overwhelmingly female, which reduces the likelihood of successful fertilization by males. Additionally, the Jefferson salamander may be genetically overwhelmed in time by the blue-spotted salamander, which is more tolerant of disturbed habitats (Jackson 1994, Bogart and Klemens 1997). Mortality on roads during migration also is a major concern for salamanders (J. Andrews, personal communication, July 2005).

For amphibians and reptiles, an outcome of "C" may be indicative of reduced long-term viability (SVE Herpetology Panel 2002). These species do not disperse very far; extirpation of local demes can result in reduced connectivity and increased genetic isolation, with adverse long-term impacts to metapopulation dynamics across a species' range. Thus, the blue-spotted and four-toed salamanders may be considered to exhibit high-risk outcomes, even under alternatives that may provide slight beneficial impacts. For the wood turtle and these salamanders, the Forest may develop into a refugium as habitat conditions persist or improve on the Forest but decline in the region overall.

Timber, vegetation, recreation, or other management activities on the Forest may affect individuals of these animal species, but these activities are not likely to affect the overall abundance and distribution of suitable habitats (or in the case of the red-headed woodpecker, the general lack of suitable habitat). These species are not likely to experience a trend toward loss of viability on the Forest because of these management activities. Potential impacts for most of these species, whether beneficial or adverse, likely will depend on site-specific and project-level details because of the narrow range of habitat conditions that are suitable for each (SVE Bird Panel 2002, SVE Herpetology Panel 2002, J. Andrews, personal communication, July 2005). Even if these species thrive on the Forest, notably the salamanders or wood turtle, their overall, regional viability may decrease as individual and demes become geographically and genetically isolated (SVE Herpetology Panel 2002).

Plant Species

Juglans cinerea (outcome declining from C to D) and *Cynoglossum virginianum* var. *boreale* (outcome staying at D/E) exhibit viability outcomes that indicate a high risk of loss of viability within the planning area over the short-term. Because *Juglans cinerea* is a Regional Forester Sensitive Species, the analysis associated with its risk of loss of viability is discussed under Indicator 2. *Cynoglossum virginianum* var. *boreale* is discussed below.

Cynoglossum virginianum var. *boreale* is a perennial herbaceous plant of circumboreal regions extending as far south as New Jersey and Pennsylvania. There are currently far more historical populations than extant, and current New England populations appear to be restricted to northern New England. In northern New England, it is found mainly in rich mesic woods on shallow sandy or rocky calcareous

soils where light is available to the understory. Populations are often found in areas where the canopy has been disturbed, such as in tree fall gaps, recent burned and logged areas, and along roads. It favors southern and western aspects. These low-elevation, calcareous conditions are rare on the Forest and are limited to the western edge of the GMNF.

All alternatives may impact *Cynoglossum virginianum* var. *boreale* but are not likely to cause a trend toward federal listing. The primary risk factor that is judged to cause a high risk of loss of viability across all alternatives is the documented decline in populations of this species throughout New England and New York, and resulting population isolation and potential genetic isolation of these populations. There is one historical site for the species on the GMNF, and it has been searched for repeatedly and not found. Botanists consider the species still likely to occur on the Forest due to its low site fidelity and potential habitat along the western edge of the Forest (SVE Oak-Pine Plants Panel 2002). All alternatives propose to manage habitat for this species similarly, by maintaining oak forests along the western escarpment. Alternatives C through E may be more effective at this because portions of the escarpment are placed in the Escarpment Special Area where management of oak forests is emphasized. Given the substantial decline for this species in New England, and marginal suitable habitat on the Forest, however, this slight shift in emphasis between alternatives is not likely to result in a change in the viability risks for this species. More details regarding the habitats with which this species is affiliated can be found in the BE (Appendix E).

Nine other plant species were identified as having viability outcomes between C and D over the short-term and are considered to be approaching a high risk of loss of viability. Because all nine of these plant species are sensitive species, the analysis associated with their risk factors is discussed under Indicator 2. Implementation of any revised Plan alternative is expected to contribute to maintaining the viability of these species, and will not cause a loss of viability.

Uncertain or Unevaluated Outcomes

Outcomes for nine animal species (two bats, seven odonates [dragonflies], and one beetle) are uncertain because of insufficient data on distribution and abundance (Tables 3.9-3 and 3.9-5) (SVE Insect Panel 2002).

Indiana bats have declined dramatically range-wide during the last four decades, but numbers in the northeastern United States appear to be increasing. It is unknown whether the increase in the Northeast is from increasing local populations or emigration from the South and Midwest, but habitat conditions in the Northeast are suitable for supporting the species and known hibernacula are protected (Clawson 2002, SVE Mammal Panels 2002, 2003). The projected outcome for Indiana bats in the Northeast, therefore, is improving. In the case of the eastern small-footed bat, there currently is insufficient information to predict abundance or trends, although the species probably has always been rare (SVE Mammal Panels 2002, 2003). Much of the GMNF may be too cool (due to elevation) to provide suitable habitat for either species of bat. Thus, the projected outcome for both bat species on the GMNF is uncertain, but unchanged from “C/D?”.

The boulder beach tiger beetle and several of the odonates (dragonflies) are known to occur near the GMNF or within the Proclamation Boundary, but not on the Forest. The other odonates are known from very few records. These species are all closely tied to riparian or wooded wetland habitats, areas that receive extensive protection on the GMNF. Activities in and adjacent to wetlands are closely regulated by Forest-wide standards and guidelines that do not vary by alternative. Thus, despite limited data, the level of protection afforded to the habitats used by these species is very high under all alternatives and these species should suffer no loss of viability as a result of Forest Service activities (SVE Insect Panel 2002).

Indicator 2 – Sensitive Species Determinations

Effects Common to All Alternatives

As required by agency policy, the Forest Service made determinations for all threatened and endangered (TE) species, and Regional Forester sensitive species (RFSS). Detailed explanations of these determinations, along with appropriate background and natural history information, are contained in the Biological Evaluation (BE; Appendix E). Determinations for TE species (gray wolf, eastern cougar, Canada lynx, Indiana bat, and bald eagle) are summarized separately in the FEIS (Section 3.8). Determinations for RFSS are discussed in this section. Table 3.9-7 summarizes determinations for the 13 animal and 65 plant RFSS evaluated.

The sensitive species determinations specifically reflect the judgment of Forest Service biologists as to which of five conditions is most likely, based on an analysis of both short and long term effects of alternatives. Determinations are expressed as “likelihood” or “risk” because of uncertainty inherent in evaluating future scenarios and because current knowledge of habitat requirements and responses of species to environmental conditions often is limited. The following is a summary of the determinations made for RFSS. Because none of the alternatives were likely to lead to Determinations 2 or 4 for any plant or animal RFSS, these determinations are not discussed here.

Determination 1: No Impact

Implementation of the revised Forest Plan under any of the alternatives should have no impact on 8 of the 13 animal RFSS (Table 3.9-7). Seven of these species are closely tied to riparian or other wetland habitats that receive considerable protection through Forest-wide standards and guidelines. Bicknell’s thrush is equally protected on the Forest in high-elevation spruce-fir and krumholtz habitats. Summarized rationales for these determinations are included in Tables 3.9-5 and 3.9-6.

Determination 3: May impact individuals but not likely to result in a trend toward federal listing or loss of viability

Implementation of the revised Forest Plan under any of the alternatives may impact individuals of three animal RFSS species (eastern small-footed bat, forcipate emerald, and gray petaltail) and 64 of the 65 plant RFSS (Table 3.9-7). The Forest Service judged that impacts associated with timber, vegetation, recreation, or other management activities may affect individuals, but are not likely to result in a trend toward federal listing or loss of viability for any of these species under any of the five alternatives. Some of these impacts may be positive, while others are negative. Summarized rationales for these determinations are included in Tables 3.9-5 and 3.9-6.

The Forest Service identified nine RFSS plants with viability outcomes between C and D over the short-term that are considered to be approaching a risk of loss of viability (Table 3.9-6). The primary risk factors contributing to this judgment, however, are outside the control of the Forest Service. Four of these nine species, *Carex bigelowii*, *Collinsonia canadensis*, *Eupatorium purpureum*, and *Huperzia appalachiana*, have outcomes that are currently between C and D and are not declining over the short-term. These species have populations that are only known from one site on the Forest, and are either historical (for example, *Huperzia appalachiana*), or are small, isolated, and vulnerable to loss due to stochastic events and genetic isolation. Habitat is marginal for these species on the Forest, and there is a low likelihood that they will expand much within their current sites, or expand their populations to other locations on the Forest. In addition to their vulnerabilities on the Forest, any declines in populations off the Forest can lead to further isolation and potential losses on the Forest. In all cases, implementation of the revised Plan under any alternative is expected to contribute to maintaining the viability of these species, and will not cause a loss of viability.

For four of the remaining five species, outcomes across alternatives decline from their current condition: *Aureolaria pedicularia* (C to

C/D), *Nabalus trifoliolatus* (C to C/D), *Panax quinquefolius* (C to C/D), and *Pinus rigida* (C to C/D). The factors affecting these species are similar to those discussed for the other four species of this group.

The outcome across alternatives for *Vaccinium uliginosum* improves from D to C/D. Factors associated with this improvement have been discussed in association with Indicator 1 and are related to conservation measures that have been implemented over the past several years to help this species recover from trampling, and will continue under all alternatives. However, its habitat will always be very limited and vulnerable to trampling, and so its viability will likely always be at risk.

Determination 3a: May impact individuals but is not likely to result in a trend toward federal listing or loss of viability, although species is at high risk of loss of viability in the planning area

Two animal species (wood turtle and Jefferson salamander) and one plant (*Juglans cinerea*, butternut) were determined to have a high risk of loss of viability within the planning area over the short-term across all alternatives. These species are classified as "3a" in Table 3.9-7.

Determinations for the wood turtle and Jefferson salamander are confounded by details of their natural history and of population ecology of reptiles and amphibians. These species require wetland habitats for breeding in close proximity to upland habitats. Forest-wide standards and guidelines protect seasonal and vernal pool (Jefferson salamander) and riparian (wood turtle) breeding areas, as well as the immediately adjacent upland forest area. Obligations under the Endangered Species Act and objectives in the revised Forest Plan direct the Forest Service to maintain or enhance habitat conditions for threatened and endangered species, Regional Forester sensitive species, and other species of viability concern. Appropriate actions to satisfy these obligations and achieve these objectives must be identified on a site-specific basis. Timber, vegetation, recreation, or other management activities may affect individual turtles or salamanders, most likely at the edges of suitable habitat, but suitable habitat will continue to be abundant and well distributed, and these species are not likely to experience a trend toward loss of viability on the Forest. The Jefferson salamander, for example, may experience slight beneficial effect under Alternatives A, C, and D, which minimize timber management on the Forest or emphasize longer rotation ages (hence the "3a & 2?" determinations in Table 3.9-7). Despite the low likelihood of management effects, the wood turtle and Jefferson salamander may be at high risk for loss of viability in the planning area. This is because of the limited capability for dispersal and the relatively greater risk of genetic isolation and extinction of local demes (see discussion under *High Risk Outcomes*).

Juglans cinerea is a tree of moist, calcium or nutrient-enriched soils that may be rocky. It occurs in rich northern hardwood, oak-northern hardwood, and floodplain forests, generally below 2,500 feet in elevation. It is intolerant of shade as a seedling, thus successful regeneration requires a disturbance to create a gap or larger opening in the forest canopy near reproductive trees. This tree is known to exist in all counties of Vermont, and there are at least ten locations on the GMNF where populations of several individuals are known to occur. It often occurs as single trees in stands of rich northern hardwood forests. Calcareous conditions are rare on the Forest, so suitable habitat is limited and not well distributed.

All alternatives may impact individual *Juglans cinerea* plants but are not likely to cause a trend to federal listing for the species. The primary risk factor judged to cause a high risk of loss of viability under all alternatives is its susceptibility to butternut canker, a disease that is killing butternut trees across its range. Six populations of butternut have been assessed for the canker on the GMNF, and all had signs of infection, although some were still healthy, and one appeared to be walling off the infection (Torsello and Allen 1994). Activities the Forest Service can undertake to contribute to viability of this species include protection of butternut trees that are healthy or showing signs of disease resistance, providing opportunities for

reproduction of butternut, and cooperating with other agencies in testing disease-resistant genotypes. Regardless of these activities, however, the species is expected to decline and remain at high risk for loss of viability.

Cumulative Effects

Cumulative effects for endangered, threatened, and Regional Forester sensitive species (RFSS) are described in the BE (Appendix E). An additional 9 animal and 18 plant species are of viability concern but are not currently designated threatened, endangered, or RFSS. Cumulative effects for these species are similar to those detailed in the BE, as these species occupy the same habitats and face the same habitat-related threats and limiting factors. Other factors and concerns specific to these species are listed in Tables 3.9-3 through 3.9-6.

For most species of viability concern, cumulative effects are very similar to direct and indirect effects. This is because the types of disturbances, land uses, and management practices occurring within the GMNF are similar to those that are occurring within the larger areas used for analysis of cumulative effects.

Activities such as development, agriculture, and intensive logging have slowed or stopped on the GMNF, but generally have continued in the cumulative effects analysis area. Continuing development of residential, recreational, or commercial uses of land off the GMNF will increase the value of Forest habitats that are important for species of viability concern. Where the Forest offers limited opportunities for some habitat types, such as low elevation forests or habitats on calcareous substrates, continued pressures and habitat losses off the Forest could jeopardize the viability of species on the Forest by reducing or limiting potential metapopulation interactions.

Many factors that are not directly under the control or authority of the GMNF from a cumulative effects standpoint, including those noted above, might also impact species of viability concern. These include, but are not limited to:

- Loss of populations from plant collecting
- Loss or degradation of habitat from ground disturbance off the GMNF caused by commercial or residential development
- Habitat degradation and loss of suitability due to pollution, such as atmospheric deposition, environmental contaminants, or eutrophication of lakes caused by nutrient enrichment
- Loss of habitat or suitability due to changes in climate, such as above or below average precipitation, drought, or long-term climate change
- Loss or decline of populations associated with small or isolated populations, such as genetic drift, inbreeding depression, and demographic stochasticity.

Table 3.9-1: Animal species of viability concern and their habitat groups on the GMNF

Common Name	Scientific Name	Federal status[1]	VT State status[2]	Habitat Groups[3]
MAMMALS				
Gray wolf	*Canis lupus*	T	n/l, X	landscape
Eastern cougar	*Puma* (=*Felis*) *concolor cougar*	E	E	landscape
Canada lynx	*Lynx canadensis*	T	E	landscape
Indiana bat	*Myotis sodalis*	E	E	landscape
Eastern small-footed bat	*Myotis leibii*	S	T	landscape, rock
BIRDS				
Bald eagle	*Haliaeetus leucocephalus*	T	E	landscape, aquatic
American peregrine falcon	*Falco peregrinus anatum*	S	E	rock
Common loon	*Gavia immer*	S	E	aquatic
Red-headed woodpecker	*Melanerpes erythrocephalus*	SVC	SC	dry forest, wet forest, wet open
Bicknell's thrush	*Catharus bicknelli*	S	SC	(sub)alpine, conifer
Rusty blackbird	*Euphagus carolinus*	SVC	SC	wet open, wet forest
FISH				
Atlantic salmon	*Salmo salar*	SVC		aquatic
REPTILES & AMPHIBIANS				
Wood turtle	*Glyptemys* (=*Clemmys*) *insculpta*	S	SC	shore, wet forest, aquatic, adjacent rich or dry upland forest, open
Jefferson salamander	*Ambystoma jeffersonianum*	S	SC	wet forest, aquatic, adjacent rich or dry upland forest
Blue-spotted salamander	*Ambystoma laterale*	SVC	SC	wet forest, wet, open, aquatic, shore, adjacent rich or dry upland forest
Four-toed salamander	*Hemidactylium scutatum*	SVC	SC	wet forest, wet, open, aquatic, rich, dry forest, w. cedar
MOLLUSKS				
Green floater	*Lasmigona subviridis*	S	T	aquatic
Creek heelsplitter	*Lasmigona compressa*	S	n/l	aquatic
INSECTS				
Boulder beach tiger beetle	*Cicindela ancocisconensis*	S	n/l	shore
Southern pygmy clubtail	*Lanthus vernalis*	S	n/l	shore
Forcipate emerald	*Somatochlora forcipata*	S	n/l	wet open
Harpoon clubtail	*Gomphus (=Phanogomphus) descriptus*	S	n/l	shore

Table 3.9-1: Animal species of viability concern and their habitat groups on the GMNF

Common Name	Scientific Name	Federal status[1]	VT State status[2]	Habitat Groups[3]
Gray petaltail	*Tachopteryx thoreyi*	S	n/l	wet forest
Ebony boghaunter	*Williamsonia fletcheri*	SVC	n/l	wet open
Delicate emerald	*Somatochlora franklini*	SVC	n/l	wet open
Black meadowhawk	*Sympetrum danae*	SVC	n/l	open, wet open
West Virginia white	*Pieris virginiensis*	SVC	SC	rich, wet forest

[1] T is threatened, E is endangered under the Endangered Species Act; S is listed by the Regional Forester of Region 9 as Sensitive for the GMNF; SVC are species of viability concern not current listed as T, E, or S.
[2] E is endangered, T is threatened, SC is special concern, X is extirpated, and n/l is not listed under Vermont's Endangered Species Law (10 V.S.A. Chapter 123).
[3] Habitat Groups: alpine – alpine and subalpine habitats; rock – cliffs, talus, and exposed rock habitats; open – barrens and open uplands; aquatic – aquatic habitats; shore – riparian shorelines; wet open – open wetlands, bogs, and fens; wet forest – forested wetlands; rich – enriched northern hardwood forest; dry forest – dry low elevation forests and woodlands; conifer – conifer forests; landscape – landscape level habitats.

Table 3.9-2: Plant species of viability concern and their habitat groups on the GMNF

Common Name	Scientific Name	Federal status[1]	VT State status[2]	Habitat Groups[3]
Boreal bentgrass	*Agrostis mertensii*	S	nl	alpine, rock
Poke milkweed	*Asclepias exaltata*	SVC	nl	rich, dry forest
Wall-rue spleenwort*	*Asplenium ruta-muraria*	SVC	nl	rock
Feverweed	*Aureolaria pedicularia* var. *pedicularia*	S	nl	dry forest
Hairy woodmint	*Blephilia hirsuta*	S	T	wet open, wet forest, rich
New England northern reed grass	*Calamagrostis stricta* ssp. *inexpansa*	S	E	rock
Small-flowered bitter cress	*Cardamine parviflora* var. *arenicola*	S	nl	rock, dry forest
Summer sedge	*Carex aestivalis*	S	nl	rich, dry forest
Narrowleaf sedge*	*Carex amphibola*	SVC	nl	wet forest, rich
Water sedge	*Carex aquatilis* var. *substricta*	S	nl	shore, wet open
Hay sedge	*Carex argyrantha*	S	nl	rock
Prickly bog sedge[5]	*Carex atlantica*	S	nl	wet open
Rocky Mountain sedge	*Carex backii*	SVC	nl	dry forest
Bigelow's sedge	*Carex bigelowii* ssp. *bigelowii*	S	nl	alpine
Bronze sedge	*Carex foenea*	S	E	rock, open
Shore sedge	*Carex lenticularis* var. *lenticularis*	S	nl	shore
Michaux's sedge	*Carex michauxiana*	S	nl	shore, wet open
Schweinitz's sedge	*Carex schweinitzii*	S	nl	wet open, wet forest
Bulrush sedge	*Carex scirpoidea*	S	nl	rock
Prickly hornwort	*Ceratophyllum echinatum*	SVC	nl	aquatic
Purple clematis	*Clematis occidentalis* var. *occidentalis*	S	nl	rock, dry forest
Horse-balm	*Collinsonia canadensis*	S	nl	rich
Squaw-root	*Conopholis americana*	S	nl	dry forest
Fragile rockbrake	*Cryptogramma stelleri*	S	nl	rock
Northern wild comfrey*[h]	*Cynoglossum virginianum* var. *boreale*	SVC	T	rich, dry forest
Northern yellow ladyslipper*	*Cypripedium parviflorum* var. *makasin*	SVC	nl	wet open, wet forest
Large yellow ladyslipper	*Cypripedium parviflorum* var. *pubescens*	S	nl	wet forest, rich
Showy ladyslipper	*Cypripedium reginae*	S	nl	wet open, wet forest
Paniculate tick-trefoil	*Desmodium paniculatum*	S	nl	dry forest
Glade fern	*Diplazium pycnocarpon*	SVC	nl	rich
Rock whitlow-grass	*Draba arabisans*	S	nl	rock, dry forest
Male fern	*Dryopteris filix-mas*	S	T	rich
Matted spike-rush	*Eleocharis intermedia*	S	nl	shore, wet open
Ovate spike-rush	*Eleocharis ovata*	SVC	nl	shore
Meadow horsetail	*Equisetum pratense*	SVC	nl	shore, wet open, wet forest
Sweet joe-pye weed	*Eupatorium purpureum*	S	nl	rich, dry forest

Table 3.9-2: continued.

Common Name	Scientific Name	Federal status[1]	VT State status[2]	Habitat Groups[3]
Boreal bedstraw*[h]	*Galium kamtschaticum*	S	nl	wet forest
Bog bedstraw*	*Galium labradoricum*	SVC	T	wet open, wet forest
Rough avens	*Geum laciniatum*	S	nl	shore, wet open
Northern stickseed	*Hackelia deflexa* var. *americana*	SVC	T	rock, dry forest
Harsh sunflower	*Helianthus strumosus*	SVC	T	open
Appalachian fir-clubmoss*[h]	*Huperzia appalachiana*	S	nl	alpine, rock
Tuckerman's quillwort[5]	*Isoetes tuckermanii*	S	nl	aquatic
Large whorled pogonia	*Isotria verticillata*	S	T	dry forest
Butternut	*Juglans cinerea*	S	nl	rich, wet forest
Highland rush	*Juncus trifidus*	S	nl	alpine, rock
Hairy bush-clover	*Lespedeza hirta*	S	T	open, dry forest
One flowered muhly	*Muhlenbergia uniflora*	S	nl	shore, wet open
Farwell's water-milfoil	*Myriophyllum farwellii*	S	nl	aquatic
Low water-milfoil[5]	*Myriophyllum humile*	S	nl	aquatic, shore
Three-leaved rattlesnake-root	*Nabalus trifoliolatus (=Nabalus trifoliolata)*	S	nl	dry forest
Snowy aster*	*Oligoneuron album*	SVC	nl	rock, open
American ginseng	*Panax quinquefolius*	S	nl	rich
Green arrow arum	*Peltandra virginica*	S	nl	shore
Broad beech fern	*Phegopteris hexagonoptera*	S	nl	rich, dry forest
Pitch pine	*Pinus rigida*	S	nl	rock, open, dry forest
American shore-grass	*Plantago (=Littorella)americana*	S	nl	aquatic, shore
Large roundleaf orchid	*Platanthera orbiculata*	S	nl	wet forest, rich, dry forest, conifer
Jacob's ladder	*Polemonium vanbruntiae*	S	T	shore, wet open, wet forest
Snail-seed pondweed	*Potamogeton bicupulatus*	S	nl	aquatic, shore
Algae-like pondweed	*Potamogeton confervoides*	S	nl	aquatic
Hill's pondweed*	*Potamogeton hillii*	S	nl	aquatic
Green pyrola*[h]	*Pyrola chlorantha*	S	nl	wet forest, dry forest, conifer
Lesser wintergreen*[h]	*Pyrola minor*	SVC	E	conifer
Chinkapin oak	*Quercus muehlenbergii*	SVC	nl	dry forest
Roseroot stonecrop	*Rhodiola (=Sedum) rosea*	S	T	rock
Swamp red currant	*Ribes triste*	S	nl	wet forest, rich, conifer
White Mountain saxifrage	*Saxifraga paniculata* ssp. *neogaea*	S	nl	rock
Pod grass	*Scheuchzeria palustris (=ssp. americana)*	S	T	shore, wet open
Rock spike-moss	*Selaginella rupestris*	S	nl	rock
Pointed blue-eyed grass	*Sisyrinchium angustifolium*	S	nl	open, wet open
Eastern blue-eyed grass	*Sisyrinchium atlanticum*	S	nl	open, wet open
Roundleaf goldenrod	*Solidago patula*	SVC	nl	wet forest
Squarrose goldenrod	*Solidago squarrosa*	S	nl	rock, open, dry forest

Table 3.9-2: continued.

Common Name	Scientific Name	Federal status[1]	VT State status[2]	Habitat Groups[3]
Northern mountain-ash	*Sorbus decora*	S	nl	conifer
Floating bur-reed	*Sparganium fluctuans*	S	nl	aquatic
Bog chickweed*[h]	*Stellaria alsine*	SVC	nl	shore, wet forest
Fernald's manna-grass	*Torreyochloa pallida* var. *fernaldii*	S	nl	shore, wet open
Hidden-fruited bladderwort	*Utricularia geminiscapa*	S	nl	aquatic
Northeastern bladderwort	*Utricularia resupinata*	S	T	aquatic, shore
Perfoliate bellwort	*Uvularia perfoliata*	S	nl	rich, dry forest
Alpine bilberry	*Vaccinium uliginosum*	S	nl	alpine
Smooth woodsia*[h]	*Woodsia glabella*	S	nl	rock

* Species likely but not known to be on the GMNF.
*[h] Species known only historically from the GMNF but are likely to still occur.
[1] T is threatened, E is endangered under the Endangered Species Act; S is listed by the Regional Forester of Region 9 as Sensitive for the GMNF; SVC are species of viability concern not current listed as T, E, or S.
[2] E is endangered, T is threatened, and n/l is not listed under Vermont's Endangered Species Law (10 V.S.A. Chapter 123).
[3] Habitat Groups: alpine – alpine and subalpine habitats; rock – cliffs, talus, and exposed rock habitats; open – barrens and open uplands; aquatic – aquatic habitats; shore – riparian shorelines; wet open – open wetlands, bogs, and fens; wet forest – forested wetlands; rich – rich northern hardwood forest; dry forest – dry low elevation forests and woodlands; conifer – conifer forests; landscape – landscape level habitats.
[4] Species listed as Sensitive (RFSS) in Region 9 but not Sensitive on the GMNF.
[5] Species that are currently Sensitive but are no longer considered likely to occur on the GMNF.

Table 3.9-3: Non-TES animal species of viability concern that are not currently designated as RFSS and factors affecting their viability

Species	Habitat Requirements	Life History/Other Factors	Occurrences (extant or historical)
Red-headed woodpecker	Open forests or woodlots, savannah-like grasslands with scattered trees and forest edges; large dead trees imperative for nesting,. Interior forest with abundant hard mast important in winter		More abundant before 1900 than at any time since; 27 current sightings across Vermont, breeding records only in Champlain Lowlands. Not abundant habitat on the GMNF, probably never has been
Rusty blackbird	Around openings in boreal wooded wetlands: fens, alder-willow bogs, muskegs, beaver ponds, swampy lake and stream shores. In Vermont, usually occur at 1,000 ft. elevation or higher	Common grackles and red-winged blackbirds represent competition for nesting sites.	Local and uncommon summer residents in Vermont, most records from the Northeast Kingdom. One sighting on the GMNF in 1995 at Stratton, and near GMNF at Somerset Reservoir in 2004 and 2005
Atlantic salmon	Shallow, swift streams with coarse gravel for spawning; pools, food, and cover to support larvae 1-3 years. Matures in ocean 1-4 years	Extensive restoration: stocking, construction of fish passage devices, removal of dams.	Stocked in most 3rd order and larger streams with drainage into the Connecticut River watershed in Vermont
Blue-spotted salamander	Permanent and semi-permanent or vernal pools in forested swamps and open marshes for breeding and larvae; adults in moist, mature woodlands, deciduous or mixed, with a closed canopy, downed logs, rocks, and leaf litter; needs connectivity between breeding pools and terrestrial habitat. Usually below 1,500 ft. elevation	Hybridization with Jefferson salamander can substantially reduce the number of males in the population, resulting in some eggs not being viable. Road mortality during migration is a concern generally, and potentially along margins of GMNF	Recorded from 39 towns in Vermont, 4 fall within the boundaries of the GMNF. Primarily in the Lake Champlain Valley, with some scattered records from the Connecticut River Valley and southern Vermont
Four-toed salamander	Small ponds, swamps, vernal or seasonal pools, bogs, and forested or partly open wetlands with moss or tussock sedges for larval development; adults live in hardwood or mixed forests with ample course woody debris on the forest floor. Needs connectivity between breeding pools and terrestrial habitat. Usually below 1,500 ft. elevation	Moss hummocks or moss mats (often sphagnum) overhanging standing water is a critical feature of breeding sites. Eggs are deposited in moss and, upon hatching, larvae drop into pools. Road mortality during migration is a concern generally, and potentially along margins of GMNF	9 extant 1 historic records near GMNF, 4 extant records from other towns in Vermont
Ebony boghaunter	Sphagnum bogs and fens with small ponds surrounded by woods; adults perch in sun-lit clearings in forest surrounding the wetland	n/a	Not documented but probable on the GMNF
Delicate emerald	Shallow water in evenly vegetated sedge and sedge/moss fens or spring-fed bogs; open water often restricted to very small, shallow puddles, possibly also vernal pools	n/a	Occurs in boreal regions of North America. One record in Vermont; not documented but probable on the GMNF
Black meadowhawk	Wide range of wetland types: fens, bogs, marshes, or oligotrophic pools and small lakes. Larvae live amongst sphagnum mosses	n/a	Primarily a Canadian and western species, disjunct in the Northeast. Occurs in Vermont; not documented but likely on the GMNF

Table 3.9-3: continued

Species	Habitat Requirements	Life History/Other Factors	Occurrences (extant or historical)
West Virginia white butterfly	Undisturbed, moist, deciduous or mixed woods (esp. beech/maple) with closed canopy, coarse woody debris, ample leaf litter. Larvae depend on 2 species of toothwort. Adults do not cross openings	An introduced European plant, garlic mustard (*Alliaria officinalis*), attracts females to oviposit, but larvae cannot successfully mature on it.	Known from Rutland, Bennington, Windham, Chittenden, and Grande Isle Counties, likely on GMNF
Sources: USDA 2002 e, g, h, i, j, k, l, p, m, n			

Table 3.9-4: Non-TES plant species of viability concern that are not currently designated as RFSS and factors affecting their viability

Species	Habitat Requirements	Life History/Other Factors	Occurrences (extant or historical)
Asclepias exaltata	Moist, fertile, or calcium-enriched soils of rich northern hardwoods and various mixed oak-hardwood forest types, generally at low elevations, generally along edges and in gaps, with light or partial shade	Insect pollinated; small populations sizes	16 extant and 3 historical in VT; 13 extant in cumulative effects analysis area; 1 extant on GMNF
Asplenium ruta-muraria	Cracks of warm, dry, natural limestone cliffs and boulders, in full sun or partial shade, at low elevations	Vegetative reproduction; hybridization; collection	16 extant and 22 historical in VT; 16 extant and 21 historical in cumulative effects analysis area; not known but considered likely but limited on GMNF
Carex amphibola	Fine to medium-textured, moist, nutrient and sometimes calcium-enriched soils of alluvial woods, floodplain forests, rich northern hardwoods, and forested wetlands, below 1,500 ft., often under a semi-closed canopy, often in the interior of multi-aged forests	n/a	At least 13 records from VT; all within the cumulative effects analysis area; not known but considered likely but limited on GMNF
Carex backii	Dry-mesic, thin, calcareous rocky or sandy soils under partial shade of oak-pine, oak-hardwood, and limestone hardwood forests and woodlands at low elevations	Responds vigorously to fire; small populations; possible ant dispersal of seeds	16 extant and 12 historical from VT; 14 extant and 10 historical in cumulative effects analysis area; 1 extant adjacent to GMNF
Ceratophyllum echinatum	Quiet, shallow, slightly acidic waters of lakes, ponds, marshes, and backwaters, with shady banks, organic substrates of detritus, and stable hydrology, generally below 1,500 ft. elevation	Dispersal of fruits and fragments by waterfowl; no roots; extensive vegetative reproduction through fragmentation; monoclonal populations; hybridization;	6 extant and 5 historical from VT; 1 extant from the cumulative effects analysis area, on GMNF

Table 3.9-4: Non-TES plant species of viability concern that are not currently designated as RFSS and factors affecting their viability

Species	Habitat Requirements	Life History/Other Factors	Occurrences (extant or historical)
Cynoglossum virginianum var. boreale	Thin, sandy or rocky, mesic calcareous soils in rich northern hardwood and oak-northern hardwood forests, generally in gaps or along edges in partial sun, generally below 1,500 ft.	Animal dispersal; low site fidelity; possible inbreeding depression in small populations	2 extant and 10 historical in VT; 2 extant and 8 historical in cumulative effects analysis area; 2 historical on GMNF
Cypripedium parviflorum var. makasin	Calcareous seepage, swamps, and peatlands, including northern white cedar swamps, rich fens, and calcareous riverside seeps, generally in light to moderate shade, generally below 1,500 ft.	Vegetative reproduction; pollinated by bees; low seed viability; 12 years to flowering; long-lived and persistent; dependent on soil mycorrhizae for successful seed germination; high seedling mortality	Uncertain #'s in VT and cumulative effects analysis area due to recent taxonomic changes; not known but considered likely but limited on GMNF
Diplazium pycnocarpon	Moist, calcium-enriched, deep, soft soils of rich northern hardwood forests, particularly at toe slopes and ravine bottoms, in light to moderate shade, generally below 1,500 ft.	Vegetative reproduction; low phenotypic tolerance of environmental variation	34 records in VT; 27 records in cumulative effects analysis area; 2 extant on GMNF
Eleocharis ovata	Muddy, wet, open calcareous shores of rivers primarily, also pools, lakes, and peatlands, generally below 2,500 ft.; associated with dynamic river systems	Is an annual; small seeds adhere to anything so moves around watersheds easily	5 extant and 8 historical in VT; 1 extant and 5 historical in cumulative effects analysis area; 1 extant and 2 historical on GMNF
Equisetum pratense	Wet, open, calcareous substrates associated with ponds and rivershores, alluvial or moist woods, springs, and wet meadows, generally below 2,500 ft.	n/a	28 extant and 8 historical in VT; 2 extant and 2 historical in cumulative effects analysis area; 1 extant on GMNF
Galium labradoricum	Wet, calcareous substrates of fens, peatlands, cedar swamps, mossy thickets, and marshes, generally below 1,600 ft. elevation	Vegetative reproduction	2 extant and 2 historical in VT; 2 extant and 1 historical in cumulative effects analysis area; not known but considered likely but limited on GMNF
Hackelia deflexa var. americana	Thin, dry, open, rocky, calcareous soils of woodlands, cliffs, ledges, talus, and cobbles, generally below 1,500 ft.; associated with disturbance	Annual/biennial; insect pollination; seed dispersal via animals; small populations	16 extant and 3 historical in VT; 16 extant in cumulative effects analysis area; 1 extant adjacent to GMNF
Helianthus strumosus	Dry, deep, sandy or rocky, open soils of oak/pine woodlands and openings associated with disturbed areas, generally in full or partial sun, generally below 1,000 ft.	Vegetative reproduction; sometimes monoclonal; seed dispersal via animals; small population concerns	25 extant and 9 historical in VT; 22 extant and 7 historical from cumulative effects analysis area; 1 extant adjacent to GMNF

Table 3.9-4: Non-TES plant species of viability concern that are not currently designated as RFSS and factors affecting their viability

Species	Habitat Requirements	Life History/Other Factors	Occurrences (extant or historical)
Oligoneuron album	Calcareous, dry soils or rock, sometimes moist soil, in full sun or light shade, generally associated with outcrops, ledges, rocky summits, cliffs, meadows, and disturbed sites like roads, across elevations	n/a	11 extant and 4 historical in VT and cumulative effects analysis area; not known but considered likely but limited on GMNF
Pyrola minor	Cold, moist, calcareous, ledgy soils with deep coniferous litter, associated with conifer forests, especially montane spruce-fir, under low light levels	Small localized populations; insect pollinated	2 extant and 2 historical in VT and cumulative effects analysis area; 1 historical on GMNF
Quercus muehlenbergii	Warm, dry to dry-mesic, calcareous rocky soils of oak or oak-pine forests and woodlands; requires high light for germination but persists as part of a closed canopy; generally below 1,000 ft.	Bird dispersal of acorns; deer browsing; insect defoliation; 20 years to maturity; small population size	42 extant in VT and cumulative effects analysis area; 1 extant on GMNF
Solidago patula	Calcareous, partially wooded wetlands, open swamps, and red maple-tamarack swamps; needs canopy gaps for flowering; generally below 1,500 ft.	Vegetative reproduction	7 extant and 1 historical in VT and cumulative effects analysis area; 1 extant on GMNF
Stellaria alsine	Wet, often calcareous springs, rills, springy stream banks, and cedar swamps, generally below 2,500 ft. elevation	Variable annual and perennial populations; vegetative reproduction	3 extant and 8 historical in VT; 6 historical in cumulative effects analysis area; 1 historical on GMNF

Source: USDA 2004a.
Notes: The cumulative effects analysis area reported for these species is the one defined for the habitat group with which the species is most strongly associated

Table 3.9-5: GMNF current and future (20 years) viability outcomes for animal species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitat[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Gray wolf	T	Land-scape	**E**	**C-E**	**C-E**	**C-E**	**C-E**	**C-E**	extirpated from VT and most of the Northeast; requires large expanses of forested habitat with adequate prey base; no connectivity to existing populations or core range; large predator may be incompatible with current human uses; outcome C dependent on re-introduction, otherwise outcome E because of habitat concerns
Eastern cougar	E	Land-scape	E	E	E	E	E	E	extirpated from VT and most of the Northeast; requires large expanses of forested habitat with adequate prey base; no connectivity to existing populations or core range; large predator may be incompatible with current human uses
Canada lynx	T	Land-scape	**E**	**C**	**C**	**C**	**C**	**C**	extirpated from VT and GMNF; requires large expanse of coniferous or mixedwood forests with adequate prey, esp. snowshoe hare; adapted to deep snow where it can out-compete other predators; no connectivity to existing populations or core range; probably more likely to occur in Vermont as dispersing migrant than as a viable population
Indiana bat	E	Land-scape	C-D?	C-D?	C-D?	C-D?	C-D?	C-D?	declining range-wide but increasing in the Northeast; known near the GMNF and likely on Forest; cool climate (esp. higher elev.) and dense forest of the GMNF may limit suitability of roosting and foraging habitat; creating forest openings may be beneficial at lower elevations
Eastern small-footed bat	S	Cliff, talus, land-scape	C-D?	C-D?	C-D?	C-D?	C-D?	C-D?	too little information to predict abundance or trends; probably has always been rare; cool climate and dense forest of the GMNF may limit suitability of roosting and foraging habitat; creating forest openings may be beneficial at lower elevations

Table 3.9-5: continued.

Species	Fed. Status[1]	Habitat[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Bald eagle	T	Aquatic, land-scape	A	A	A	A	A	A	not known to nest on GMNF although suitable habitat is available; occurs as occasional visitor or migrant; no management effects to habitat on GMNF
American peregrine falcon	S	Cliff	**B**	**A**	**A**	**A**	**A**	**A**	recently de-listed from ESA; improving outcome reflects region-wide recovery; nests on GMNF; no management effects to habitat
Common loon	S	Aquatic (lakes & ponds)	C	C	C	C	C	C	populations stable or increasing viable in New England; recently de-listed in Vermont; no management effects to habitat on GMNF
Red-headed woodpecker	SVC	Dry low-elev. forest	≤D	≤D	≤D	≤D	≤D	≤D	needs openings with standing dead trees; hard mast important in winter; Vermont at eastern limit of range; habitat never has been abundant on GMNF
Bicknell's thrush	S	Subalpine conifer forest	**B**	**C**	**C**	**C**	**C**	**C**	high elevation spruce-fir and krummholz; greatest overall threat is on Caribbean wintering areas; expansion of ski areas and wind turbine projects are potential threats, otherwise no management effects to habitat on GMNF
Rusty blackbird	SVC	Open-wetland/ bog, forested wetland	B/C	B/C	B/C	B/C	B/C	B/C	rare and local breeder in Vermont near ponds and wetlands; at elevations above 1,000 ft. on GMNF; little known about historic populations and trends; range-wide decline due to loss of winter habitat (wooded wetland in SE US); no management effects to habitat on GMNF
Atlantic salmon	SVC	Aquatic	C	C	C	C	C	C	Vermont stocks in larger streams of the Connecticut R. watershed; indigenous stocks extirpated before 1900; substantial restoration effort underway in New England; current fish a mix of native and non-native strains of hatchery-reared and wild-run fish; enhancement on GMNF unaffected by alternatives
Wood turtle	S	Riparian, forested wetland, northern hardwood	**≤C**	**D**	**D-**	**D**	**D+**	**D**	viability threat due to habitat and population losses off-Forest & loss of connectivity; GMNF could become refugium; no management effects to habitat on GMNF
Jefferson salamander	S	Forested wetland and adjacent upland forest	**C**	**D+**	**D**	**D+**	**D+**	**D**	breeds in pools in undisturbed woodland; decreased viability from hybridization with blue-spotted salamander; may benefit from larger un-fragmented tracts of mature or late-successional forest

Table 3.9-5: continued.

Species	Fed. Status[1]	Habitat[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Blue-spotted salamander	SVC	Forested wetland and adjacent upland forest	C?	**C+**	C	C	**C+**	C	breeds in forested wetlands and vernal pools, primarily in Champlain Valley; may be more hardy and flexible to forest disturbance and forest openings than Jefferson salamander, with which it hybridizes; may benefit from larger un-fragmented tracts of mature or late-succession forest
Four-toed salamander	SVC	Forested wetland Northern hardwood Conifer forest	≤C	**C**	≤C	C+	**C+**	≤C	requires a matrix of upland and wetland habitats in close proximity; less dependent on vernal pools than Jefferson salamander; mostly in southern part of VT or Champlain Valley; off-Forest habitat loss a concern; may benefit from larger un-fragmented tracts of mature or late-successional forest
Brook floater fresh-water mollusk	S	Aquatic	B	B	B	B	B	B	riffles or rapids over sand, gravel, and cobble in shallow streams and small rivers; near GMNF in Jamaica, VT, but not known on Forest; no management effects to habitat on GMNF
Creek heelsplitter	S		B	B	B	B	B	B	headwaters of small or medium rivers with fine gravel or sand; known within GMNF proclamation boundary & likely on Forest; suitable habitat abundant across range; no management effects to habitat on GMNF
Boulder beach tiger beetle	S	Riparian	1	1	1	1	1	1	open sand and/or cobble along permanent streams of mid-sized rivers; abundance and trends unknown; no management effects likely to habitat on GMNF
Southern pygmy clubtail	S	Riparian	1	1	1	1	1	1	small, shallow, spring-fed headwater streams with clean sandy or mud substrates and heavy shading; at edge of range in VT; abundance and trends unknown; no management effects likely to habitat on GMNF
Forcipate emerald	S	Open wetland/ bog, forested wetlands	1	1	1	1	1	1	local and scarce; spring-fed steams or puddles in bogs or fens; 2 recent occurrences on GMNF, 1 in northern VT; abundance and trends unknown; no management effects to habitat on GMNF
Harpoon clubtail	S	Riparian	1	1	1	1	1	1	larger streams and small rivers; habitat limited but widespread; at edge of range in VT; abundance and trends unknown; no management effects to habitat on GMNF

Table 3.9-5: continued.

Species	Fed. Status[1]	Habitat[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Gray petaltail	S	Forested wetland	1	1	1	1	1	1	permanent, spring-fed, sunny hillside seeps, bogs, fens, and swamps in deciduous forest; southern species at edge on range in VT; may prefer open canopy/dense understory; one recent report on GMNF; abundance and trends unknown; no management effects to habitat on GMNF
Ebony boghaunter	SVC	Open wetland/ bog, forested wetlands	1	1	1	1	1	1	low-elevation sphagnum bogs and fens; abundance and trends unknown; no management effects to habitat on GMNF
Delicate emerald	SVC	Open wetland, forested wetlands	1	1	1	1	1	1	shallow water in evenly vegetated sedge and sedge/moss fens and bogs; probable but not known on GMNF; abundance and trends unknown; no management effects to habitat on GMNF
Black meadowhawk	SVC	Barrens/ open upland, open wetland/ bog	1	1	1	1	1	1	fens, bogs, marshes, large grassy meadows with shallow pools; primarily Canadian and western species, disjunct in the VT; abundance and trends unknown; no management effects to habitat on GMNF
West Virginia white butterfly	SVC	Rich hardwood stands, often along narrow stream valleys	B?	B?	B?	B?	B?	B?	outcome uncertain for lack of data; abundance and trends unknown; outcome on GMNF should stay good if habitat and toothwort maintained; no management effects to habitat on GMNF

Note: [1] Outcome uncertain due to limited available data.

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Agrostis mertensii	S	Alpine, Rock	C	C	C	C	C	C	single tiny isolated population; may occur elsewhere; current site in protected area across all alternatives but vulnerable to trampling; habitat limited; habitat generally protected; metapopulation concerns
Asclepias exaltata	SVC	Rich, Dry Forest	B/C	B/C	B/C	B/C	B/C	B/C	single population in protected area in Alts B-E; habitat very limited; habitat quantity and quality expected to remain stable across alternatives; small/isolated population concerns
Asplenium ruta-muraria	SVC	Rock	C	C	C	C	C	C	not known on GMNF but thought likely; outcome based on concern for isolation of single occurrence if found; habitat limited to escarpment but generally protected across all alternatives
Aureolaria pedicularia var. *pedicularia*	S	Dry Forest	C	**C/D**	**C/D**	**C/D**	**C/D**	**C/D**	single population in protected area across all alternatives; population is declining; habitat very limited and vulnerable to succession; all alternatives allow management to maintain habitat; viability concerns related to declining habitat suitability and population size at current site, as well as population isolation
Blephilia hirsuta	S	Wet Forest, Rich, Wet open	B/C	B/C	B/C	B/C	B/C	B/C	1 of 3 populations in protected area across all alternatives; remaining two managed in similar ways across alternatives; habitat very limited; habitat generally protected across all alternatives; small/isolated population concerns
Calamagrostis stricta ssp. *inexpansa*	S	Rock	B/C	B/C	B/C	B/C	B/C	B/C	single persistent population; site in protected area and well-protected across all alternatives; habitat likely restricted to known site; small/isolated population concerns

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Cardamine parviflora var. *arenicola*	S	Rock, Dry Forest	B	B	B	B	B	B	2 small populations; sites in protected areas across all alternatives; habitat limited; rock habitat generally protected; all alternatives allow management in escarpment to perpetuate open habitat
Carex aestivalis	S	Rich, Dry Forest	B	B	B	B	B	B	1 of 4 populations in protected area across all alternatives; remaining sites managed in similar ways across al alternatives; habitat limited; habitat quantity and quality expected to remain stable across alternatives
Carex amphibola	SVC	Wet Forest, Rich	C	C	C	C	C	C	not known on GMNF but considered likely; outcomes related to likely isolation of any population found; habitat very limited; wetland habitat is generally protected across all alternatives; forest habitat expected to remain stable across alternatives
Carex aquatilis var. *substricta*	S	Shore, Wet Open	B/C	B/C	B/C	B/C	B/C	B/C	1 of 3 population sites protected across all alternatives; remaining two sites protected in Alts B-E; habitat very limited; wetland habitat generally protected; small/isolated population concerns, as well as concerns for loss of habitat and populations off Forest
Carex argyrantha	S	Rock	B	**B/C**	**B/C**	**B/C**	**B/C**	**B/C**	single population in protected area across all alternatives; habitat very limited within the escarpment; habitat generally protected; management to maintain habitat allowed in escarpment across all alternatives; decline related to expected increases in hiking pressure.

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Carex atlantica	S	Wet Open	n/a	n/a	n/a	n/a	n/a	n/a	records on Forest now considered unlikely this species, and species no longer considered likely to occur on GMNF; site is in a protected area in Alts B-E and habitat generally protected.
Carex backii	SVC	Dry Forest	C	C	C	C	C	C	single population adjacent to GMNF protected area across all alternatives; habitat very limited; isolation concerns due to habitat limitations; habitat likely to remain stable across all alternatives
Carex bigelowii ssp. *bigelowii*	S	Alpine	C/D	C/D	C/D	C/D	C/D	C/D	single small population in poor condition; site in protected area across all alternatives but vulnerable to trampling; restricted to very limited alpine habitat; habitat generally protected; potential for D outcome with increasing recreation pressures, limited metapopulation interactions, small population problems
Carex foenea	S	Rock, Open	B/C	B/C	B/C	B/C	B/C	B/C	single small population; site in protected area across all alternatives; limited habitat restricted to escarpment, but could occur elsewhere; management and fire allowed in habitat and alternatives to maintain habitat; small/isolated population concerns
Carex lenticularis var. *lenticularis*	S	Shore	B/C	B/C	B/C	B/C	B/C	B/C	1 of 3 population sites in protected area across all alternatives; uncertain about species' persistence; habitat generally protected across alternatives; vulnerable to succession; small/isolated population concerns
Carex michauxiana	S	Shore, Wet Open	B	B	B	B	B	B	3 populations; all sites in protected areas across alternatives; habitat limited; most of suitable habitat also in protected areas across alternatives

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Carex schweinitzii	S	Wet Open, Wet Forest	B/C	**C**	**C**	**C**	**C**	**C**	globally rare; one small population; population not in protected area and managed similarly under all alternatives; habitat very limited; most populations in VT on private, and expect reductions in habitat and populations off-Forest; habitat generally protected on GMNF, but population interactions may become more limited
Carex scirpoidea	S	Rock	B/C	B/C	B/C	B/C	B/C	B/C	single small but persistent population; site in protected area across alternatives; habitat limited and likely restricted to current site; habitat generally protected; concern with increasing recreation pressures
Ceratophyllum echinatum	SVC	Aquatic	C	C	C	C	C	C	single population in pond adjacent to AT; habitat very limited but generally protected; water quality concerns related to AT use and maintenance, as well as small/isolated population concerns
Clematis occidentalis var. *occidentalis*	S	Rock, Dry Forest	B	B	B	B	B	B	3 small populations; sites in protected areas across all alternatives; habitat limited; rock habitat generally protected across all alternatives; all alternatives allow vegetation management in escarpment to perpetuate habitat
Collinsonia canadensis	S	Rich	C/D	C/D	C/D	C/D	C/D	C/D	single small population at northeastern edge of species range; site managed similarly across all alternatives; habitat very limited and likely restricted to existing site; viability concerns related to small population size and isolation; habitat stable across all alternatives

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Conopholis americana	S	Dry Forest	C	**B/C**	**B/C**	**B/C**	**B/C**	**B/C**	2 populations; both populations managed similarly under all alternatives; habitat limited; habitat likely stable or slightly improving, although populations vulnerable to deer herbivory and loss of oak tree hosts
Cryptogramma stelleri	S	Rock	B/C	B/C	B/C	B/C	B/C	B/C	2 small isolated populations; sites in protected areas across all alternatives; habitat very restricted; habitat generally protected across all alternatives; small/isolated population concerns
Cynoglossum virginianum var. *boreale*	SVC	Rich, Dry Forest	D/E	D/E	D/E	D/E	D/E	D/E	2 historical populations; have not been relocated in spite of searches, but has low site fidelity and is considered still likely; experiencing a dramatic regional decline; historical sites managed similarly across all alternatives; habitat expected to remain stable across alternatives; viability concerns associated small/isolated populations, likely loss of historical population, and loss of populations in VT and New England that make any GMNF populations more isolated
Cypripedium parviflorum var. *makasin*	SVC	Wet Open, Wet Forest	B/C	B/C	B/C	B/C	B/C	B/C	not known from GMNF but considered likely to occur; habitat very limited and generally protected across all alternatives; only example of most suitable habitat is in a special area under Alts B-E; small/isolated population concerns as well as concerns regarding loss of habitat and populations off-Forest

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Cypripedium parviflorum var. *pubescens*	S	Wet Forest, Rich	B	**B/C**	**B/C**	**B/C**	**B/C**	**B/C**	2 of 5 populations in protected areas in Alts B-E; remaining populations in areas managed similarly across all alternatives; habitat limited on GMNF; habitat quality likely to remain stable; populations vulnerable to changes in hydrology and habitat degradation, as well as collection, herbivory, and loss of habitat and populations off-Forest; taxon undergoing a range-wide decline
Cypripedium reginae	S	Wet Open, Wet Forest	B/C	B/C	B/C	B/C	B/C	B/C	1 of 3 populations in protected area across all alternatives; remaining two sites in protected areas in Alts B-E; habitat very limited; habitat generally protected across all alternatives; small/isolated population concerns as well as concerns regarding loss of habitat and populations off-Forest
Desmodium paniculatum	S	Dry Forest	C	C	C	C	C	C	historical population in a protected area across all alternatives; current population site is managed similarly across all alternatives; habitat very limited; viability concerns related to limited suitable habitat and isolated populations
Diplazium pycnocarpon	SVC	Rich	B/C	B/C	B/C	B/C	B/C	B/C	single population in protected area in Alts B-E; habitat very limited; habitat generally managed similarly across all alternatives and expected to remain stable or improve slightly; small/isolated population concerns

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Draba arabisans	S	Rock, Dry Forest	B/C	B/C	B/C	B/C	B/C	B/C	single small but persistent population; site in protected area across all alternatives; habitat limited and restricted within the escarpment; management allowed within escarpment across all alternatives to maintain habitat; small/isolated population concerns
Dryopteris filix-mas	S	Rich	B/C	B/C	B/C	B/C	B/C	B/C	populations limited to central portion of VT from Brandon to Woodstock; only known from AT corridor east of GMNF; habitat very limited; habitat managed similarly across all alternatives and expected to remain stable; small/isolated population concerns
Eleocharis intermedia	S	Shore, Wet Open	B/C	B/C	B/C	B/C	B/C	B/C	2 populations; sites in protected areas across all alternatives; habitat very limited; habitat generally protected across all alternatives; habitat vulnerable to succession; small/isolated population concerns, as well as concerns for loss of habitat and populations off-Forest
Eleocharis ovata	SVC	Shore	B/C	B/C	B/C	B/C	B/C	B/C	single current population and historical records all in protected areas across alternatives; habitat very limited; habitat generally protected across alternatives; small/isolated population concerns
Equisetum pratense	SVC	Shore, Wet Open, Wet Forest	C	C	C	C	C	C	1 population; site not in protected area in any alternatives but within similar management areas under all alternatives; habitat very limited; habitat generally protected across all alternatives; small/isolated population concerns

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Eupatorium purpureum	S	Rich, Dry Forest	C/D	C/D	C/D	C/D	C/D	C/D	single population in protected area in Alts B-E; population along edge of woods road and vulnerable to loss from use of road during logging or access to private lands; habitat very limited but quality and quantity expected to remain stable across alternatives; viability concerns related to small/isolated populations
Galium kamtschaticum	S	Wet Forest	B	B	B	B	B	B	only documented historical record from GMNF in protected area across all alternatives; forest habitat is common, but seep characteristics may be limited on Forest; habitat generally protected across all alternatives
Galium labradoricum	SVC	Wet Open, Wet Forest	C	C	C	C	C	C	not known from GMNF but considered likely to occur; outcome based on concern for isolation of single occurrence if found; habitat very limited on GMNF but generally protected across all alternatives
Geum laciniatum	S	Shore, Wet Open	B	B	B	B	B	B	4 populations; none in protected areas but within similar management areas under all alternatives; habitat limited; habitat generally protected
Hackelia deflexa var. *americana*	SVC	Rock, Dry Forest	B/C	B/C	B/C	B/C	B/C	B/C	single large persistent population off-Forest; site adjacent to GMNF protected area across all alternatives; habitat limited and restricted within the escarpment; vulnerable to trampling; concerns related to population isolation
Helianthus strumosus	SVC	Open	C	C	C	C	C	C	single population adjacent to GMNF; habitat very limited; habitat managed similarly in all alternatives; management allowed to maintain habitat across all alternatives; limited habitat and isolated population lead to concerns for viability

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Huperzia appalachiana	S	Alpine, Rock	C/D	C/D	C/D	C/D	C/D	C/D	population historical only; historical site in protected area across all alternatives; may occur elsewhere; habitat limited; C outcome assumes population relocated; D outcome represents loss from historical site but possibility of another location
Isoetes tuckermanii	S	Aquatic	n/a	n/a	n/a	n/a	n/a	n/a	records on Forest now considered unlikely this species; no longer considered likely to occur on GMNF; sites are protected across all alternatives
Isotria verticillata	S	Dry Forest	C	C	C	C	C	C	single population on GMNF not in protected area; site managed similarly across all alternatives; habitat very limited; habitat likely to remain stable across alternatives; species particularly vulnerable to ground-disturbance; viability concern related to isolated population and limited habitat
Juglans cinerea	S	Wet Forest, Rich	C	**D**	**D**	**D**	**D**	**D**	several populations and scattered individuals; 4 documented sites in protected areas across all alternatives; habitat limited; outcomes due to disease which is causing decline range-wide; loss of viability predicted even with protection measures
Juncus trifidus	S	Alpine, Rock	B/C	B/C	B/C	B/C	B/C	B/C	single small but persistent population; may occur elsewhere; current site in protected area across all alternatives; habitat limited; habitat generally protected; small/isolated population concerns

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Lespedeza hirta	S	Open, Dry Forest	C	C	C	C	C	C	single population adjacent to GMNF; habitat limited and restricted to escarpment; vulnerable to loss due to closing of canopy; management and fire are allowed to maintain habitat across all alternatives; emphasis on habitat management may improve conditions but not better than C; small/isolated population concerns
Muhlenbergia uniflora	S	Shore, Wet Open	B	B	B	B	B	B	3 of 4 populations in protected areas across all alternatives; habitat somewhat well-distributed and generally protected across all alternatives; vulnerable to habitat degradation
Myriophyllum farwellii	S	Aquatic	B	B	B	B	B	B	sites for single known population and three potential populations in protected areas across all alternatives; habitat generally protected; populations vulnerable to water quality degradation from recreational use
Myriophyllum humile	S	Aquatic, Shore	n/a	n/a	n/a	n/a	n/a	n/a	records on Forest now considered unlikely this species - considered *M. farwellii*; no longer considered likely on GMNF; all sites are in protected areas across all alternatives
Nabalus trifoliolatus (=Prenanthes trifoliolata)	S	Dry Forest	C	**C/D**	**C/D**	**C/D**	**C/D**	**C/D**	single population in protected area across all alternatives; population vulnerable to trampling because site along edge of trail; population isolated and has not been observed recently; habitat very limited; habitat managed similarly across all alternatives; management allowed across alternatives to maintain habitat; viability concern related to isolated population and possible loss, and limited habitat

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Oligoneuron album	SVC	Rock, Open	B/C	B/C	B/C	B/C	B/C	B/C	not known on GMNF but thought likely; outcome based on concern for isolation of single occurrence if found; habitat limited to escarpment but generally protected across all alternatives; habitat can be maintained through vegetation management across alternatives
Panax quinquefolius	S	Rich	C	**C/D**	**C/D**	**C/D**	**C/D**	**C/D**	6 of 10 populations in protected areas across alternatives; habitat limited; habitat quantity and quality expected to remain stable across alternatives; key limiting factor is harvesting of roots; collection permits prohibited in all alternatives; outcomes due to expectation that illegal collection will continue to reduce population numbers and size, leading to a decline
Peltandra virginica	S	Shore	B	**B/C**	**B/C**	**B/C**	**B/C**	**B/C**	single population not in protected area, and is only partially on NFS land; habitat very limited; habitat generally protected across all alternatives; vulnerable to water quality degradation; concerns related to single isolated population and lack of metapopulation interactions
Phegopteris hexagonoptera	S	Rich, Dry Forest	C	**B/C**	**B/C**	**B/C**	**B/C**	**B/C**	3 current and 1 historical population not in protected areas, but managed similarly across all alternatives; habitat very limited but expected to remain stable and may improve slightly, although concerns still remain regarding small/isolated populations

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Pinus rigida	S	Rock, Open, Dry Forest	C	**C/D**	**C/D**	**C/D**	**C/D**	**C/D**	small populations on GMNF restricted to limited habitat along escarpment; vulnerable to loss due to lack of reproduction, which requires fire or ground-disturbance; creation of disturbance allowed in habitat across all alternatives; emphasis on habitat management may help move toward outcome C; outcome D may result if management is not effective
Plantago (=Littorella)americana	S	Aquatic, Shore	B	B	B	B	B	B	2 small but persistent populations; sites in protected areas across all alternatives; habitat limited; remaining suitable habitat also in protected areas across all alternatives
Platanthera orbiculata	S	Wet Forest, Rich, Dry Forest, Conifer	B	**B/C**	**B/C**	**B/C**	**B/C**	**B/C**	3 of 8 populations in protected areas across alternatives; 1 is in protected area in Alts B-E; remaining sites are managed similarly; wetland habitat generally protected across all alternatives; forest habitat common overall; habitat quantity and quality expected to remain stable; vulnerability to loss of canopy, leaf litter and ground disturbance, loss of mycorrhizal symbiont, and heavy browsing, all of which increase risks to populations and habitat
Polemonium vanbruntiae	S	Shore, Wet Open, Wet Forest	B	B	B	B	B	B	globally rare; 7 of 9 VT populations on GMNF in Ripton & Lincoln only; 1 of 7 current populations in protected area across alternatives; populations persistent and resilient; habitat restricted to circumneutral conditions in Ripton & Lincoln; habitat managed similarly across alternatives; roadside populations vulnerable to mowing

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Potamogeton bicupulatus	S	Aquatic, Shore	B	B	B	B	B	B	single population; site is in protected area across all alternatives; habitat limited; remaining suitable habitat also in protected areas across all alternatives
Potamogeton confervoides	S	Aquatic	A	A	A	A	A	A	8 populations; 6 sites in protected areas across alternatives; populations persistent and resilient; habitat limited; occupies most suitable available habitat; rare across United States
Potamogeton hillii	S	Aquatic	A	A	A	A	A	A	not known on GMNF but considered likely; considered gobally rare, with VT likely home to most populations in world; populations resilient and opportunistic; habitat on Forest very limited, restricted to the edges, but edges very close to bulk of VT populations
Pyrola chlorantha	S	Wet Forest, Dry Forest, Conifer	B/C	B/C	B/C	B/C	B/C	B/C	single historical population; site protected under all alternatives, but vulnerable due from being adjacent to trail; habitat very limited; wetland habitat generally protected across all alternatives; remaining habitat expected to be stable across all alternatives; concern related to small/isolated populations
Pyrola minor	SVC	Conifer	C	C	C	C	C	C	very limited distribution in VT; single historical population on GMNF thought likely still there; site is managed similarly across all alternatives; another current population in AT corridor; very limited suitable habitat within a broader common habitat; habitat likely to remain stable across alternatives; viability concerns related to isolated populations on and off-Forest, possible loss of historical population, and limited habitat

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Quercus muehlenbergii	SVC	Dry Forest	C	C	C	C	C	C	single population on GMNF not in protected area, but managed similarly across all alternatives; habitat very limited; management allowed across alternatives to maintain habitat; viability concerns related to isolated population and limited habitat
Rhodiola (=Sedum) rosea	S	Rock	B/C	B/C	B/C	B/C	B/C	B/C	single persistent population; site in protected area across all alternatives; habitat restricted to the one protected site; small/isolated population concerns
Ribes triste	S	Wet Forest, Rich, Conifer	B	B	B	B	B	B	1 current and 1 historical population site in protected area in Alts B-E; remaining 9 extant and 2 historical sites with similar management effects across all alternatives; suitable habitat limited; wetland habitat generally protected across all alternatives; habitat quantity and quality expected to remain stable across all alternatives
Saxifraga paniculata ssp. *neogaea*	S	Rock	B/C	B/C	B/C	B/C	B/C	B/C	single persistent population; site in protected area across all alternatives; habitat restricted to the one protected site; small/isolated population concerns
*Scheuchzeria palustris (=*ssp. *americana)*	S	Shore, Wet Open	B/C	B/C	B/C	B/C	B/C	B/C	single population and all historical sites in protected areas across all alternatives; habitat very limited on GMNF; habitat generally protected across alternatives; vulnerable to changes in hydrology; small/isolated population concerns

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Selaginella rupestris	S	Rock	B/C	B/C	B/C	B/C	B/C	B/C	2 current and 1 historical populations; sites in protected areas across all alternatives; habitat limited and restricted to escarpment; habitat generally protected; particularly vulnerable to ground disturbance; small/isolated population concerns
Sisyrinchium angustifolium	S	Open, Wet Open	B	B	B	B	B	B	4 populations; open habitats widely distributed and maintained through natural processes and management activities; likely overlooked; habitat more well-distributed than species
Sisyrinchium atlanticum	S	Open, Wet Open	B	B	B	B	B	B	1 population; open habitats widely distributed and maintained through natural processes and management activities; likely overlooked; habitat more well-distributed than species
Solidago patula	SVC	Wet Forest	B/C	B/C	B/C	B/C	B/C	B/C	single isolated population in protected area under Alts B-E; habitat very limited; habitat generally protected across all alternatives; small/isolated population concerns
Solidago squarrosa	S	Rock, Open, Dry Forest	B/C	B/C	B/C	B/C	B/C	B/C	1 current and 1 historical population; current site in protected area across all alternatives; habitat somewhat restricted, generally protected when on rock; forest and open habitat generally maintained across alternatives through vegetation management; small/isolated population concerns

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Sorbus decora	S	Conifer	A/B	A/B	A/B	A/B	A/B	A/B	1 of 4 known sites in protected area across all alternatives; remaining populations managed similarly across alternatives; suitable habitat limited; persistent shrub associated with edges, so does not tend to be vulnerable to types of activities that occur within habitat; most likely habitat limited
Sparganium fluctuans	S	Aquatic	B	B	B	B	B	B	9 of 10 known sites in protected areas across all alternatives; populations persistent; habitat limited; occupies most of likely suitable habitat; vulnerable to water quality degradation; some populations in region have been lost
Stellaria alsine	SVC	Shore, Wet Forest	C	C	C	C	C	C	1 historical site, in protected area across alternatives; habitat very limited; habitat generally protected across alternatives; concerns regarding possible loss of historical population, limited suitable habitat, and single/isolated population concerns
Torreyochloa pallida var. *fernaldii*	S	Shore, Wet Open	B	B	B	B	B	B	1 population in protected area across all alternatives; second in protected area in Alts B-E; remaining are in similar management areas; habitat well-distributed and generally protected across all alternatives
Utricularia geminiscapa	S	Aquatic	B	B	B	B	B	B	8 of 10 known sites in protected areas across all alternatives; populations persistent; habitat limited; occupies most of likely suitable habitat; vulnerable to water quality degradation

Table 3.9-6: GMNF current and future (20 years) viability outcomes for plant species of viability concern, including rationale for GMNF outcomes.

Species	Fed. Status[1]	Habitats[2]	Viability outcomes for the GMNF[3]						Rationale
			Current	Future Alt. A	Future Alt. B	Future Alt. C	Future Alt. D	Future Alt. E	
Utricularia resupinata	S	Aquatic, Shore	C	C	C	C	C	C	single population in protected area across all alternatives; nearest population off-Forest may be lost; habitat limited to few of the ponds on Forest; vulnerable to water quality and shoreline degradation caused by humans and beaver; small/isolated population concerns
Uvularia perfoliata	S	Rich, Dry forest	C	**B/C**	**B/C**	**B/C**	**B/C**	**B/C**	single population not in protected area, but managed similarly across all alternatives; habitat limited but expected to remain stable across alternatives or improve slightly; viability concerns related to single/isolated populations
Vaccinium uliginosum	S	Alpine	D	**C/D**	**C/D**	**C/D**	**C/D**	**C/D**	single small population of 2 individuals; site in protected area under all alternatives but vulnerable to trampling; restricted to very limited alpine habitat; habitat protected; potential for D outcome with increasing recreation pressures, limited metapopulation interactions, small population problems; outcome C represents improvements based on conservation measures
Woodsia glabella	S	Rock	B/C	B/C	B/C	B/C	B/C	B/C	single historical population; likely still at historical site; site in protected area under all alternatives; tends to be persistent, but usually small populations; habitat on Forest restricted to historical site; small/isolated population concerns

[1] Federal Status: S = designated Regional Forester Sensitive Species (RFSS); SVC – other species of viability concern that are not currently designated as RFSS
[2] Habitat Groups: Alpine – Alpine and subalpine habitats; Rock – Cliffs, talus, and exposed rock habitats; Open – Barrens and Open Uplands; Aquatic – Aquatic habitats; Shore – Riparian shorelines; Wet Open – Open wetlands, bogs, and fens; Wet Forest – Forested wetlands; Rich – Rich northern hardwood forest; Dry Forest – Dry low elevation forests and woodlands; Conifer – Conifer forests
[3] For outcome definitions, see Indicator description in text; represents risk to viability ranging from low risk at A to high risk at E; outcomes in bold are those that are different from current condition.

Table 3.9-7: Summary of Determination of Effect for Sensitive Species

Species	Alternatives				
	A	B	C	D	E
Animals					
Eastern small-footed bat	3	3	3	3	3
American peregrine falcon	1	1	1	1	1
Common loon	1	1	1	1	1
Bicknell's thrush	1	1	1	1	1
Wood turtle	3a	3a	3a	3a	3a
Jefferson salamander	3a	3a & 2?	3a 2?	3a & 2?	3a
Brook floater	1	1	1	1	1
Creek heelsplitter	1	1	1	1	1
Boulder beach tiger beetle	1	1	1	1	1
Southern pygmy clubtail	1	1	1	1	1
Forcipate emerald	3	3	3	3	3
Harpoon clubtail	1	1	1	1	1
Gray petaltail	3	3	3	3	3
Plants					
Juglans cinerea, butternut	3a	3a	3a	3a	3a
All other Sensitive Plants (n=64)	3	3	3	3	3

Source: Biological Evaluation (Appendix E) and this section.
Notes:
1 = No impacts.
2 = Beneficial Impacts.
3 = May impact individuals but is not likely to result in a trend toward federal listing or loss of viability.
3a = May impact individuals but is not likely to result in a trend toward federal listing or loss of viability, although species is at high risk of loss of viability in the planning area.
4 = May impact individuals and likely to result in a loss of viability or a trend toward federal listing.

3.10 RECREATION OPPORTUNITIES AND FOREST SETTINGS

Issue Statement

Public concern is focused on differing opinions about the appropriate mix of recreation opportunities and forest settings that should be emphasized on the Green Mountain National Forest (GMNF). Recreation opportunities can be described along a continuum of settings ranging from highly developed, with dense concentrations of visitors and alterations to the landscape, to more primitive settings where natural forces dominate and the evidence of people are hardly noticeable. Some people prefer to recreate in developed settings where services such as constructed camping pads, potable water, and toilet facilities are available while others prefer a more primitive setting where services and facilities are reduced or non-existent.

Trails on the GMNF provide a wide range of settings and opportunities. Some people would prefer to utilize the trail system with motorized vehicles such as snowmobiles and summer off-road vehicles (ORV) while others prefer non-motorized travel such as mountain biking, horseback riding, or hiking. These uses of the Forest can compete against one another because one type of recreation activity does not always complement the setting for another type of activity. Trail system planning is needed to identify the right mix of trail types in order to meet the needs of Forest users.

In addition, there is a concern that certain resource management actions such as timber management and recreation management can have impacts on each other, as well as impacts to other resources such as wildlife and plants. The following section analyzes the effects of multiple-use management on Forest recreation opportunities. Effects of recreation management on other resources can be found in their respective sections of Chapter 3 in this document.

Indicator 1 – Desired Recreation Opportunity Spectrum Classes by Management Area

The Forest Service uses a nationally recognized classification system called the Recreation Opportunity Spectrum (ROS) to help describe different recreation settings, opportunities, and experiences, and to help guide management activities (USDA 1986). The amount and location of each Recreation Opportunity Spectrum class provides an effective way to compare the Forest settings and recreation opportunities emphasized in each alternative. Nationally, recreation settings vary from primitive, where there is little evidence of other people, more difficult access, and more opportunities for self-reliance, to more developed rural areas which offer more facilities, improved access, and opportunities to interact with other recreationists. Table 3.10-1 describes the characteristics of each ROS class on the GMNF.

ROS is referred to in two different ways. The first is as an inventory tool to describe the existing array of recreation settings. This application describes the existing condition of the Forest and is referred to as the “Inventoried ROS Class.” The second way ROS is used is to set management direction and those are referred to as the “Desired ROS Class.” Each management area is assigned a Desired ROS Class.

This indicator highlights the differences between alternatives because each alternative has different management area allocations and associated Desired ROS Classes to guide recreation management.

Indicator 2 – Trails: Number of Acres Available for Development by Trail Activity

The Forest Service provides trails as a recreation opportunity for the public. A trail is a linear feature constructed for the purpose of allowing the free movement of people, stock, or off-road vehicles (ORV). There are many types of trail activities that the Forest Service manages including, but not limited to, hiking, horseback riding, bicycling, cross-country skiing, snowmobiling, and summer ORVs. Trails are constructed to standards according to their designed use. The designed use of a trail is the use that requires the highest level of development. Many trails provide for more than one type of trail use.

Currently the GMNF has an established trail system that provides for hiking, bicycling, horseback riding, cross-country skiing, and snowmobiling. Summer ORVs are allowed on designated trails and roads, however, no trails or roads are currently designated for this use. The revised Forest Plan sets management area prescriptions that restrict certain types of trail uses, therefore limiting the number of acres available for future trail development by use type. Comparing the acres of land available for future trail development by use type will provide an effective way of comparing trail opportunity emphases among alternatives.

Indicator 3 – Acres of Land Available for Future Developed Recreation Facilities

The Forest Service constructs and maintains developed recreation facilities such as campgrounds, picnic areas, and trailheads. Each developed recreation facility is designed for a capacity that is measured in terms of the maximum number of “people at one time” (PAOT) that can be served at any given site. Each developed recreation facility is measured with a PAOT capacity that provides specific opportunities in a developed setting depending on the site.

The Forest Plan does not propose any new specific developed recreation facilities but does allow for future development based on demand. Some management areas are open to future recreation facility development while others limit or prohibit development. Identifying the acres of land available for future developed recreation facilities is an effective way of comparing future opportunities among the alternatives.

Indicator 4 – Acres of Land Available for Recreation Special Use Activities

The Forest Service, in partnership with private and commercial groups, provides assistance to visitors seeking a quality recreation experience on public lands. The partnerships between the Forest Service and private and commercial groups are formalized through Recreation Special Use Permits. Recreation activities under special use permit are important to the visitor, the agency, the resources, and the economy of surrounding communities. Recreation Special Use Permits formalize a partnership to assure that the public has reasonable access to National Forest opportunities, that the use resulting from them is of the highest quality, that the resources are protected, and that the public learn the unique attributes of the environment.

Forest Plan management area prescriptions provide guidance on where recreation use permits are appropriate across the Green Mountain National Forest. Some management areas are open to future recreation special uses while others limit or prohibit the activity. Identifying the acres of land available for future recreation special use activities is an effective way of comparing future opportunities among alternatives.

Indicator 5 – Impacts to Recreation Resources from Timber Harvest Activities

The Forest Service manages land using a multiple-use ethic. Multiple-use land management activities are primarily designed to complement each other, but in some cases demand for resources compete and result in

desirable and undesirable effects. Recreation and timber management are resource areas that coexist with the multiple-use ethic.

The revised Forest Plan management area prescriptions provide guidance on what resource activities are emphasized across the Green Mountain National Forest. This indicator will identify management areas where timber management can occur and highlight the potential effects to recreation resources.

Indicator 6 – Impacts of Wilderness Designation on Recreation Opportunities

Wilderness is designated through an Act of Congress. Congressionally designated Wilderness Areas are managed to allow natural processes to dominate and provide for primitive recreation experiences. The Forest Plan recommends Wilderness Study Management Areas that emphasize management activities that will not preclude the land's capability for future Wilderness Management Area designation.

According to the Wilderness Act (PL 88-577 1964), certain uses and infrastructure are prohibited in wilderness including motorized vehicles, motorized equipment, mechanized equipment, roads, and structures. Within the GMNF proposed Wilderness Study MAs, some of these uses currently exist. According to the Wilderness Study MA, these existing uses would not be allowed to remain if the Congress formally designates it as Wilderness.

This indicator focuses on the effect on existing recreation facilities and access within the Wilderness Study Management Area. Specifically, the indicator will display the miles of motorized trails, miles of roads, and number of recreation facilities (trail shelters, fire towers, and trailheads) that currently exist and are inconsistent with the Wilderness Act (PL 88-577 1964) and Eastern Wilderness Act (PL 93-622 1975).

This indicator highlights the differences between alternatives because each alternative proposes different Wilderness Study Area allocations that could impact recreation activities and facilities existing in those areas, if they are designated formal wilderness.

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the Green Mountain National Forest. This area represents National Forest System lands where recreation resources exist, and the lands where those resources could receive impacts from management activities.

The analysis area for cumulative effects includes all GMNF lands and the lands administered by other owners, both public and private, which provide recreation opportunities within the State of Vermont.

Table 3.10-1: Description of National ROS classes.

ROS Element	Rural (R)	Roaded Natural (RN)	Semi-primitive Motorized (SPM)	Semi-primitive Non-motorized (SPNM)	Primitive (P)
Access	All methods of access and travel may occur, but subject to formal regulations.	All methods of access and travel may occur, when compatible with intended activities within zones of motorized use.	Travel on trails designed for or open to motorized use.	Trails are closed to motorized use.	Non-motorized primitive trails
Remoteness	Remoteness from sites and sounds of human activity not available or important.	Remoteness from continuous sounds of human activity is of moderate importance.	Nearby sights and sounds of human activity are relatively rare. Distant sounds may be heard.	Nearby sounds of human activity are relatively rare. Distant sounds may be heard.	None to very infrequent sounds of human activity.
Visitor Management	On-site regimentation and control is obvious.	On-site regimentation and controls are few.	On-site regimentation and controls are few.	On-site regimentation and controls are rare.	On-site regimentation and controls are very rare.
On-Site Recreation Development	Recreation structures and facilities readily evident, but appropriate for setting, designed for high use levels. Information and interpretive facilities may be large and complex.	Recreation structures and facilities may be present, but are provided primarily for protection of the resource rather than user convenience. Facilities are rustic and harmonize with a backcountry setting.	Recreation structures and facilities may be present, provided primarily for site protection rather than user convenience. Facilities are rustic and harmonize with the natural setting.	Recreation structures and facilities may be present but provided primarily for site protection rather than user convenience. Facilities are rustic and harmonize with the natural setting.	Recreation structures and facilities rarely present, provided primarily for protection of site rather than user convenience. Facilities constructed of native material and harmonize with natural setting.
Social Encounters	Moderate to high concentrations of people at one time.	Moderate concentrations of users on roads; moderate to low evidence or interactions with others on trails and at facilities.	Low interaction between users. Campsites seldom within sight or sound of another group except during peak periods.	Low interaction between users. Campsites seldom within sight or sound of another group except during peak periods.	Very low interaction between users. No other groups in sight or sound of overnight camps.
Visitor Impacts	Very noticeable but managed to prevent physical resource degradation.	Use noticeable but not degrading to resources.	Use noticeable but not degrading to resources or backcountry setting.	Human use noticeable but not degrading to resources.	Human use essentially unnoticeable. Site hardening of trails and campsites may be present.

Source: Based on the USDA 1986 ROS Book.
Notes: These descriptions are desired future condition setting indicators and not management area standards and guidelines.

3.10.1 Affected Environment

Introduction

The Green Mountain National Forest is a popular recreation destination in Vermont, as well as regionally in the Northeast. Historically the role of the National Forest has been to provide high-quality scenery and opportunities for dispersed recreation such as hiking, horseback riding, hunting, fishing, and camping in undeveloped settings. The GMNF provides multiple recreation opportunities in predominantly natural settings within a region of dense populations and urban settings. The GMNF has developed a recreation niche statement (USDA 2004) that highlights the Forest's unique regional role in providing public recreation opportunities. It states:

- Provide high-quality scenery along with opportunities for viewing to support tourism
- Provide diverse and high-quality, trail-based recreation opportunities in predominantly natural settings for all seasons
- Provide large contiguous public land areas for dispersed recreation opportunities
- Provide semi-primitive developed water based recreation opportunities

According to the National Visitor Use Monitoring (NVUM) report (USDA 2001d), 46 percent of visitors to the GMNF are between 31-50 years old. Fifty-nine percent of the visitors live within 50 miles of the Forest (Stynes and White 2004). The top three activities that visitors participate in include viewing scenery (50%), hiking or walking (47%) and downhill skiing or snowboarding (25%).

Opportunities for outdoor recreation are not limited to the National Forest within Vermont, which provides approximately 400,000 acres of public land. Other public opportunities, such as a National Park, State Parks, non-government organizations, and private tourism operators, serve to connect and expand the range of recreation opportunities within the State.

Recreation and tourism within Vermont are important to the State, regional, and local economies. In Vermont, tourism is recognized as one of the State's leading economic industries. This is evident with large resorts that provide year-round recreation activities such as hiking, mountain biking, and viewing scenery during the summer and fall, and skiing, snowboarding, and snowmobiling in the winter. Smaller independent businesses, considered a signature of Vermont, also rely on the tourism trade while providing more personalized year-round services such as bed and breakfasts, unique gift shopping, and nature-dependent activities. The GMNF plays an important role in acting as an anchor to complement the private tourism sector by providing predominantly natural settings and nature-based recreation opportunities.

Existing Forest Plan Management Direction

The 1987 Forest Plan provides several goals and objectives relating to public use and enjoyment of the Forest. The goals of the Forest Plan are to provide a full range of high-quality recreation opportunities with an emphasis on backcountry recreation. The 1987 Forest Plan also states that the Forest Service should provide recreation opportunities that other public land and private landowners cannot.

The Recreation Opportunity Spectrum (ROS) (Table 3.10-1) is a management tool used to inventory and classify land into a variety of recreation settings which provide a range of recreation experiences from Urban to Primitive. The 1987 Forest Plan identifies four ROS classes (Primitive, Semi-primitive, Roaded Natural, Rural) and describes the characteristics of these classes as well as management standards and guidelines put in place to emphasize their character.

The 1987 Forest Plan used an ROS inventory mapping criteria that differed from the national criteria. This created primitive areas on the GMNF that did not meet national criteria for the primitive classification. Furthermore, the 1987

Forest Plan differs in that it does not distinguish between Semi-primitive Motorized and Semi-primitive Non-motorized classes. Management area prescriptions in the 1987 Plan do not provide clear direction as to the appropriate amount or location of motorized uses in Semi-primitive areas.

In addition, the 1987 Forest Plan did not distinguish between the inventoried ROS and the desired ROS. This created confusion when applying the ROS system in the 1987 Forest Plan to proposed management actions. The 1987 Forest Plan applied the ROS inconsistently by assigning class settings to some management areas, but not to all of them.

The 1987 Forest Plan addresses management of the trails system through Forest-wide standards and guidelines as well as management area prescriptions. Forest-wide standards and guidelines contain general information about the location, construction, and maintenance of trails.

The 1987 Plan permits motorized trail uses only on designated roads and trails. This direction covers snowmobiles, off-road vehicles (ORVs), trail bikes, and other trail vehicles. The use of Jeeps and other four-wheel drive street-size vehicles are only allowed on permanent roads open to all passenger vehicles. Motorized trail uses are not allowed within Wilderness (MA 5.1) and Primitive (MA 6.1) areas. Snowmobile use is allowed within White Rocks National Recreation Area but summer off-road vehicles are not permitted.

The 1987 Forest Plan designates the Appalachian Trail/Long Trail (AT/LT) as a Special Area with its own management area prescription (MA 8.1A). The Plan recognizes the trails' uncommon and outstanding recreational values with direction to enhance the qualities of the AT/LT that make it part of the National Trails System. The Special Area (8.1A) includes all National Forest System (NFS) lands within 500 feet on both sides of the center of the AT/LT.

The 1987 Forest Plan has four other management areas that relate directly to recreation resources. Management areas 7.1A (Alpine Ski Areas), 7.1B (Hapgood Pond), 8.1B (White Rocks NRA), and 8.1H (Robert Frost Interpretive Trail) provide specific standards and guidelines to emphasize and manage recreation resources.

Proposed Changes in Management Direction Common to All Alternatives

The revised Forest Plan will provide a single goal for recreation that states: "Provide a diverse range of high-quality, sustainable recreation opportunities that complement those provided off National Forest System land" (Goal 12). There are several recreation objectives that focus on various aspects of the Forest recreation program including reducing the maintenance backlog and emphasizing more strategic planning to meet the demands of Forest visitors.

The revised Forest Plan will continue to use the Recreation Opportunity Spectrum (ROS) as the system for inventorying and classifying recreation settings across the Forest. The revised Forest Plan will utilize the national ROS criteria and recreation settings in all categories as described in Table 3.10-1.

The Inventoried ROS was closely considered while mapping the management areas in the revised Forest Plan. There are many instances where the Inventoried ROS is different from the Desired ROS. These differences highlight the direction of future management activities.

The revised Forest Plan will continue to provide management direction for trails through updated Forest-wide standards and guidelines, as well as management area descriptions. Revised Forest-wide standards and guidelines contain updated information about the construction and maintenance of trails. Management area prescriptions prohibit certain types of trail uses within areas of the Forest.

Motorized trail uses are referred to in the revised Forest Plan in two categories that include

snowmobiles and summer ORVs. Snowmobiles are defined as a motor vehicle that is designed exclusively for use over snow and that runs on a track or tracks and/or ski or skis. Summer ORVs are defined as any motorized vehicle designed for or capable of cross-country travel on, or immediately over, land, water, sand, marsh, swampland, or other natural terrain (see the Glossary for complete definitions).

Management area standards and guidelines dictate where future motorized trail uses are permitted to be developed across the GMNF. The revised Forest Plan is more explicit about where future motorized trails may be developed across the Forest. Management areas where future snowmobile trails can be considered to be developed include: Diverse Forest Use, Moosalamoo Recreation and Education Area, Diverse Backcountry, White Rocks NRA, Alpine Ski Area, Alpine Ski Area Expansion, and Eligible Scenic and Recreation River corridors.

Future summer ORV trail development will be limited to connecting corridors of trails between other public and private lands. The GMNF will not provide a self-contained summer ORV trail system, but rather it will be available to link to a larger public trail system primarily located off of National Forest System lands.

Summer ORV trail development will be limited to certain management areas. Summer ORV trails may be developed in the Diverse Forest Use and Diverse Backcountry management areas and Eligible Recreation River corridors. Eligible Scenic River corridors will be limited to trails needing to cross the river segment and corridor.

Other future trail development uses such as hiking, bicycling, and horseback riding are also permitted across the Forest through management area standards and guidelines. All future trail development will be based on demonstrated demand for the recreation opportunity.

The Appalachian National Scenic Trail (AT) and Long National Recreation Trail (LT) will have individual management area prescriptions, including revised standards and guidelines to enhance trail values. Within the proclamation boundary of the Forest, the Appalachian National Scenic Trail Management Area is the National Forest land mapped as the foreground area visible from the AT footpath and associated trail shelters, overnight use sites, viewpoints, water sources, and spur trails (spur trails intersect the AT and provide passage to points of interest or trail facilities within the trail corridor). This MA has a minimum width of 500 feet on both sides of the AT footpath.

The Long Trail Management Area extends from Maine Junction (Sherburne Pass where the AT heads east and the LT heads north) to the northern proclamation boundary of the Forest. The MA contains NFS lands within 500 feet on both sides of the footpath, associated trail shelters, overnight use sites, viewpoints, and water sources. The LT Management Area has updated standards and guidelines that help guide future management actions that affect the trail.

There are two Recreation Special Areas in the revised Forest Plan, Blueberry Lake Special Area and the Robert Frost Interpretive Trail Special Area. A separate management area for the Hapgood Pond Developed Recreation Area was not included in the revised Forest Plan because there was no benefit in separating out this developed recreation facility from other recreation facilities on the GMNF.

Alpine Ski Areas and the White Rocks NRA will have their own management area descriptions with updated standards and guidelines in the revised Forest Plan. The White Rocks NRA Management Plan (USDA 1985) and individual ski area master plans will continue to be consistent with the revised Forest Plan.

The Moosalamoo Recreation and Education Area is a new management area in the revised Forest Plan. The objectives of the Moosalamoo Recreation and Education Area are to: 1) provide a showcase for National Forest multiple use management; 2) provide outstanding education and interpretation opportunities in the areas of

ecological processes and forest management; 3) provide for public enjoyment of the area for outdoor recreation and other benefits; and 4) manage the other resource values present in the area in a manner that does not impair the public recreation values and other special attributes of the area.

Existing Condition

For planning purposes, recreation supply is defined as existing recreation opportunities available for public participation in a preferred setting. Three components of recreation supply are settings, activities, and facilities. Recreationists choose a setting and activity to create desired recreation experiences. The Green Mountain National Forest manages a variety of settings and facilities.

ROS Inventory

The ROS inventory system helps characterize the existing condition of the Forest. The GMNF Inventoried ROS indicates that current National Forest conditions can provide a range of opportunities, settings, and experiences.

The ROS is a planning tool used to identify and evaluate the supply of recreation settings on national forests based on actual on-the-ground conditions (Table 3.10-1). Five ROS classes are currently inventoried on the Green Mountain National Forest as shown in Table 3.10-2. These settings include Urban, Rural, Roaded Natural, Semi-primitive Motorized, and Semi-primitive Non-motorized.

Twenty nine percent of the Forest is within the Semi-primitive Non-motorized ROS class. These areas are predominantly natural environments with subtle modifications (such as rock fire rings and natural surface tent pads) that provide opportunities for dispersed recreation. Evidence of other visitors is uncommon and motorized trail uses are not present. Semi-primitive Non-motorized areas are less remote than Primitive areas and are at least 2,500-acres in size and one-half mile to three miles from any roads open to motorized use.

Semi-primitive Motorized areas comprise 26 percent of the Forest. Conditions in this class consist of a mostly natural environment with low-standard, natural surface roads and trails. These areas are at least 2,500 acres in size and at least one-half mile from improved roads.

The largest proportion (42%) of the Forest is inventoried in the Roaded Natural ROS class. Developed recreation opportunities such as campgrounds, picnic areas, and other facilities are common within these areas.

A small percentage (3%) of the Forest is inventoried in the Rural ROS class and less than one percent is inventoried as Urban. Within the rural areas the environment may be considerably altered and facilities may be designed for large numbers of people and special activities. Sights and sounds of people are common and visitor interactions are moderate to high. Urban areas are characterized as highly-altered environments with dense populations of people.

Primitive is the most remote, undeveloped ROS class. Primitive settings are generally located at least three miles from any open road, 5,000 acres or larger in size, and usually limited to designated Wilderness Areas. No area on the GMNF meets national criteria for the Primitive ROS class. The GMNF has six designated Wilderness Areas, but none meet the 5,000-acre core area criteria for the Primitive setting. Most of the wilderness acres are inventoried as Semi-primitive Non-motorized ROS class, although most wilderness areas are managed in a manner consistent with the Primitive ROS setting.

Table 3.10-2: GMNF Inventoried ROS Classes

ROS	Acres	Percent
Urban	206	<1%
Rural	11,566	3%
Roaded Natural	168,108	42%
Semi-primitive Motorized	104,702	26%
Semi-primitive Non-motorized	116,110	29%
Primitive	0	0%

Source: Green Mountain National Forest GIS Data
Note: The Inventoried ROS analysis includes all GMNF lands including Newly Acquired Lands (MA 9.2).

Developed Recreation Facilities

Recreation facilities are developed within different outdoor settings to facilitate desired recreational use. "Developed recreation" is a term used to describe areas with facilities such as campgrounds, picnic areas, trail shelters, and interpretive sites.

Developed recreation facilities provide varying levels of user comfort and convenience based on the desired ROS class. For instance, the trail shelters along the AT/LT are managed to meet Semi-primitive Non-motorized conditions (except for within Wilderness). The shelters are typically constructed with local materials, are rustic in nature to blend in with the surrounding environment, and provide a limited capacity for few visitor interactions.

In contrast, Hapgood Pond Campground and Day Use Area are located within an area managed to complement Roaded Natural ROS settings. Hapgood Pond developed recreation site contains constructed features such as hardened camping pads, potable water, showers, and flush toilets to accommodate a large number of people comfortably.

The Forest Service defines the capacity of developed recreation facilities in terms of "people at one time" (PAOT) a site can support. Currently there are 114 developed sites managed by the Green Mountain National Forest to accommodate an array of recreation activities. Table 3.10-3 lists the facility types provided across the Forest and their current capacity in PAOTs.

Table 3.10-3: GMNF Developed Recreation Facility Capacities

Developed Recreation facility Type	Total Number of Areas	Total Capacity (PAOT[1])
Trailheads	53	2,189
Campgrounds	9	880
Swimming Area	1	580
Trail Shelters &Tent Areas	35	402
Picnic Sites	6	359
Fishing/Wildlife Viewing Sites	2	190
Interpretive Sites	4	151
Observation Sites	4	149

Source: Green Mountain National Forest INFRA Data
Note: [1]PAOT = People At One Time

Dispersed Recreation

Dispersed recreation is defined as those activities that occur outside of developed recreation sites such as sport activities including fishing and hunting, and trail activities such as hiking, snowmobiling, and cross-country skiing. There are also many dispersed recreation uses such as roadside camping and picnicking outside of locally popular developed recreation areas. Trailheads and parking areas facilitate dispersed use of the Forest.

Large lakes, streams, and ponds are natural attractors for Forest visitors. They provide popular dispersed recreation opportunities for fishing, canoeing, wildlife viewing, swimming, and relaxing.

The GMNF trail system is managed for multiple-uses. Multiple-use trails provide for various trail users to utilize the same sections of trail. For instance, many of the snowmobile trails on the Forest also provide for cross-country skiing. Some trails, such as the Appalachian Trail, provide only for single uses to preserve a Semi-primitive Non-motorized recreation experience. The total GMNF trail system is approximately 906 miles.

Table 3.10-4 displays the miles of trails that are managed for certain uses. Currently foot travel, such as hiking and cross-country skiing, is allowed anywhere on the Forest. For instance, although the table displays 166 miles of trails as managed for cross-country ski use on the Forest, there are endless opportunities for cross-country travel or travel on trails that are not managed for that use.

Horseback riding opportunities are limited to trails that are managed for that use and to Forest roads. The 1987 Plan does not allow cross-country travel by horseback on the Forest. The GMNF has fourteen miles of trails managed for horseback riding trail standards (Table 3.10-4).

Bicycle riding opportunities on trails are limited to trails that are managed for that use. Forest roads are also open to bicycling. Opportunities for bicycle riding on trails are limited to those displayed in Table 3.10-4 and Forest roads.

Snowmobiles and summer ORVs are allowed only on trails that are managed for those uses. Forest roads are closed to snowmobile and summer ORVs unless designated for those uses. Cross-country travel by these use types are not allowed on the Forest. Currently there are no trails on the GMNF managed for summer ORVs. Opportunities for snowmobile riding on trails are limited to those displayed in Table 3.10-4.

Approximately 434 miles of non-motorized trails traverse the Forest including the Appalachian National Scenic Trail (AT) and the Long National Recreation Trail (LT). The AT and LT traverse about 145 miles and 157 miles respectively, and offer some of the premier long distance hiking opportunities in the country. There are many side trails linking to the AT and LT that provide a multitude of day and overnight hiking opportunities. The AT and LT are managed on the GMNF in partnership with the Green Mountain Club and the Appalachian Trail Conservancy.

The Catamount Trail is a cross-country ski trail that spans the State of Vermont from Massachusetts to the Canadian border. The trail within the GMNF utilizes existing roads and trails. The Catamount Trail is managed on the GMNF in partnership with the Catamount Trail Association.

Motorized trails are currently limited to snowmobile use. There are approximately 471 miles of designated snowmobile trails within the Green Mountain National Forest. The snowmobile trail system is part of a popular statewide network managed in partnership with the Vermont Association of Snowmobile Travelers (VAST). Snowmobile trail opportunities vary from two-way groomed corridor trails to single lane un-groomed feeder trails.

Summer motorized trails have not been designated on the GMNF. During the planning period, the Forest Service analyzed the impacts of summer ORV management policies through case study and staff interview analysis of other national forests (Stokowski et al. 2004). Research revealed that nearly all of the forests contacted in the study have designated roads and/or trails open to summer ORV, the majority of which are self-contained trail systems. Interviewees noted both positive and negative impacts from summer ORV use. For example, summer ORV opportunities meet the recreational needs of people and provide access to the lands, but impacts occur to soils and water. Furthermore, illegal riding was reported by all interviewed Forests. Examples of illegal activities include user-created trails and riding on non-designated roads or trails. It could not be determined whether illegal activities increased with increased legal access.

Table 3.10-4: GMNF Miles of Trails by Managed Use

Trail Managed Use	Miles
Snowmobile	471
Hike	349
Cross-country ski	166
Bicycling	37
Horseback Ride	14

Source: GMNF INFRA Data
Notes: Total trail system is 906 miles. Some trails allow for multiple uses along single sections of trail.

There are 37 miles of trail open for bicycling. Bicycling is a relatively new activity on the Green Mountain National Forest and currently there are efforts under way to create formal partnerships with mountain bike clubs for assistance in operation and maintenance of trails. Two trails have been established on the Forest as pilot tests to evaluate the social and biophysical impacts associated with bicycling.

Historically, the public demand for horseback riding on the Forest trail system has been low. But in the recent years there has been more public demand for horseback riding experiences on the Forest (Desisto et al. 2003). The Green Mountain National Forest has 14 miles of designated horseback riding trails.

Recreation Special Uses

Recreation special uses provide the public a service that the Forest Service typically cannot provide. The recreating public continues to ask for a diversity of experiences and opportunities on National Forest System lands that are better provided by private groups. For instance, there are businesses that operate and outfit cross-country ski tours on National Forest land. These businesses provide a recreation service that the National Forest cannot provide and the agreement between the Forest Service and the business is validated through special use permits. Currently, recreation special uses on the Green Mountain National Forest consist of approximately 35 outfitter and guide permits and average 7 recreation event permits at any given time.

In addition, there are nine permits that feature winter sports on the Green Mountain National Forest. The nine permits consist of six nordic ski areas and three alpine ski areas. The special use permits formalize a partnership with private businesses to provide recreation services on National Forest System lands.

Nordic ski areas provide the public with the opportunity to cross-country ski. Each nordic area relies on National Forest land for a portion of their trail system. There are approximately 56 miles of groomed nordic ski trails under special use permit with the Green Mountain NF. Nordic ski areas provide the public with services such as ski rental, ski instruction, lodging, and groomed trails.

The three alpine ski areas under permit with the GMNF include Sugarbush, Mount Snow and Bromley. None of the ski areas are totally dependent on National Forest System land. Only a portion of each ski area uses National Forest System land totaling 2,889 acres that are under permit with the Green Mountain NF. Alpine ski areas have expanded their services in the past 10 to 15 years to include year round recreation opportunities such as sightseeing, mountain biking and hiking in the summer to supplement their skiing and snowboarding activities in the winter. During the 2002-2003 ski season, the three alpine ski areas provided approximately 976,000 skier visits.

Recreation Demand

Recreation demand is a complex relationship between people's desires and preferences, and availability of time, price, and facilities. The evaluation of current and future demand for recreation on the Green Mountain National Forest is based on recent studies that identify and quantify:

- Estimated number of current recreation visits to the Green Mountain National Forest
- Participation rates for recreation activities within Vermont
- Future activity demand based on projected population growth
- Activity demand by demographic strata

The recent National Visitor Use Monitoring (NVUM) study by the Forest Service has estimated current use of recreation sites on the Green Mountain National Forest (USDA 2001d).

Based on NVUM data, 3.4 million recreation visits occurred on the Green Mountain National Forest during 2000. Of these visits, developed recreation areas (day-use and overnight) on the Forest accommodated approximately 33 percent

of the estimated recreation visits (Table 3.10-5). The remaining 68 percent of recreation visits can be defined as "dispersed recreation" that occurs away from developed sites in general forest areas. Wilderness visits account for one percent of the total forest visitor use. These numbers only account for people visiting developed or dispersed sites for the purpose of engaging in a recreation activity. They do not include the millions of people that simply drive through the National Forest.

Table 3.10-5: Recreation Site Use on the Green Mountain National Forest

Type of Recreation Site	Current % of Total Estimated Forest Recreation Visits
Day-Use Developed Sites	30%
Overnight Use Developed Sites	3%
General Forest Areas (Dispersed Sites)	67%
Wilderness	1%

Source: GMNF NVUM Data. Notes: Statistics interpolated from Green Mountain and Finger Lakes National Visitor Use Monitoring Study (USDA 2001d). Percents do not equal 100 due to rounding.

The top six activities participated in on the Green Mountain National Forest during 2000 included viewing natural features, hiking or walking, downhill skiing or snowboarding, relaxing, gathering natural products, and cross-country skiing (snowmobiling was not well represented in the study due to poor winter conditions) (Table 3.10-6). The most utilized recreation facilities were trails, forest roads, interpretive sites, and Forest Service owned cabins or shelters (USDA 2001d).

The majority (98.9%) of residents in Vermont participate in some outdoor recreation activity at some point during the year. Almost 85 percent of residents agreed that the outdoor recreation opportunities now offered in the state satisfy their needs (DeSisto et al. 2003).

According to the National Survey on Recreation and the Environment (Cordell et al. 2004), the top five recreation activities participated in by Vermont residents include walking for pleasure (90.9%), family gatherings (79.3%), view/photograph nature (71.5%), view/photograph wildlife (61.6%), and drive for pleasure (66.7%) (Table 3.10-7).

Table 3.10-8 illustrates the trends in activity participation between 1995 and 2003 among residents of the Vermont region (defined as Vermont, Massachusetts, New Hampshire, and New York) (Cordell et al. 2004). This data, along with other local and regional recreation studies, can give a general indication of relative future recreation demand on the Forest (Cordell et al. 2004, Warnick 2005). The top five activities with the greatest projected increase in participation are snowboarding, snowmobiling, backpacking, viewing wildlife, and day hiking. Those activities projected to decline are sightseeing, small game hunting, and big game hunting.

Table 3.10-6: Top Recreation Activities Participated in on the Green Mountain National Forest

Recreation Activity	Percentage Participation
Viewing natural features such as scenery or flowers	50%
Hiking or walking	47%
Downhill skiing or snowboarding	25%
General/other-relaxing, hanging out, escaping noise and heat, etc.	22%
Gathering mushrooms, berries, firewood, or other natural products	16%
Cross-country skiing	14%

Source: GMNF NVUM Data. Notes: Statistics interpolated from Green Mountain and Finger Lakes National Visitor Use Monitoring Study (USDA 2001d). Percents do not equal 100 because a visitor can participate in more than one activity.

Table 3.10-7: Estimated participation in Selected Recreation Activities for Vermont, Vermont's Market Region, and the U.S.

Activity	Vermont		Vermont's Market Region (NH, MA, NY, VT)		United States
	%	Number	%	Number (Millions)	%
Walking for pleasure	90.9	435,625	87.1	18.505	82.4
Family gathering	79.3	380,057	74.2	15.764	73.9
View/photograph nature	71.5	342,674	61.6	13.087	59.6
View/photograph wildlife	61.6	295,227	42.8	90.93	44.2
Driving for pleasure	66.7	319,670	51.1	10.856	50.3
Swim in lakes, streams	62.8	300,978	49.0	10.410	39.9
Picnicking	60.5	289,955	54.3	11.536	54.9
Sightsee	59.3	284,204	51.1	10.856	50.8
Snow and ice activities	58.2	278,932	38.9	8.264	26.5
Gather mushrooms, berries, etc.	49.4	236,757	28.7	6.097	28.6
Visit historic sites	48.4	231,964	49.7	10.559	45.4
View/photograph birds	45.9	219,983	34.7	7.372	31.8
Day hiking	45.9	219,983	32.2	6.841	32.4
Visit a wilderness or primitive area	45.3	217,107	30.0	6.374	32.0
Fishing	39.3	188,351	27.1	5.757	34.2
Mountain biking	35.0	167,743	23.7	5.035	21.3
Developed camping	33.0	158,157	23.1	4.908	26.4
Canoeing	23.7	113,586	13.0	2.762	9.6
Cross country skiing	22.7	108,793	8.0	1.700	3.8
Hunting	21.4	102,563	6.5	1.381	11.1
Backpacking	21.0	100,646	12.6	2.677	10.4
Snowmobiling	19.5	93,457	8.6	1.827	5.5
Drive off-road	18.8	90,102	13.7	2.911	17.4
Downhill skiing	18.1	86,747	12.5	2.656	8.5
Horseback riding	8.2	39,300	6.8	1.445	9.6
Snowboarding	7.2	34,507	6.3	1.338	4.9

Source: NSRE data from Cordell et al. 2004, Vermont State Report

Table 3.10-8: Percent Change in Participation, 1995 to 2003, for Residents in Vermont's Market Region (NH, MA, NY, VT)

Activity	1995 Participants (Millions)	2003 Participants (Millions)	% Change in Participation1995-2003
Snowboarding	0.61	1.34	119.67
Snowmobiling	0.97	1.83	88.66
Backpacking	1.63	2.67	63.80
Viewing wildlife	5.93	9.09	53.29
Day hiking	4.50	6.85	52.22
Bicycle	5.90	8.89	50.68
Driving off road	1.98	2.92	47.47
Developed camping	3.61	4.91	36.01
Cross country skiing	1.29	1.69	31.01
Primitive camping	2.10	2.73	30.00
Viewing birds	5.69	7.73	29.53
Horseback riding	1.14	1.46	28.07
Picnicking	9.59	11.53	20.23
Visiting historic sites	9.21	10.56	14.66
Swim in lakes and streams	9.27	10.41	12.30
Downhill skiing	2.47	2.66	7.69
Sightseeing	11.12	10.86	-2.34
Small game hunting	0.75	0.73	-2.67
Big game hunting	1.15	1.07	-6.96

Source: NSRE data from Cordell et al. 2004, Vermont State Report

3.10.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Indicator 1 – Desired Recreation Opportunity Spectrum Classes by Management Area

A desired ROS class is identified in each management area's desired future condition to emphasize different recreation settings (Table 3.10-9). Each alternative provides for varying quantities of desired ROS classes across the Forest as shown in Table 3.10-10.

Table 3.10-9: Desired ROS Classification for each Management Area

Desired ROS	Management Area
Rural (R)	• Alpine Ski Area • Alpine Ski Area Expansion
Roaded Natural (RN)	• Diverse Forest Uses • Moosalamoo Recreation and Education Area
Semi-primitive Motorized (SPM)	• Diverse Backcountry • White Rocks NRA • Green Mountain Escarpment • Recreation Special Area
Semi-primitive Non-motorized (SPNM)	• Remote Backcountry • Remote Wildlife Habitat • Appalachian Trail • Long Trail • Alpine/Subalpine Special Area • Ecological Special Area
Primitive (P)	• Wilderness • Existing and Candidate Research Natural Areas • Wilderness Study Area

Effects Common to All Alternatives

The revised Forest Plan utilizes the ROS system to a greater degree by assigning a desired ROS class to each management area's desired future condition. Assigning ROS classes to management areas was developed by using the management area description. The proportion of Forest management area desired ROS classes for each alternative are summarized in Table 3.10-10.

In all alternatives, management activities would move the Forest towards the desired ROS class. Management activities may meet a less developed, but are not permitted to meet a higher developed, ROS class than the desired ROS class for a management area. Existing facilities, accesses, services, and use levels which do not meet the desired ROS class will be permitted until they can be managed to meet the desired future condition.

Even though all management areas have a desired ROS, recreation may not be the primary emphasis. For instance, Candidate Research Natural Areas have a desired ROS class of Primitive. Recreation use in these areas will be subordinate and will not be emphasized as stated in the desired future condition and standards and guidelines.

The desired ROS class will provide a direction for recreation opportunities and settings that may be managed or proposed within the management area.

Alternative A

Alternative A allocates 23 percent of the Forest to MA 9.2 newly acquired lands. MA 9.2 does not have a desired ROS in the management area prescription. MA 9.2 lands emphasize management of existing conditions until assigned a permanent management area and will be managed for their inventoried ROS characteristics. Alternative A is the only alternative that has an Urban ROS class because a small portion (30 acres) of MA 9.2 lands was inventoried as such. Recreation infrastructure such as trails and facilities can be used and maintained but new infrastructure cannot be developed until it is allocated to a permanent management area.

In this alternative the Forest will be managed toward the Urban (<1%), Rural (2%), Roaded Natural (36%), Semi-primitive Motorized (34%), Semi-primitive Non-motorized (13%), and Primitive (15%) ROS classes (Table 3.10-10). Management in the Rural and Roaded Natural settings will emphasize recreation settings that include developed facilities in the natural environment. The Semi-primitive settings will provide for less developed recreation and fewer encounters with other Forest visitors (Table 3.10-1). The Primitive setting will be emphasized in designated wilderness areas.

This alternative provides for the greatest majority (72%) of the Forest recreation opportunities in the motorized ROS classes (Rural, Roaded Natural, and Semi-primitive Motorized). If this alternative is implemented, it will not fulfill the Forest Plan goal to provide recreation opportunities that complement those off of National Forest System lands since most areas adjacent to the Forest are generally considered roaded natural and/or rural.

Table 3.10-10: Estimated Distribution (percent) of Desired ROS Classes by Alternative

Desired ROS	Alt. A[1]	Alt. B	Alt. C	Alt. D	Alt. E
Urban	<1%	0%	0%	0%	0%
Rural	2%	1%	1%	1%	1%
Roaded Natural	36%	49%	33%	26%	33%
Semi-primitive Motorized	34%	21%	31%	25%	24%
Semi-primitive Non-motorized	13%	14%	12%	21%	21%
Primitive	15%	15%	22%	27%	22%

Notes: [1]MA 9.2 (Newly Acquired Lands) do not have a desired ROS identified in the desired future condition. Inventoried ROS was calculated for MA 9.2 lands and included in the totals for Alternative A. Percents do not total 100 due to rounding.

Alternative B

Alternative B assigns all Green Mountain National Forest lands into a desired ROS. This alternative provides for more of the Forest to be managed toward the Roaded Natural (49%) and Semi-primitive Non-motorized (14%) ROS classes than Alternative A. The Semi-primitive Motorized (21%) ROS class has decreased and the Primitive (15%) ROS class is unchanged compared to Alternative A (Table 3.10-10).

This alternative emphasizes the greatest amount of Roaded Natural recreation opportunities compared to all alternatives. In this ROS class remoteness from continuous sounds of human activity is of moderate importance and all methods of access and travel may occur when compatible with intended activities (Table 3.10-1).

Compared to the other action alternatives, this alternative provides for the greatest majority (71%) of the Forest recreation opportunities in the motorized ROS classes, Rural, Roaded Natural, and Semi-primitive Motorized. If this alternative is implemented, it will not fulfill the Forest Plan goal to provide enough recreation opportunities in the Semi-primitive Non-motorized and Primitive ROS classes that complement those off of National Forest System lands since most areas outside of the Forest in Vermont are generally not able to provide Primitive recreation settings (More et al. 2003).

Alternative C

Alternative C assigns all Green Mountain National Forest lands into a desired ROS. This alternative provides for the Forest to be managed towards a nearly equal amount of the Roaded Natural (33%) and Semi-primitive Motorized (31%) ROS classes. Semi-primitive Non-motorized and Primitive will be emphasized on 12 and 22 percent of the Forest respectively (Table 3.10-10).

This alternative will provide for a range of recreation opportunities across the Forest with emphasis placed in the motorized ROS classes (Rural, Roaded Natural and Semi-primitive Motorized).

This alternative provides more Semi-primitive Non-motorized and Primitive ROS settings, and less motorized settings than Alternatives A and B. But compared to Alternatives D and E, it does not provide the optimum balance needed to achieve the Forest Plan goal of providing a diverse range of recreation opportunities that complement those provided off National Forest System land since most areas outside of the Forest in Vermont are generally not able to provide Primitive recreation settings (More et al. 2003).

Alternative D

Alternative D assigns all Green Mountain National Forest lands into a desired ROS. This alternative provides for the Forest to be proportionally divided between Roaded Natural (26%), Semi-primitive Motorized (25%), Semi-primitive Non-motorized (21%) and Primitive (27%).

This alternative offers a wide-range of recreation opportunities across the Forest. Forest visitors will have near equal opportunities for recreation settings ranging from constructed developed recreation facilities with high levels of visitor interactions to remote settings with little or no people around.

Compared to all other alternatives, this alternative provides the greatest amount of non-motorized ROS settings, (Semi-primitive Non-motorized and Primitive) and the least amount of motorized ROS settings. It provides the optimum balance needed to achieve the Forest Plan goal of providing a diverse range of recreation opportunities that complement those provided off National Forest System land since most areas outside of the Forest in Vermont are generally not able to provide Primitive recreation settings (More et al. 2003).

Alternative E

Alternative E assigns all Green Mountain National Forest lands into a desired ROS. This alternative provides for the majority of the GMNF to be managed toward the Roaded Natural (33%) and Semi-primitive Motorized (24%) ROS classes.

The remainder will be managed toward the Semi-primitive Non-motorized (21%) and Primitive (22%) ROS classes (Table 3.10-10).

This alternative will provide for a wide-range of recreation opportunities across the Forest. Forest visitors will have diverse opportunities for recreation settings ranging from developed recreation facilities with moderate to high levels of visitor interactions to remote settings with few or no people around.

This alternative provides more non-motorized ROS settings, (Semi-primitive Non-motorized and Primitive) than Alternatives A, B and C, but less than Alternative D. It does a good job of achieving the Forest Plan goal of providing a diverse range of recreation opportunities that complement those provided off National Forest System land since most areas outside of the Forest in Vermont are generally not able to provide Primitive recreation settings (More et al. 2003).

Indicator 2 – Number of Acres Available for Development by Trail Activity

Effects Common to All Alternatives

The revised Forest Plan provides management area descriptions that prohibit certain types of future trail development including hiking, cross-country skiing, horseback riding, bicycling, snowmobiling, and summer ORVs. Table 3.10-11 summarizes the trail uses allowed in each management area. Existing uses would be permitted until they can be managed to meet the desired future condition. A summary of acres of land available for potential future trail development by use type and alternative is provided in Table 3.10-12.

If any of these alternatives were implemented future trail based recreation opportunities would meet the recreation goal and recreation niche on the GMNF. The alternatives, to varying degrees, provide a mix of trail based recreation experiences and future opportunities that complement those found elsewhere in Vermont.

The current trail system on the GMNF is adequate to meet projected increased demands for hiking and snowmobiling over the short-term and long-term. Future demand for bicycling, horse, pack animal, and dog team, and summer ORV trails are expected to increase as well. Current capacity for these types of uses on the Forest is limited, and future development of trails to accommodate these uses may be necessary. All alternatives provide capacity for the projected future demand of trail uses into the future.

Table 3.10-11: Allowed Future Trail Development by Use Type for each Management Area

Trail Use Type	Management Area
Hike/Foot Travel	• Diverse Forest Use • Diverse Backcountry • Escarpment • Remote Backcountry • Wilderness • Wilderness Study Area • White Rocks National Recreation Area • Appalachian Trail • Long Trail • Moosalamoo Recreation and Education Area • Recreation Special Areas • Alpine Ski Area • Alpine Ski Expansion Area • Candidate Research Natural Area • Ecological Special Area • Alpine/Subalpine Special Area • Eligible Wild, Scenic, and Recreation River Corridors
Bicycling	• Diverse Forest Use • Diverse Backcountry • Escarpment • Remote Backcountry • White Rocks National Recreation Area • Moosalamoo Recreation and Education Area • Recreation Special Area • Alpine Ski Area • Alpine Ski Area Expansion • Ecological Special Area • Eligible Wild, Scenic, and Recreation River Corridors

Table 3.10-11: Allowed Future Trail Development by Use Type for each Management Area

Trail Use Type	Management Area
Horse/ Pack Animal/ Dog Team	• Diverse Forest Use • Diverse Backcountry • Escarpment • Remote Backcountry • White Rocks National Recreation Area • Moosalamoo Recreation and Education Area • Recreation Special Area • Alpine Ski Area • Alpine Ski Area Expansion • Ecological Special Area • Eligible Wild, Scenic, and Recreation River Corridors
Snowmobile	• Diverse Forest Use • Diverse Backcountry • Moosalamoo • White Rocks National Recreation Area • Alpine Ski Area • Alpine Ski Area Expansion • Eligible Scenic and Recreation River Corridors
Summer ORV	• Diverse Forest Use • Diverse Backcountry • Eligible Recreation River Corridor

Alternative A

Alternative A provides for 77 percent of the Forest to remain open for future hiking trail development. Fifty-eight percent would remain open to future bicycling and horse/pack animal/dog team trails. Fifty-five percent would remain open to future snowmobile trail development and 49 percent would be available for consideration of potential future summer ORV corridors as described in the Forest-wide standards and guidelines (Table 3.10-12).

Alternative A is the most restrictive for future hiking trail development because of the large proportion of MA 9.2 newly acquired lands. MA 9.2 does not allow any future trail construction until it is assigned to another MA, but does provide for maintenance of existing trails.

This alternative would provide for a range of future trail uses across the Forest, but some uses such as summer ORVs would be more restricted. Alternative A would be less efficient from a management perspective because of the lands assigned to MA 9.2. Trails located in newly acquired lands would continue to be maintained and open for use.

This alternative provides minimum opportunities to achieve the Forest recreation goal and recreation niche for the GMNF. The MA 9.2 newly acquired lands management area standards and guidelines restrict a significant proportion of the Forest from consideration for future trail development.

Alternative B

Alternative B provides for 97 percent of the Forest to remain open for future hiking trail development. Future bicycling and horse, pack animal, and dog team trails would be permitted on 77 percent of the Forest. Seventy percent would remain open to future snowmobile trails and 64 percent would be available for consideration of potential future summer ORV corridors as described in the Forest-wide standards and guidelines (Table 3.10-12).

Alternative B provides for 97 percent of the Forest to remain open to future hiking trails. Overall, this alternative provides for the maximum diversity of opportunities for future trail uses. The majority of the Forest would remain open for all uses. Compared to Alternative A, all future trail uses are allowed on a greater proportion of NFS lands.

Table 3.10-12: Percent of Green Mountain National Forest Available for Future Trail Development by Trail Activity

Trail Activity	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Hike/Foot Travel	308,689 (77%)	388,577 (97%)	394,969 (99%)	358,505 (89%)	370,293 (92%)
Bicycling	230,742 (58%)	309,153 (77%)	288,605 (72%)	233,937 (58%)	266,373 (66%)
Horse/ Pack Animal/ Dog Team	230,742 (58%)	309,153 (77%)	288,605 (72%)	233,937 (58%)	266,373 (66%)
Snowmobile	221,544 (55%)	280,939 (70%)	254,320 (63%)	189,452 (47%)	216,922 (54%)
Summer ORV	195,410 (49%)	254,596 (64%)	215,275 (54%)	163,109 (41%)	178,382 (45%)

Source: GMNF revised Forest Plan management area standards and guidelines
Definitions: Summer ORV trail activity would be designated motorized trail uses on bare soil during non-winter months.
Notes: Percentages do not equal 100 because multiple trail uses are permitted within single management areas; The significantly less proportions in Alternative A are due to MA 9.2 (Newly Acquired Lands) 1987 Forest Plan standards and guidelines.

Alternative C

Alternative C provides for 99 percent of the Forest to remain open to future hiking trails. Future bicycling and horse, pack animal, and dog team trails would remain open on 72 percent of the Forest. Sixty-three percent of the Forest would remain open to future snowmobile trails and 54 percent would be available for consideration of potential future summer ORV corridors as described in the Forest-wide standards and guidelines (Table 3.10-12).

This alternative provides for the most land to remain open for future hiking trail development across the Forest. Only one percent of the Forest would be closed to future hiking trails. Compared to Alternative A, all future trail uses are allowed on a greater proportion of NFS lands.

Alternative D

Alternative D provides for 89 percent of the Forest to remain open to future hiking trails. Future bicycling and horse, pack animal, and dog team trails would remain open to 58 percent of the Forest. Forty-seven percent of the Forest would remain open to future snowmobile trails and 41 percent would be available for consideration of potential future summer ORV corridors as described in the Forest-wide standards and guidelines (Table 3.10-12).

This alternative provides for the least amount of land to be open to new trail construction for most use types. Compared to Alternative A, future hiking trails would be allowed on a greater proportion of Forest lands and bicycling and horse, pack animal, and dog team trails would be allowed on an equal proportion. Motorized trail activities would be prohibited on a greater proportion of Forest lands than Alternative A. This alternative is the most restrictive to snowmobile and summer ORV trail development.

Alternative E

Alternative E provides for 92 percent of the Forest to remain open to future hiking trails. Future bicycling and horse/ pack animal/ dog team trails would remain open to 66 percent of the Forest. Fifty-four percent of the Forest would remain open to future snowmobile trails and 45 percent would be available for consideration of potential future summer ORV corridors as described in the Forest-wide standards and guidelines (Table 3.10-12).

Compared to Alternative A, this alternative allows for increased trail uses on a greater proportion of Forest lands except for summer ORVs and snowmobile opportunities. Forty-five percent of the Forest would be available for future summer ORV trails. Compared to the other action alternatives, this alternative is the second most restrictive in terms of both motorized and non-motorized trail-based recreation. In comparison, both Alternative A and B provide greater trail-based opportunities; Alternative D provides less opportunity for trail-based recreation.

Indicator 3 – Acres of Land Available for Future Developed Recreation Facilities

Effects Common to All Alternatives

The revised Forest Plan does not analyze any specific proposals for new developed recreation facilities. New developed recreation facilities would be considered based on demonstrated visitor demand. Trends in visitor demand have the potential to add or reduce developed recreation facility capacity or alter existing facilities to accommodate changing social demands.

Management area prescriptions provide direction on where future developed recreation facilities may be constructed. Table 3.10-13 displays where developed recreation opportunities may be developed across the National Forest according to management area standards and guidelines. Some management areas don't have any restrictions while others limit or prohibit new construction based on the desired future condition and standards and guidelines.

If any of these alternatives were implemented, except for Alternative A, developed recreation opportunities would meet the demand for a growing population. Currently, developed recreation facilities (such as picnic areas and campgrounds) on the GMNF are lightly to moderately used by the public except on holiday weekends. The existing recreation facilities have ample capacity to meet projected future demands. Alternatives B, C, D, and E provide adequate opportunities to achieve the Forest recreation goal and recreation niche for high-quality recreation opportunities over the short-term and long-term.

Table 3.10-13: Future Developed Recreation Opportunities by Constraint Level for each Management Area

Developed Recreation Opportunity Constraint Level	Management Area
Open	• Diverse Forest Use • White Rocks National Recreation Area • Moosalamoo Recreation and Education Area • Recreation Special Areas • Alpine Ski Area • Eligible Recreation River Corridor
Limited	• Appalachian Trail • Long Trail • Diverse Backcountry • Escarpment • Remote Backcountry • Alpine Ski Area Expansion • Alpine/ Subalpine Special Area • Ecological Special Area • Eligible Scenic River Corridors
Closed	• Remote Wildlife • Wilderness • Wilderness Study Area • Candidate Research Natural Area • Eligible Wild River Corridors • Newly Acquired Land (Alternative A only)

Alternative A

Alternative A provides for 34 percent of the Forest to remain open to future developed recreation facilities. Twenty-eight percent of the Forest is limited and 38 percent is closed to future developed recreation facilities (Table 3.10-14). It provides for an almost equal distribution of Forest lands to be open to, or prohibited to future developed recreation facilities.

This alternative provides minimum opportunities to achieve the recreation goal and niche for the GMNF. The MA 9.2 newly acquired lands management area standards and guidelines restrict a significant proportion of the Forest from consideration for future developed recreation opportunities.

Alternative B

Alternative B provides for 55 percent of the Forest to remain open to future developed recreation facilities. Twenty-six percent of the Forest is limited and 18 percent is closed to future developed recreation facilities (Table 3.10-14).

This alternative has the greatest amount of acres open to future developed recreation facilities. Compared to Alternative A, a greater proportion of the Forest would be open to future developed recreation facilities. This alternative will provide for the greatest opportunity for future developed recreation facilities.

Alternative C

Alternative C provides for 40 percent of the Forest to remain open to future developed recreation facilities. Thirty-seven percent of the Forest is limited and 24 percent is closed to future developed recreation facilities (Table 3.10-14).

This alternative has the greatest amount of acres limiting future developed recreation facilities. It allows for more of the Forest to remain open for future developed recreation facilities than Alternative A.

Alternative D

Alternative D provides for 32 percent of the Forest to remain open to future developed recreation facilities. Thirty percent of the Forest is limited and 38 percent is closed to future developed recreation facilities (Table 3.10-14).

This alternative has the least amount of acres open to future developed recreation facilities. In terms of acreage open to future developed recreation or open to limited recreation development, this alternative most closely represents the current condition (Alternative A) of the Forest. As in Alternative A, 62 percent of the Forest is open to some level of development.

Alternative E

Alternative E provides for 39 percent of the Forest to remain open to future developed recreation facilities. Thirty-two percent of the Forest is limited and 29 percent is closed to future developed recreation facilities (Table 3.10-14).

This alternative provides for more of the Forest to remain open or limited to future developed recreation facilities than Alternative A, but less than Alternatives B or C.

Table 3.10-14: Acres (Percent) of Green Mountain National Forest Available for Future Developed Recreation Opportunities by Constraint Level

Alternative	Open	Limited	Closed
Alt. A	135,937 (34%)	112,205 (28%)	152,550 (38%)
Alt. B	221,385 (55%)	105,429 (26%)	73,878 (18%)
Alt. C	159,462 (40%)	146,675 (37%)	94,555 (24%)
Alt. D	130,009 (32%)	119,225 (30%)	151,458 (38%)
Alt. E	156,896 (39%)	126,452 (32%)	117,284 (29%)

Source: GMNF revised Forest Plan management area standards and guidelines
Definitions: **Open** – No Management Area restrictions for future construction of new developed recreation sites; **Limited** – Management Area standards & guidelines limit types of future new developed recreation facilities; **Closed** – Management Area standards & guidelines prohibit future construction of new developed recreation facilities.
Notes: The large proportion of "Closed" land in Alternative A is due to 9.2 MA (Newly Acquired Lands) 1987 Forest Plan standards and guidelines.

Indicator 4 – Acres of land available for recreation special use activities

Effects Common to All Alternatives

Management area descriptions provide direction where recreation special uses are compatible with resources across the Forest. Some management areas have no restrictions on future recreation special use permits while other management areas limit or prohibit permits. Table 3.10-15 displays which areas allow future recreation special use permits by management area. All recreation special uses must comply with current Forest Service policies and laws not discussed in the revised Forest Plan.

Future recreation special use permits are prohibited only in the Candidate and Existing Research Natural Areas (cRNA). The quantity of acres (<1%) allocated to the cRNAs does not change between alternatives. Table 3.10-16 summarizes the acres of land available for potential future recreation special use activities.

Alternative A

Alternative A provides for 55 percent of the Forest to remain open to future recreation special uses. Twenty-one percent would be limited and 23 percent would be closed to future recreation special uses (Table 3.10-16).

Future recreation special use permits are prohibited in MA 9.2 newly acquired lands in addition to Candidate and Existing Research Natural Areas in Alternative A.
The high proportion of closed areas in this alternative is due to MA 9.2 newly acquired lands. This MA does not allow recreation special use authorization until it is assigned a permanent management area.

This alternative is the most restrictive for future recreation special use activities and provides minimum opportunities to achieve the recreation goal and niche of the Forest because of the high proportion of MA 9.2 newly acquired lands that prohibit future recreation special use services.

Alternatives B, C, D, and E

If any of these alternatives were implemented, recreation special use opportunities would meet the demand for a growing population. Currently, the heaviest utilized services under recreation special use permit are the all season resorts that specialize in winter sports (USDA 2001d). None of the alternatives propose expanding the Alpine Ski Area MA and Alpine Ski Area Expansion MA because there is currently ample capacity to meet projected future demands.

Alternative B, C, D, and E provide similar capacities for future recreation services under special use permit. These alternatives all achieve the Forest recreation goal and recreation niche to provide high-quality recreation opportunities.

Table 3.10-15: Future Recreation Special Use Permits by Constraint Level for each Management Area

Future Recreation Special Use Permit Constraint Level	Management Area
Open	• Diverse Forest Use • Diverse Backcountry • Remote Wildlife • White Rocks National Recreation Area • Moosalamoo Recreation and Education Area • Recreation Special Areas • Alpine Ski Area • Alpine Ski Area Expansion • Eligible Wild, Scenic, and Recreation River Corridors
Limited	• Escarpment • Remote Backcountry • Wilderness • Wilderness Study Area • Appalachian National Scenic Trail • Long National Recreation Trail • Ecological Special Area • Alpine/Subalpine Special Area
Closed	• Candidate Research Natural Area • Newly Acquired Land (Alternative A Only)

Table 3.10-16: Acres (Percent) of Green Mountain National Forest Available for Future Recreation Special Uses by Constraint Level

Alternative	Open	Limited	Closed
Alt. A	221,630 (55%)	85,513 (21%)	93,549 (23%)
Alt. B	293,211 (73%)	107,010 (27%)	471 (<1%)
Alt. C	260,200 (65%)	140,021 (35%)	471 (<1%)
Alt. D	231,796 (58%)	168,425 (42%)	471 (<1%)
Alt. E	247,478 (62%)	152,743 (38%)	471 (<1%)

Source: GMNF revised Forest Plan management area standards and guidelines
Definitions: **Open** – No Management Area restrictions for future recreation special uses; **Limited** – Management Area standards & guidelines limit types of future recreation special uses; **Closed** – Management Area standards & guidelines prohibit future recreation special uses.
Notes: High level of closed areas to recreation special uses in Alternative A due to MA 9.2 1987 Forest Plan standards and guidelines.

Indicator 5 – Impacts to Recreation resources from Timber Harvest Activities

Effects Common to All Alternatives

Commercial timber management in the revised Forest Plan is allowed in the Diverse Forest Use, Diverse Backcountry, Moosalamoo Recreation and Education, Remote Wildlife Habitat, and Escarpment management areas. All alternatives provide for varying amounts of land to be allocated to these management areas.

Effects of timber harvest activities on recreation resources typically impact access (i.e. road building) and visuals of the harvested area. The effects can have both positive and negative impacts to recreation resources. Direct and indirect negative effects of timber harvesting may involve noise from harvest activities, temporary closure of recreation facilities or trails due to health and safety concerns, and visuals.

Direct and indirect positive effects can include improved access to an area for recreation activities such as driving for pleasure, sightseeing, gathering forest products, hunting, fishing, improved habitat for hunting and wildlife viewing opportunities, and cleared areas for roadside dispersed camping.

In all alternatives, the desired ROS settings and existing recreation resources will be included in all site-specific analyses for timber harvest proposals. Interdisciplinary teams, with public input, will develop proposals that provide the maximum benefit for all resources within a site specific analysis. The Green Mountain National Forest forest-wide standards and guidelines as well as site specific mitigation measures have kept negative impacts from timber harvesting on recreation resources to minimal, acceptable levels.

Indicator 6 – Impacts of Wilderness Designation on Recreation Opportunities

Wilderness is designated through an Act of Congress. The revised Forest Plan proposes Wilderness Study Areas that emphasize management activities that will not preclude the capability of the lands future wilderness designation. Congressionally designated wilderness areas are managed to allow natural processes to dominate and provide for primitive recreation experiences.

The designation of new wilderness areas will provide for additional primitive ROS settings. Indicator 1, Desired ROS Classes by Management Area, considers new wilderness in the ROS analysis. Indicator 5 focuses exclusively on existing recreation infrastructure that is inconsistent with the Wilderness Act.

All alternatives, except Alternative A, provide for varying degrees of potential new wilderness acres. Existing recreation infrastructure inconsistent with the Wilderness Act may be impacted by the designation of new wilderness. Table 3.10-17 displays the miles of motorized trails and roads and the number of recreation facilities (trailheads, trail shelters, and fire towers) that are inconsistent with the Wilderness Act (PL 88-577 1964).

Recreation infrastructure and uses that are inconsistent with the Wilderness Act would typically have to be removed or discontinued upon formal designation of wilderness by Congress. Nationally there are examples where the Congress has made exceptions for existing uses and infrastructure inconsistent with the Wilderness Act to remain. This is achieved by including those exceptions into the enabling wilderness legislation. This indicator does not assume that any exceptions will be made by the Congress in future enabling wilderness legislation on the GMNF.

Table 3.10-17: Existing Recreation Infrastructure within Wilderness Study Areas that are Inconsistent with Wilderness Act

Alternative	Miles of Motorized Trails	Miles of Road	Number of Recreation Facilities[1]
Alt. A	0	0	0
Alt. B	0	0.3	3
Alt. C	0	7.8	3
Alt. D	12	19.3	8
Alt. E	0	7.8	3

Source: GMNF GIS Data
Definitions: Recreation facilities include trail shelters and fire towers
Notes: [1]Alternative B, C and E recreation facilities include Cooley Glen/ Emily Proctor Trailhead, Skylight Pond Trailhead and FR 54/59 Trailhead. Alternative D recreation facilities include Cooley Glen/ Emily Proctor Trailhead, Skylight Pond Trailhead, FR 54/59 Trailhead, Sucker Brook Trail Shelter, Goddard Trail Shelter, Kid Gore Trail Shelter, Caughnawaga Trail Shelter, Glastenbury Lookout Tower.
Alternative A proposes no new wilderness acres. Alternative B proposes no new wilderness areas and only adds acres to existing wilderness areas (2,291 acres). Alternative C proposes two new wilderness areas and adds acres to existing wilderness areas (29,360 acres). Alternative D proposes two new wilderness areas and adds acres to existing wilderness areas (49,799 acres). Alternative E proposes one new wilderness area and adds acres to existing wilderness areas (27,473 acres).

Alternative A

This alternative proposes no new Wilderness areas. Existing recreation infrastructure would not be impacted by implementation of this alternative.

Alternative B

Alternative B proposes no new individual wilderness areas, but does propose 2,291 acres to be added to the Breadloaf Wilderness Area. If this alternative was implemented, approximately 0.3 miles of existing roads and three recreation facilities would be inconsistent with the Wilderness Act (PL 88-577 1964).

Implementing this alternative will not have a significant effect to existing recreation infrastructure. A small amount of road access and three trailheads may have to be removed or relocated to be consistent with the Wilderness Act. Impacts to forest visitors would be minimal.

Alternative C

Alternative C proposes two new wilderness areas and increases to existing wilderness areas totaling 29,360 acres. If this alternative was implemented, approximately 7.8 miles of existing roads and three recreation facilities would be inconsistent with the Wilderness Act.

Implementing this alternative would have a greater impact on existing infrastructure than Alternative A. Approximately 7.8 miles of roads and three trailheads may have to be removed, relocated, or converted to trail to be consistent with the Wilderness Act. Displacement of existing uses and forest visitors would continue to be minor but would be more than Alternative A.

Alternative D

Alternative D proposes two new wilderness areas and increases to existing wilderness areas totaling 49,799 acres. If this alternative was implemented, approximately 12 miles of snowmobile trails, 19.3 miles of roads and eight recreation facilities would be inconsistent with the Wilderness Act.

Implementing this alternative would have the greatest impact on existing infrastructure compared to all alternatives. Twelve miles of snowmobile trail known as the Up and Down Trail in the Glastenbury area would be inconsistent with the Wilderness Act. Removing twelve miles of snowmobile trail would have a minor impact on the 471 mile snowmobile trail system on the GMNF. The recreation experience associated with the Up and Down Trail is considered unique because of its challenging terrain and panoramic views from the top of Glastenbury Mountain. Removing the recreation experience may have an adverse impact to some snowmobile users because there are no other snowmobile trails on the GMNF that offer this type of experience.

If this alternative were implemented approximately 19.3 miles of roads would have to be removed, relocated outside of the wilderness area, or converted to trails. This may displace some recreation users that currently rely on vehicles to access these areas.

If this alternative were implemented, eight recreation facilities would be inconsistent with the Wilderness Act. Three of the eight recreation facilities are trailheads on the west side of the Breadloaf Wilderness Area. Removal or relocation of these trailheads would have little impact to forest visitors.

The remaining five recreation facilities include four trail shelters and Glastenbury Mountain Fire Tower all located on the Appalachian Trail and Long Trail. The four trail shelters include Sucker Brook Shelter located in the Worth Mountain Wilderness Study MA and Goddard Shelter, Kid Gore Shelter, and Caughnawaga Shelter located in the Glastenbury Wilderness Study MA. Removal or relocation of these recreation facilities may have an adverse impact on the shelter-to-shelter hiking experience on the Appalachian Trail and Long Trail.

Alternative E

Alternative E proposes one new wilderness area and increases to existing wilderness areas totaling 27,473 acres. If this alternative was implemented, approximately 7.8 miles of roads and three recreation facilities would be inconsistent with the Wilderness Act.

Implementing this alternative would have a greater impact on existing infrastructure than Alternative A, similar to Alternative C. Approximately 7.8 miles of roads and three trailheads may have to be removed, relocated, or converted to trails to be consistent with the Wilderness Act. Displacement of existing uses and Forest visitors will be minor, but would be more than Alternative A and less than Alternative D.

Cumulative Effects

Cumulative effects are discussed using the recreation emphasis on non-federal lands within the State of Vermont. Providing outdoor recreation opportunities can be considered a public-private partnership. Federal, State, and local levels of government are involved and each has its own particular segment in the recreation market. The federal and State levels focus on opportunities that require large land bases such as wildlife areas, developed sites with few amenities, and primitive areas. Local governments tend to focus on population-oriented facilities such as athletic fields and community parks. The private sector is a large provider too, as demonstrated by the region's four-season resorts, campgrounds, and locally owned businesses.

The National Forest has the greatest ability to provide more dispersed forms of recreation due to its large contiguous land base. State Forests and counties/towns are not able to supply quite as many dispersed forms of recreation. State Parks generally provide a higher level of development than federal developed camping and recreation facilities.

The primary challenge for National Forest recreation managers is how to maintain the unique high quality natural settings and dispersed recreation experiences that the public seeks on federal land. In the future, supply and demand for kinds of recreation may shift, but the variety that can be accommodated on National Forest System lands with their large land bases would ensure some level of user satisfaction. Maintaining an array of forest settings and opportunities helps level fluctuating responses to weather, travel distance, or societal values about when or what recreation activities to pursue.

If any of the alternatives were implemented, land-based recreation opportunities would meet the demand for a growing population. The alternatives, to varying degrees, provide a mix of recreation opportunities and settings that provide a unique experience not found elsewhere in Vermont. Societal expectations of finding a recreation experience that relies on large contiguous land bases on National Forest System land would be met.

Recreation cumulative effects will not have negative impacts to other government and private recreation service providers in Vermont. They meet the National Forest's recreation goal to provide a range of high quality recreation opportunities that don't compete with recreation service providers outside the National Forest. In addition, all alternatives, to varying degrees, in the revised Forest Plan will fulfill the Forest recreation niche.

Snowmobile recreation

3.11 AREAS OF SPECIAL SIGNIFICANCE – RESEARCH NATURAL AREAS, CANDIDATE RESEARCH NATURAL AREAS, SPECIAL MANAGEMENT AREAS, AND OLD GROWTH AREAS

Issue Statement

Public concern is focused on the desire for designation of special areas, resolution of existing candidate Research Natural Areas, and determining the most appropriate mix, size, and configuration of future old growth and other special areas. This is an issue within the broader topic of restoration, protection, maintenance, and enhancement of biological and ecological diversity, and conservation of species, communities, and ecosystems.

Indicator 1 – Acres of RNAs, cRNAs, ecological SMAs, and Old Growth Areas

The first indicator to be used in this effects analysis is acres of Research Natural Areas (RNAs), candidate RNAs (cRNAs), ecological special management areas (SMAs), and old growth areas. This indicator highlights the differences between alternatives because it describes the mix, size, and configuration of various management designations designed to conserve special natural features and representative ecological communities.

Indicator 2 – Percentage of Ecological Units Represented Within RNAs, cRNAs, ecological SMAs, and Old Growth Areas

The second indicator to be used in this effects analysis is percentage of ecological units represented within RNAs, cRNAs, ecological SMAs, or old growth areas. This indicator highlights the differences between alternatives because it describes the extent to which the mix, size, and configuration of these special management designations represent the range of ecological communities found on the GMNF.

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the Green Mountain National Forest. This area represents National Forest System lands where special areas and features exist, and the lands where those resources could receive impacts from management activities. The analysis area for cumulative effects includes all GMNF lands and the lands administered by other owners, both public and private, which fall within the Vermont portions of the Northern and Southern Green Mountain Subsections, the Taconic Mountains Subsection, and the Champlain Glacial Lake and Marine Plains Subsection (Keys et al. 1995). This area represents an ecological region in which special features and representative ecosystems that occur across the region, including on the GMNF, can be conserved.

3.11.1 Affected Environment

Introduction

The introduction to Chapter 3 (3.1) introduces the reader to the concepts and the coarse filter/fine filter approach to the analysis of biodiversity. The terrestrial vegetation and natural communities of the GMNF, including rare and uncommon natural communities, are discussed in detail in the Vegetation section (3.5) of this Chapter. The Threatened and Endangered Species section (3.8) and the Species of Potential Viability Concern section (3.10) both provide information about the rare biota that often inhabit and rely on rare or exemplary natural communities. This section evaluates how well alternatives do at

protecting various types of communities of special significance, including types of long-term protective designations, types of rare or exemplary communities, and types of ecological units.

A fundamental principle of conservation biology is that representative examples of each type of ecological system, along with their full ranges of variation in composition, structure, and function, should be conserved in a way that prevents extractive management (for example, timber harvesting or drilling for oil or gas), while allowing limited management activities that restore or maintain the system (Huggard 2004). Conservation in this context includes both areas that have been removed from harvesting due to planning allocations or regulation, such as designation of land as Wilderness or remote areas, as well as areas that are inoperable or unproductive because of site factors (Huggard 2004). These areas together provide ecological reference or benchmark conditions for baseline monitoring and research, provide refuge for rare species, and provide some ecological conditions or functions that are not otherwise available across the landscape. These areas together can be described in general as ecological reference areas, and include such formal designations as Wilderness or Research Natural Areas, or other administrative designations like ecological areas, natural areas, or special areas. In these roles, ecological reference areas contribute to biological diversity, an element of ecosystem sustainability.

Dramatic changes have occurred to ecosystems within the Green and Taconic Mountains over the past 200+ years (see also the Chapter 3 Introduction (3.1) and the Vegetation section (3.5)). While the land was used by native peoples prior to European settlement, large areas of land within the Green Mountains were in mature forests of northern hardwoods mixed with spruce in the higher elevations, and hemlock and pine in the lower elevations and valleys (Cogbill et al. 2002). Most of this land was cleared for settlement during the 18th century and, as a result, there are currently very few known sites of old growth forest within the ecological sections that contain the GMNF. A few small patches are documented from the GMNF. Much of the land is recovering through natural reforestation of most of the mountains since the 1930s, but a substantial proportion of the Champlain Valley region, and the lower elevations and river valleys of the mountains, are either still in agriculture or are becoming desirable for housing development.

Because of the significant level of historical human activity and vegetation modifications within the ecological regions of the GMNF, there are very few opportunities to develop an ecological reference area network from lands that have been unmodified by humans. The recovering landscape is generally in good condition and maturing, however, and offers opportunities to develop a reference area network for the future. Conserved lands across Vermont can help to meet some of the reference area needs, depending on their conservation status and their quality.

Within Vermont and across the United States, conserved lands are often considered to be lands formally protected from development through conservation easement, ownership by a conservation organization, or ownership by a federal or State agency (Thompson 2002). A little more than 19 percent of Vermont lands are considered conserved lands (Thompson 2002). The GMNF represents about 38 percent of the conserved land in the State, State lands account for 33 percent and private conserved lands account for 25 percent (Vermont Conserved Lands Database 2000).

The distribution of conserved lands within ecological subsections tells a different story, however. Within the northern Green Mountains, 26 percent of the land is conserved, while in the southern Green Mountains, 33 percent is conserved (Thompson 2002). Most of the conserved land in the southern Green Mountains is on the GMNF, while in the northern Green Mountains there is a substantial proportion of State land as well as federal land. Within the Taconics and Vermont Valley, only around ten percent of the lands are conserved (Thompson 2002). The GMNF has very little ownership

within the Taconics/Vermont Valley region, although the entire Vermont portion of the Taconic Mountains Subsection falls within the GMNF Proclamation Boundary.

Of all of the conserved lands within Vermont, only around three percent is conserved in areas that do not allow extractive uses, or what would be equivalent to ecological reference areas (Thompson 2002). A little over half of these lands are on the GMNF. Within the ecological subsections of the GMNF, less than one percent of the lands are conserved this way within the Taconics, while about six percent of the lands within each of the Northern and Southern Green Mountain Subsections are conserved this way. If one includes lands on the GMNF under timber management that are considered unsuitable for logging operations (e.g. steep or wet soils), a little more than one percent of the Taconics, nine percent of the Northern Green Mountains, and 17 percent of the Southern Green Mountains are reserved this way.

The GMNF represents about seven percent of the land area within the State of Vermont. In ecological regions where National Forest ownership is more prevalent, however, the Forest can contribute to conservation efforts at that scale. The GMNF manages between 13 percent of the lands in the northern Green Mountains, and 26 percent of the lands within the southern Green Mountains, while only managing one percent of the lands within the Taconics. More opportunities to develop ecological reference areas would be available in the Green Mountain portions of the Forest's ownership than in the Taconics.

Research Natural Areas

Forest Service Manual 4060 describes the purpose and justification for establishing RNAs. RNAs are permanently protected and maintained in a natural condition. Recreational uses are limited, although hunting, fishing, and hiking are usually permitted. These areas include: (1) unique ecosystems or ecological features, (2) habitat for rare or sensitive species of plants and animals, and (3) high-quality examples of common ecosystems. RNAs are designated by the Eastern Region Regional Forester with concurrence from the Northeastern Research Station Director, upon recommendation by individual national forests and their associated Forest Service research stations. Each RNA has an establishment record that defines the reason for its designation and describes the values it provides for the national RNA network. Until the Regional Forester and Station Director sign the establishment record for an RNA, areas recommended for this designation are considered candidate RNAs.

A national network of RNAs helps protect genetic, species, ecosystem, and landscape level biological diversity. RNAs representing the natural condition of common ecosystems serve as baseline or reference areas. To help answer resource management questions, RNA baseline areas can be compared with similar ecosystems undergoing silvicultural or other management prescriptions. RNAs make an important contribution to ecosystem management as a monitoring tool measuring the effects of management activities in other areas.

RNAs are managed to maintain natural features and processes. Because of an emphasis on natural condition, they are excellent areas for studying ecosystems or their component parts, and for monitoring successional and other long-term ecological changes. Non-manipulative research and monitoring activities are encouraged in RNAs and can be compared with manipulative studies conducted in other areas. In addition, RNAs serve as sites for low-impact educational and recreational activities.

Determining the highest quality example of an ecosystem requires a fairly comprehensive inventory and assessment of ecosystems and their condition on the Forest, which has not been completed on the GMNF. In addition, co-designation of RNAs within other designations, particularly those established by the Congress such as Wilderness or National Recreation Areas, can lead to conflicts over management goals and objectives. In general, because other areas set aside for special management of ecological values or old growth development are often equivalent in their management approach to

RNAs, they can be considered equivalent to RNA designation in terms of research and monitoring opportunities, and can represent the variety of ecosystems on the Forest until an evaluation of the best examples can be completed.

Special Management Areas

National Forest System lands (except Wilderness) that contain scenic, historical, geological, botanical, zoological, paleontological, recreational, or other special features often merit special management area (SMA) designation. SMAs are managed to protect and, where appropriate, foster public use and enjoyment of the areas. Other uses are permitted within the areas to the extent that they are in harmony with the purpose for which the area was designated. SMAs can be congressionally or administratively designated by the Forest Service. Congressional designation of SMAs is considered permanent, while administrative designation is not. The SMAs considered in this section are those with significant natural features, and are considered as an "ecological SMAs" group.

Old Growth and Developing Old Growth Areas

Old growth has been defined in various ways over the years (Leverett 1996). In the broadest terms, old growth forests are represented by the oldest examples of forested stands that have survived catastrophic or stand-replacing disturbances associated with the prevailing natural disturbance regime. While old growth forests in northern New England are not generally undisturbed, the disturbances associated with them tend to be very small and scattered enough to allow large patches of forest to mature to old ages. These old forests often have at least half of the canopy trees at half of the maximum age or older for the species represented, with a few trees at or near the maximum age. Depending upon the physical characteristics of a particular site, as well the forest type, some old growth stands may look much smaller and younger in stature than they really are, while others may never reach maximum age due to frequently occurring natural disturbances like fire or flooding.

One of the attributes most valued about old growth is that it serves as an example of how forests develop within a particular region under natural processes and disturbance regimes. As discussed in the Chapter 3 Introduction (Section 3.1), ecosystems that develop in the face of the natural dynamics with which they are associated provide insight into how species and other levels of biodiversity develop, survive, and thrive within a natural system. Such examples also contribute to knowledge on the extent to which management activities can change natural dynamics and biodiversity associated with a particular ecosystem. Regions that have very little remaining old growth, like New England, can foster old growth development by minimizing extractive uses in designated areas and allowing these areas to develop under natural processes.

National Forest System lands can be conserved for current or desired future old growth characteristics through a number of designations, including both congressional and administrative designation by the Forest Service. Congressional designations like Wilderness, and some administrative designations, such as RNAs, are generally permanent. Designation of sites in these more permanent designations would lead to long-term development of old growth characteristics as only natural disturbance processes are allowed to disrupt these areas.

Designation of sites as ecological SMAs, which can also be done by the Congress or administratively, can have the same effect when the value for which the area is designated is consistent with old growth characteristics. Some SMAs may be designated for a vegetative condition that requires regular disturbance, such as woodland savannas that need fire. In these cases, if the natural pattern of disturbance has been disrupted, managers are often allowed to introduce the disturbance to maintain the desired vegetation. Most ecological SMAs are protected over the long-term and have the potential to develop or maintain old growth characteristics.

The Forest Service is also able to make use of the management area or zoning concept to define a management prescription that would foster old growth characteristics. Such management area designations are fairly common across national forests. While they are less permanent than congressional designation or RNA establishment, they are similar to SMAs in that long-term maintenance in those administrative designations can lead to the same desired old growth characteristics.

The Forest Service recognizes that even within management areas or zones considered generally suitable for timber management, there will always be a certain proportion of these areas that will be unsuitable, due to physical or economic inoperability, or to low productivity. Areas such as these are also likely over time to develop old growth characteristics, and provide opportunities for improving representation of less common ecosystem types. Areas considered inoperable due to economic constraints may be less stable than other types, in terms of protection from extractive uses, because economic suitability can change with markets.

Existing Forest Plan Management Direction

The 1987 Forest Plan identified the following goal that applies to all areas of special significance:

> *Protect all uncommon or outstanding biological, geological, or recreational areas which are special to the GMNF. Ensure that the qualities which make these areas special are preserved for the education and enjoyment of present and future generations.*

There are no Forest-wide standards and guidelines that address areas of special significance, as all such areas are designated within a particular management area where management area standards and guidelines would apply.

Research Natural Areas

The 1987 Forest Plan did not establish any RNAs but did identify five areas within the Special Areas Management Area (MA 8.1) as cRNAs, totaling 1,546 acres (Table 3.11-1). The Cape cRNA was designated an RNA in 1992 and direction for management was included in Forest Plan Amendment 8. While the four remaining areas are managed as Special Areas under the guidance specific to them in the Forest Plan, they continue to be managed as candidates for establishment as RNAs under Forest Plan direction.

Table 3.11-1: Existing RNAs, candidate RNAs, Ecological SMAs, and Future Old Growth Areas on the GMNF

Site Name	Acres[1]
RNAs and candidate RNAs	1,546
Ecological Special Areas	796
Wilderness (MA 5.1)	59,001
Primitive Areas (MA 6.1)	8,316
White Rocks NRA (MA 8.1B)	22,758
Eligible Wild Rivers[2]	1,382
Unsuitable lands[3]	36,052
Newly Acquired Lands (MA 9.2)	92,003
Total	**221,854**

Source: Forest GIS data
Notes:
[1] Acres are estimated using GIS and represent improved precision over acres shown for these areas in the Forest Plan; the differences in acres do not represent changes in the intent of the 1987 Forest Plan.
[2] Eligible Wild River acres are based on Significant Streams determined to be potentially eligible based on the Wild and Scenic Rivers Eligibility Study (Appendix D) and previous studies, and are those acres that do not already overlap with RNAs, cRNAs, ecological SMAs, or other future old growth areas.
[3] Unsuitable lands are those lands within management areas otherwise suitable for timber management that will not be harvested due to site or productivity constraints; acres are estimated using GIS based on timber inventory data.

Forest Service Manual (FSM) 4063.3 describes the types of management allowed within RNAs, including limits on vegetation management, facility construction, and trail construction. Timber harvesting and motorized uses are not

allowed within these areas. All uses but research and education tend to be discouraged.

Ecological Special Management Areas

Ecological SMAs are those areas with biological, geological, or ecological values, and consist of all the 1987 Plan Special Area designations except for the Long Trail/Appalachian Trail (MA 8.1A), White Rocks National Recreation Area (MA 8.1B), and the Robert Frost Interpretive Trail (MA 8.1H). While the RNAs/cRNAs are also considered part of the MA 8.1 Special Area management area, they are discussed above and so are not included here. White Rocks National Recreation Area (MA 8.1B) is considered a Special Area, but for the purpose of this analysis it will be considered as part of the Old Growth Areas discussion due to its size and purpose. Currently, ecological SMAs tend to emphasize unique features over exemplary or representative features. They comprise 796 acres on the Forest, and range in size from the 4-acre Crystal Brook Glacial Kettle to the 415-acre Grout Pond (Table 3.11-1). While most of these areas allow limited vegetation management, management is toward maintaining the special features for which the areas were designated.

Old Growth and Developing Old Growth Areas

There are no specific management goals in the 1987 Plan for old growth, although there are several goals that recognize the value of lands that are not manipulated and are allowed to develop under natural processes. The 1987 Plan defines old growth as a self perpetuating vegetative community that has reached a dynamic steady state. The dominant vegetation is considered to be climax with all age classes present. Old growth communities on the GMNF are defined to be at least 170 years old and more than 500 acres in size. To represent ecologically sound habitats, the definition indicates that old growth would not be silviculturally treated. This definition is built into the vegetative composition objectives for the 1987 Plan, which recommends that old growth communities occur in areas of all productivity classes, elevations, and vegetative types represented on the Forest.

The 1987 Plan (Amendment 8) identifies four management areas as existing old growth, or for the development of future old growth. These include Wilderness, Primitive Areas, White Rocks NRA, and The Cape RNA. Individual areas range in size from 290 acres at The Cape RNA to 22,758 acres at White Rocks NRA. Table 3.11-1 shows the acreage of these existing and future old growth areas by management area. White Rocks NRA allows some timber harvesting under restricted circumstances along roads, but is not considered suitable land for timber management. It is likely that substantial portions of this area would develop old growth conditions with time.

Significant Streams (MA 9.4) that are potentially eligible for Wild River designation, based on the analysis in the Wild, Scenic and Recreational River Eligibility Study (Appendix D) also offer opportunities for long-term old growth development within the half-mile corridor along these rivers (quarter mile on each side of the river). Acres of Significant Streams that are considered potentially eligible for Wild River designation and are not already part of one of the other old growth designations are shown in Table 3.11-1.

Lands considered unsuitable for timber management that fall within otherwise suitable management areas can also provide for the development of old growth conditions. Most of these areas are associated with steep slopes, areas of cliffs and rock outcrops, areas of very wet or erosive soils, or land that is considered unproductive. These areas may have been harvested at the turn of the century, but have likely not been harvested since under the forest management practices in place on the GMNF since the 1930s. Acres of these unsuitable lands are shown in Table 3.11-1.

Management Area 9.2, Newly Acquired Lands, also provides potential future old growth conditions. While it was intended as a temporary designation, some lands have had this designation for more than 20 years. Timber

harvesting and new development are generally prohibited within these areas except for safety or salvage purposes. If held within this designation for a long enough time, these areas could also begin to develop old growth characteristics. Consequently, the acreage of these lands is also included within Table 3.11-1.

In addition, most of the SMAs, RNAs, and cRNAs would develop old growth conditions with time. Direction for all of these areas restricts vegetation management either completely, or to ecological or recreational purposes. Natural or rare features are protected, and recreational use is non-motorized except in White Rocks NRA.

Proposed Changes in Management Direction Common to All Alternatives

The existing goal for areas of special significance from the 1987 Forest Plan is retained as Goal 7 in the revised Forest Plan (to protect rare or outstanding biological, ecological, or geological areas on the GMNF), but is supplemented by Goal 6. Goal 6 seeks to maintain or restore ecological processes and systems on the GMNF within desired ranges of variability, and includes objectives to achieve this goal.

Concepts of old growth have changed over the last 17 years, based on the tremendous amount of research and inventory that has taken place within the Northeast during that time (Davis 1996). The old growth definition in the 1987 Plan is outdated and is replaced with one that is based on the most recent scientific information, and an acknowledgement of the high level of variability associated with old growth forests in New England. In the revised Forest Plan, old growth is defined as a patch of relatively old forest of at least 5-10 acres that has escaped catastrophic or stand-replacing disturbance associated with the prevailing natural disturbance regimes of the Forest. Such old growth stands exhibit a long history of continuity and a demonstrated future via replacement dynamics. Composition objectives for old growth have been replaced with an objective under Goal 6 that states at least five percent of each ecological type on the Forest be managed for old growth characteristics.

A Forest-wide standard was incorporated into the revised Plan for protection of significant rare or uncommon natural communities to ensure that their composition, structure, and functioning are maintained or improved. In addition, a Forest-wide guideline was built into the revised Plan to ensure that the ecological values of ecological special areas are protected during management activities that may occur adjacent to them.

One of the changes proposed in the revised Forest Plan that is applied across all alternatives is the reorganization of the single comprehensive Special Areas MA designation into smaller groups of special management area designations, including separate management area designations for RNAs/cRNAs (Research Natural Areas/candidate Research Natural Areas), ecological SMAs (Ecological Special Areas), and recreational SMAs (Recreational Special Areas). The two major trail systems were separated into distinct management areas for each system, the Appalachian Trail Management Area and the Long Trail Management Area.

Areas that were identified as cRNAs in the 1987 Forest Plan were evaluated, and those that met the criteria of having had extensive scientific evaluation and met the standards for designation in FSM 4063 were maintained as cRNAs. Of the four candidate RNAs, two were determined to meet these criteria. The remaining areas, and any new areas identified as ecological SMAs or needing evaluation for RNA designation, were considered for designation as Ecological Special Areas.

Ecological Special Area designation includes areas originally designated in the 1987 Plan as ecological SMAs, and those cRNAs that have either not been evaluated or have been determined to be better designated as an Ecological Special Area. The Mount Abraham Special Area (MA 8.1J) in the 1987 Plan was expanded in concept to include related subalpine krummholz communities and renamed the Alpine/Subalpine Special Area, with additional

protections for the alpine zone. For purposes here it is considered an ecological SMA. Other areas considered for addition to the Ecological Special Area designation would need to have a documented outstanding biological, ecological, or geological feature.

A new special designation was developed for the revised Plan known as the Green Mountain Escarpment. This MA is designed to conserve rare and uncommon ecosystems along the western edge of the Forest through active restoration and management. This landscape is dominated by a west-facing series of cliffs, ledges, outcrops, and steep slopes, and is generally referred to as the escarpment. Given the risks associated with fire in this steep and prominent landscape, timber management would be used to help facilitate restoration in this management area. As a result, this area would generally not be considered an ecological SMA, due to the active vegetation management that is likely to take place, and is not factored into the analysis here associated with reference areas. Some portions of the escarpment landscape are placed within the Ecological Special Area designation in the alternatives to provide ecological reference conditions for the actively managed portion. Significant features are otherwise conserved in this management area, as that is part of its emphasis.

Several additional management areas of the revised Forest Plan are also considered part of the ecological reference area network by providing future old growth. The Primitive Areas MA was renamed Remote Backcountry Forest, and an emphasis on forest development through natural processes was highlighted. For alternatives with Wilderness recommendations, the new Wilderness Study Areas MA would serve a role similar to Wilderness and Remote Backcountry Forest in providing future old growth. Eligible Wild Rivers are also considered part of this network. As under current management, the existing Wilderness and National Recreation Area designations, as well as the unsuited lands within management areas suitable for timber management, are considered part of the network of ecological reference areas as well.

One of the major changes brought about by Plan revision is an emphasis on representation of ecosystems within an ecological reference area network. The revised Forest Plan recognizes the state-level conservation planning work that took place in northern New England and Vermont during the 1990s, in which the Forest Service was involved. This work sought to identify approaches to conservation of biodiversity through evaluating the distribution and conservation status of ecosystems and species (TNC 2004, Burbank 2004, Thompson 2002, VNNHP 1997).

Existing Condition

Indicator 1 – Acres of RNAs, cRNAs, ecological SMAs, and old growth areas

There are currently about 221,854 acres of the GMNF designated as RNAs, cRNAs, SMAs, and future old growth (Table 3.11-1). This represents more than half of the Forest.

Existing Research Natural Areas and candidate Research Natural Areas

There are currently 1,546 acres of designated RNAs and candidate RNAs on the Forest, including one designated RNA and four candidate RNAs (Table 3.11-1). These areas are also considered Special Areas in the 1987 Plan.

In 1992, The Cape, one of the candidate RNAs identified in the 1987 Plan, was established as an RNA. Two candidate RNAs, Mt. Horrid and Blue Ridge Fen (known as “Cranberry Bog” in the 1987 Plan), were evaluated and are pending designation. One candidate RNA, Beaver Meadows/Abbey Pond, was evaluated and recommended for SMA designation. The Remote Ponds candidate RNA has been the subject of several inventories but has not been evaluated.

Existing Ecological Special Management Areas

There are currently 796 acres on the Forest designated as ecological SMAs with values associated with natural features (Table 3.11-1). The 1987 Plan referred to these areas as Special

Areas. The boundaries of these areas have not been adjusted since the 1987 Plan was approved, and no additional areas have been designated during Plan implementation. The evaluation of the Beaver Meadows/Abbey Pond cRNA led to the recommendation that it remain an ecological SMA.

Existing Areas for Old Growth and Developing Old Growth

The 1987 Plan allocates 219,512 acres for potential future development of old growth, not including The Cape RNA or other ecological SMAs (Table 3.11-1). There have been no additional sites designated for old growth since the 1987 Plan was approved, and the boundaries of existing designated sites have not been changed over the intervening time. Lands have been acquired since the 1987 Plan was approved, however, and those that have not been subsequently allocated to other management areas have been allocated to the MA 9.2 designation and are here considered developing old growth.

At present, only small portions of the Forest are considered existing old growth, although the forests are maturing and recovering, offering opportunities for developing old growth characteristics (Table 3.11-2).

Table 3.11-2: Current Acres and Percent of the GMNF in Documented Old Growth and Older Age Class Stands.

Age	Acres	% of Forest
Old growth	737	0.2
150+	5,029	1.2
120+	40,357	10.1
100+	144,639	36.2

Source: Forest CDS and GIS data; VNNHP 1997

Potential RNA, cRNA, ecological SMA, and Old Growth Area Analysis Process

The process for identifying the pool of potential RNAs, cRNAs, ecological SMAs, and areas for old growth development around which to develop an ecological reference area network is described in "Green Mountain National Forest Special Area Assessment" (Burbank 2004). Various sources of information were consulted, including data from the Vermont Nongame and Natural Heritage Program (VNNHP), information and data from the Vermont Biodiversity Project (VBP), information and data from the University of Vermont (UVM) and The Nature Conservancy (TNC), and evaluations by various researchers. In general, addition to the ecological reference area network was based on identifying ecosystems with high quality, exemplary features, as well as representative ecosystems that can serve as reference areas within a particular ecological subsection.

Data gathered from VNNHP helped to identify 129 sites with at least one significant feature, including plants, animals, and/or natural communities, for a total of almost 13,000 acres. Of these, 61 sites (around 9,500 acres) were identified as having high-quality features, primarily natural communities, which could be conserved as distinct management areas within the ecological reference area network. These sites include some that are currently designated as part of the ecological reference area network either in whole or in part. The VBP identified representative landscapes and high quality exemplary aquatic ecosystems for conservation, some of which overlap with the GMNF. Information developed jointly by GMNF, UVM, and TNC was also used to help identify potential areas of rare or uncommon ecological types where designation in an ecological reference area network would lead to more complete conservation of biodiversity.

Indicator 2 – Percentage of ecological units represented within RNAs, cRNAs, ecological SMAs, and old growth areas

A variety of ecological units on the Forest, including landtype associations (LTAs), ecological land unit groups (ELUGs), and vegetation types, were used to help determine representation of ecosystems within a network of ecological reserves, including RNAs, cRNAs, ecological SMAs, and old growth areas (as defined for Indicator 1). LTAs are landscape-sized units representing broad patterns of vegetation in combination with the physical environment. Information developed with UVM and TNC led to

the development of ELUGs. ELUGs are groups of smaller ecological units that represent smaller scale combinations of physical and biological factors. These units are mapped consistently across the Appalachian Mountains and New England, which is not the case for the other ecological units used in this analysis. There is more modeling and less field validation, however, associated with the ELUG data. Because forest type data is gathered in the field and is not modeled, vegetation types were also evaluated in terms of representation within an ecological reference network for this indicator.

Consideration was given to National Forest System lands and how ecological units there were represented, but also how these units were distributed and conserved within ecological subsections. As noted earlier, only three percent of the lands within Vermont are conserved at a level equivalent to ecological reference areas, and this level of conservation was found predominantly on the GMNF. Consequently, the most opportunities for representation of ecosystems are likely to be found on the Forest. Ecosystem representation was examined by looking at the distribution and conservation status of LTAs, ELUGs, and existing major forest communities within the GMNF and within ecological subsections. Another ecological unit that the Forest developed, ecological land types (ELTs), were not used in the analysis presented here as they are currently under revision based on the new LTA classification, and they are not mapped across as much of the Forest as the other units used.

Landtype Associations

The GMNF has mapped 16 LTAs, nested within each of the four ecological subsections of the GMNF (Table 3.11-3). Of the 16 LTAs on the GMNF, all are represented in a special designation at levels greater than 30 percent, with most greater than 40 percent and some areas in the Taconics represented at 100 percent due to Newly Acquired Lands within that region.

The GMNF Forest staff worked cooperatively with other researchers from UVM, the Forest Service, and Vermont Department of Forest, Parks and Recreation to develop the map of LTAs for the ecoregions of the Forest (Burbank 1999). As noted earlier, LTAs describe the environmental and potential vegetative characteristics of landscape-size ecological units. Preliminary maps for the Northern and Southern Green Mountain Subsections and the Taconic Mountains Subsection were developed in 1998. These maps were based on data available in a GIS that consisted primarily of elevation, topography, physiography, bedrock geology, surficial geology, and ELT information.

Ecological Land Unit Groups (ELUGs)

The Nature Conservancy conducted an analysis of representation of ELUGs within various conservation categories on the GMNF, with recommendations for additional special designations (TNC 2004). In their analysis, 11 ELUGs were identified as being under-represented within special designations. The threshold for representation used in their analysis was a minimum acreage, depending on the rarity and general patch size of the ELUG. Table 3.11-4 shows that only one ELUG is below five percent representation, and the remaining ELUGs are represented at 16 percent or greater, with all but four greater than 40 percent. Although the alpine ELUG is showing no representation, the model for ELUGs did not correctly identify Mt. Abraham as an alpine/krummholz area, which it is based on vegetation.

ELUGs on the Forest represent a model of biophysical characteristics of the Northern Appalachian Mountains in the Northeast, and the types of vegetation or natural communities one might expect to find in these areas. Data used to develop this model included elevation, aspect, landforms, bedrock geology, and land cover data. While ELUGs are more theoretical in nature than other field mapped ecological units, such as ELTs, they do represent recognizable differences in potential vegetation, some of which are not recognized in ELTs. Also, because they are derived from GIS data available across the region, they are mapped for the entire Proclamation Boundary of the Forest, which is not

the case for ELTs. Consequently, evaluation of ELUGs provides another level for assessing representation of ecosystems that would capture smaller patch ecosystems that are currently not described either at the broader LTA scale, or at the broad scale of the vegetative groups discussed below that are based on field inventory.

Table 3.11-3: Acres and proportion of the GMNF and of special designations (RNAs, cRNAs, SMAs, and old growth areas) under the 1987 Plan in each LTA

LTA	GMNF Area[1]	Proportion of GMNF Area	Acres in Special Desig.	Proportion of LTAs in. Special Desig.
	(acres)	(%)	(acres)	(%)
Northern Green Mountain Subsection (M212Ca)				
1 - Valley Bottoms	504	<1	313	62
2 - Small Hills and Footslopes	13,107	3	4,365	33
3 - Mountain Slopes	54,101	14	22,993	42
4 - Upper Mountain Slopes	33,743	9	23,980	71
5 - Alpine-Krummholz	904	<1	412	46
Southern Green Mountain Subsection (M212Cd)				
1 - Valley Bottoms	3,588	1	1,657	46
2 - Low Mountains and Hills	118,993	30	57,962	49
3 - Vermont Escarpment	34,363	9	20,849	61
4 - Precambrian Plateau	42,215	11	22,706	54
5 - Mountain Slopes	46,870	12	27,741	59
6 - Upper Mountain Slopes and Mountain Tops	32,097	8	22,918	71
Taconic Mountain & Vermont Valley Subsection (M212Cb)				
1 - Valley Bottoms	822	<1	386	47
2 - Small Hills and Footslopes	938	<1	464	50
3 - Mountain Slopes	5,400	1	5,400	100
4 - Upper Mountain Slopes and Mountain Tops	1,889	<1	1,889	100
Champlain Glacial Lake and Marine Plains Subsection (212Ec)				
1 - Valley Clayplain	267	<1	173	65
TOTAL	389,801	100	214,208	55

Source: Burbank (1999), Forest GIS data
[1] Acres are less than 400,000 due to rounding, lack of LTA mapping in the Appalachian Trail Corridor on National Park Service lands, and acreage in large bodies of water like Somerset and Chittenden Reservoirs.

Table 3.11-4: Acres and proportion of the GMNF and of special designations (RNAs, cRNAs, SMAs, and old growth areas) under the 1987 Plan in each ELUG.

ELUG	GMNF Area	Proportion of GMNF Area	Acres in Special Designations	Proportion of ELUGs in Special Desig.
	(acres)	(%)	(acres)	(%)
Alpine/Krummholz	10	<1	0	0
Subalpine Forests	33,199	8	24,556	74
Boreal Acidic Cliff/Talus/Outcrop	241	<1	99	41
Temperate Acidic Cliff/Talus/Outcrop	731	<1	687	94
Temperate Calcareous Cliff/Talus/Outcrop	72	<1	61	84
Mid-elevation cool slope forest	106,464	27	65,515	62
Mid-elevation slope forest	188,549	47	92,959	49
Mid-elevation enriched slope forest	2,458	<1	953	39
Mid-elevation enriched warm slope forest	875	<1	198	23
Mid-elevation warm slope forest	22,357	6	10,019	45
Low cool slope forest	19,867	5	7,163	36
Low cool enriched slope forest	843	<1	358	42
Transitional-zone slope and flat forest	1,211	<1	652	54
Cool transitional-zone slope and flat forest	665	<1	399	60
Rich transitional-zone slope forest	289	<1	162	56
Cool rich transitional-zone slope forest	140	<1	85	61
Dry transitional-zone slope forest	1,864	<1	948	51
Low rocky slope and crest forest	1,201	<1	728	61
Low enriched slope and crest forest	89	<1	14	16
Forest and woodlands on very well-drained soils	1,124	<1	725	64
Moist flat conifer dominated	6,335	2	3,543	56
Developed/Agricultural/Wetland	9,427	2	6,376	68
Total	398,012	100	216,200	54

Source: TNC (2004), Forest GIS data; acres are less than 400,000 due to lack of ELUG coverage in the western portion of the Appalachian Trail Corridor on National Park Service lands

Table 3.11-5: Acres and proportion of the GMNF and of special designations (RNAs, cRNAs, SMAs, and old growth areas) under the 1987 Plan in each vegetative community.

Major Forest Community	GMNF Area[1]	Proportion of GMNF Area	Acres in Special Designations	% of Forest Comm. in Special Desig.
	(acres)	(%)	(acres)	(%)
Aspen/birch	11,531	3	5,972	52
Higher elevation softwoods	21,877	6	10,704	49
Northern hardwoods	289,646	76	151,876	52
Lower elevation softwoods	3,441	1	1,802	52
Mixed hardwoods/softwoods	39,018	10	16,540	42
Oaks	3,781	1	1,796	47
Open conditions	11,034	3	4,536	41
Total	380,328	100	193,226	51

Source: Forest CDS and GIS data
[1] Total acres are less than 400,000 due to lack of inventory data on some Newly Acquired Lands and within parts of the AT Corridor.

Vegetative Communities

Seven vegetative communities were evaluated for this analysis, including aspen/birch, higher elevation softwoods (spruce and fir), northern hardwoods, lower elevation softwoods (hemlock and pine), mixed hardwoods and softwoods, oaks, and open conditions (including wetlands, barrens, and upland openings). Among these vegetation classes, all have representation within special designations of more than 40 percent (Table 3.11-5).

The Vegetation section of this Chapter introduces a number of forest communities represented on the GMNF. Some of these forest communities are quite prevalent in the region, like northern hardwood forests or spruce-fir forests. Others, like aspen/birch, oak, or open areas, cover a much smaller proportion of the GMNF and tend to occur in small patches. These communities are important for biodiversity, but are often not considered of ecological significance unless they are rare, and so are not tracked by the VNNHP. Assessing the representation of these forest communities within special designations is another way to evaluate the extent to which ecosystems are conserved.

Maps of these communities represent current vegetation data that has been gathered in the field, rather than the more theoretical models of ecosystems represented by LTAs and ELUGs. While the data that is used to develop ELUGs and LTAs is also based on field data, these units make assumptions about how this data represents functional ecosystems in the field that have not been rigorously tested, although preliminary evaluation on the GMNF suggests they do represent actual natural communities. Consequently, adequate representation of all three types of ecological units in an ecological reference area network helps to ensure that most ecosystems are captured.

3.11.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Indicator 1 – Acres of RNAs, cRNAs, ecological SMAs, and Old Growth Areas

Effects Common to All Alternatives

Across alternatives, the revised Forest Plan will apply the new goal and Forest-wide standard and guideline to all areas of special significance, including those that are not currently within a special management area designation. This means that all 129 features or 13,000 acres identified as ecologically significant will receive some level of protection under the revised Plan. The ecological integrity and values of these areas will be evaluated during project planning in the same general area. Management actions and mitigation measures will be identified as needed to preserve the values of these areas as long as they are considered significant. It is expected that within these areas of special significance, natural processes will tend to dominate, and the ecological values and biodiversity associated with these areas will be conserved.

In addition, all 10 areas originally identified as ecological SMAs and cRNAs in the 1987 Forest Plan (Tables 3.11-1), representing 2,342 acres, are maintained within the ecological reference area network across all alternatives (Table 3.11-6). The acreages have increased slightly from the existing condition due to differences in mapping accuracy between 1987 and 2005. The High Elevation Ponds Special Area in the 1987 Plan is represented by two ponds in Table 3.11-6, Little Pond and Branch Pond. The remaining ponds associated with this Special Area are found within other equivalent designations in the 1987 Plan, and continue in these designations across all alternatives.

All alternatives maintain the existing congressionally designated areas, including Wilderness and White Rocks NRA. These areas

will continue to be managed for natural processes with limited human intervention. White Rocks NRA will continue to allow management along roads and edges of the area for wildlife habitat. Overall, the consistent management approach within these areas over the long-term will help to conserve both the diversity of organisms and communities associated with old forests, as well as those associated with younger forests within the NRA. The large size of these blocks of land also helps to mitigate against large catastrophic disturbances that have the potential to level large acreages of forest land.

In all alternatives, areas identified as part of the ecological reference area network, including RNAs, cRNAs, SMAs, Wilderness, White Rocks NRA, Remote Backcountry Forest, Eligible Wild Rivers, unsuitable lands, and Wilderness Study Areas, will be managed similarly in respect to conservation of ecological attributes. There is abundant agency policy direction on management of RNAs, and candidates would be managed as if they were RNAs until they are administratively established as such. Management for timber and motorized or developed recreation are prohibited from RNAs and cRNAs, as well as from most of the remaining areas. In White Rocks NRA, recreational use can include winter motorized uses, and timber harvesting may occur, but only under specific circumstances and generally near roads. Most of the NRA will be managed similarly to the other areas in this group. Consequently, the effects of the revised Forest Plan on the values represented by these management designations are positive. Because the alternatives vary in the amount, location, and type of protected designation used, those differences will be discussed below for each alternative.

None of the alternatives designate new candidate RNAs, and some of the original candidate RNAs are allocated to Ecological Special Areas in some alternatives. A comprehensive assessment of large natural communities (like northern hardwoods or montane spruce-fir) within Vermont has not been finished, and so there is no way to evaluate which examples of these large natural communities can best be represented within an RNA designation. In addition, none of the remaining areas identified as ecologically significant for natural communities have been evaluated as to their eligibility for RNA designation. Consequently, the Forest Service placed those areas that have not been evaluated into other designations that would continue to protect their values, and evaluations for eligibility can take place during the life of the revised Plan. It is unlikely that these other designations will affect the viability of these areas for future designation as RNAs.

Effects Common to Alternatives B through E

Across all alternatives except Alternative A, the current management alternative, one set of ecologically significant areas was placed within one of the ecological reference area designations discussed here. Sixty-one areas were identified as ecologically significant for consideration during alternative development (Burbank 2004), and 52 of these areas currently exist or were placed within the ecological reference area network across Alternatives B through E (Table 3.11-6).

Of the nine ecologically significant areas that were not placed within a designation within the reference area network, two were considered too small for a separate management area designation, and will be protected through Forest-wide standards and guidelines. Two areas were considered to be significant but better represented elsewhere in the network, but would also be protected by Forest-wide standards and guidelines. One area is associated with an Eligible Scenic River corridor that is highly valued for its current moderate levels of recreational use; consequently it was not placed in a designation that may further restrict those uses. Eligible Scenic River designation does have some restrictions on use and development that will maintain the ecological values of this site. The remaining four areas are associated with the escarpment, which is an area of many significant features that also require disturbance to maintain them. All ecologically significant features located on the escarpment that were not added to the network were placed within the Escarpment

management area in Alternatives B through E. This will ensure that these areas are conserved, and that active or intensive management activities can be used to maintain or enhance them.

The overall direct and indirect effects of allocating these ecologically significant areas to management designations that are designed to conserve their values is that these areas are likely to persist and develop older and more complex characteristics as they age. Most areas in these designations do not require human intervention to persist. Areas on the escarpment within these designations are recognized as baseline reference areas, and would have limited levels of intervention. Consequently, some of the significant natural communities within them may change over the long-term, well beyond the life of the revised Forest Plan. As baseline communities, however, it is important to allow some to mature and change for comparison to other areas on the escarpment that are more intensively managed.

Alternatives B through E would also be providing long-term conservation of these areas for research, monitoring, education, and biological diversity conservation. They would continue to provide current opportunities, and would open new opportunities, for research and monitoring of natural processes and conditions across a wide variety of ecosystems.

The primary effect on the areas of ecological value that weren't designated is that they would depend on project-by-project application of standards and guidelines for protection. This should still maintain the characteristics that are important at these sites, although it entails a minor amount of risk.

Table 3.11-6: Significant Features and their designations in RNAs, cRNAs, ecological SMAs or old growth areas across alternatives

Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Thendara Camp Fen	*DBF*	SMA	SMA	SMA	SMA
Stamford Meadows	9.2	SMA	SMA	SMA	SMA
Stamford Stream Wetland Complex	*AT*	SMA	SMA	SMA	SMA
Glastenbury Mountain	RBF	RBF	WSA	WSA	WSA
Little Pond	cRNA	SMA	RBF	WSA	WSA
Bourn Pond	Wilderness	Wilderness	Wilderness	Wilderness	Wilderness
Branch Pond	cRNA	SMA	SMA	SMA	SMA
Beebe Pond	*DFU*	SMA	SMA	SMA	SMA
The Burning	Wilderness	Wilderness	Wilderness	Wilderness	Wilderness
Lye Brook Headwaters	*DBF*	SMA	RBF	RBF	RBF
Lye Brook Ledge	Wilderness	Wilderness	Wilderness	Wilderness	Wilderness
Colebrook Trail Swamp	*DFU*	*DFU*	*DFU*	*Escarpment*	*Escarpment*
Stratton Mountain	*AT*/9.2*	SMA	SMA	SMA	SMA
Grout Pond	SMA	SMA	SMA	SMA	SMA
Somerset Fen	9.2	SMA	SMA	SMA	SMA
Winhall River Headwater Flowage	Wilderness*	Wild/SMA	Wild/RBF	Wild/RBF	Wild/RBF
Downer Glen	Wilderness	Wilderness	Wilderness	Wilderness	Wilderness
Little Mud Pond	Wilderness	Wilderness	Wilderness	Wilderness	Wilderness
French Hollow	DFU	SMA	SMA	SMA	SMA
Green Mountain Ridge	NRA	NRA	NRA	NRA	NRA
Big Mud Pond	Wilderness	Wilderness	Wilderness	Wilderness	Wilderness
Griffith Lake	NRA	NRA	NRA	NRA	NRA
McGinn Brook	Wilderness	Wilderness	Wilderness	Wilderness	Wilderness
Devil's Den	NRA	NRA	NRA	NRA	NRA
West of Mt. Tabor	Wilderness	Wilderness	Wilderness	Wilderness	Wilderness
Big Branch	Wilderness	Wilderness	Wilderness	Wilderness	Wilderness
Lost Pond Bog	Wilderness	Wilderness	Wilderness	Wilderness	Wilderness
Mt. Tabor Work Center Swamp	DFU	SMA	SMA	SMA	SMA
Moses Pond	*DBF*	*DFU*	*DBF*	*DFU*	*DFU*
West River Headwater Cove	*DFU*	*DFU*	*DFU*	*DFU*	*DFU*
Peabody Hill	*DFU/DBF*	SMA	SMA	SMA	SMA
White Rocks	NRA	NRA	NRA	NRA	NRA
Wallingford Pond	NRA	NRA	NRA	NRA	NRA
Fifield Pond	NRA	NRA	NRA	NRA	NRA
Little Rock Pond	NRA	NRA	NRA	NRA	NRA
Blue Ridge Fen	cRNA	cRNA	cRNA	cRNA	cRNA
North Pond	9.2	*DBF*	*DBF*	*DBF*	*DBF*
Mt. Horrid	cRNA	cRNA	cRNA	cRNA	cRNA
The Cape	RNA	RNA	RNA	RNA	RNA
Chandler Ridge	*DBF*	*Escarpment*	*Escarpment*	*Escarpment*	*Escarpment*
Leicester Hollow	*SS*	*Elig. Scenic R.*	*Elig. Scenic R.*	*Elig. Scenic R.*	*Elig. Scenic R.*
Dutton Brook Swamp	*DFU*/9.2*	SMA	SMA	SMA	SMA
Rattlesnake Point	SMA	SMA	SMA	SMA	SMA
Mount Moosalamoo	*DBF*	*Escarpment*	*Escarpment*	*Escarpment*	*Escarpment*
Bryant Mountain Hollow	*DFU*	SMA	SMA	SMA	SMA
Burnt Mountain	*DFU*	*Escarpment*	*Escarpment*	*Escarpment*	*Escarpment*
Bryant Mountain	*DBF/DFU*	*Escarpment*	*Escarpment*	*Escarpment*	*Escarpment*
Monastery Mountain	*DBF*	RBF	WSA	WSA	RBF
Hat Crown/Silent Cliff	Wilderness	Wilderness	Wilderness	Wilderness	Wilderness
Breadloaf Mountain	Wilderness	Wilderness	Wilderness	Wilderness	Wilderness
Skylight Pond	Wilderness	Wilderness	Wilderness	Wilderness	Wilderness
Middlebury Gap	*DBF*	RBF	WSA	WSA	RBF
Bristol Cliffs	Wilderness*	Wild/*Escarp**	Wild/*Escarp**	Wild/*Escarp**	Wild/*Escarp**
Gilmore Pond	Wilderness	Wilderness	Wilderness	Wilderness	Wilderness
Elephant Mountain	*DFU*	SMA	SMA	SMA	SMA
Beaver Meadows and Abbey Pond	cRNA	SMA	SMA	SMA	SMA
Mount Abraham	SMA	SMA	SMA	SMA	SMA
Mt. Roosevelt to Mt. Wilson	Wilderness	Wilderness	Wilderness	Wilderness	Wilderness
Lincoln Ridge	*DBF/LT*	SMA	SMA	SMA	SMA
Crystal Brook Glacial Kettle	SMA	Wilderness	Wilderness	Wilderness	Wilderness

Table 3.11-6: Significant Features and their designations in RNAs, cRNAs, ecological SMAs or old growth areas across alternatives

Name	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Texas Falls	SMA	SMA	SMA	SMA	SMA

Source: Alternative maps; Burbank 2004.
Notes: Only ecological reference area designations are indicated, except where the alternatives do not place an area within one of the designations for ecological reference areas. Areas and designations that are italicized indicate allocation to management areas that are not considered part of the ecological reference area network. DFU = Diverse Forest Use; DBF = Diverse Backcountry Forest; RBF = Remote Backcountry Forest; WSA = Wilderness Study Area; 9.2 = Newly Acquired Lands; AT = Appalachian Trail Corridor; LT = Long Trail Corridor; SS = Significant Stream. An "*" indicates that the area is only partially conserved within the network.

Table 3.11-7: Acres of RNAs, cRNAs, Ecological SMAs, and potential old growth forest by Alternative

Management Area	Alt. A Current Mgt.	Alt. B	Alt. C	Alt. D	Alt. E
	(acres)	(acres)	(acres)	(acres)	(acres)
RNA/cRNA	1,546	471	471	471	471
Ecological SMA	796	3,706	3,126	4,288	4,634
Wilderness	59,001	59,001	59,001	59,001	59,001
Remote Backcountry Forest	8,316	22,163	23,220	23,036	30,930
White Rocks NRA	22,758	22,758	22,758	22,758	22,758
Eligible Wild Rivers	1,382	1,664	1,284	633	633
Unsuitable Lands	36,052	37,563	33,403	28,033	31,283
Newly Acquired Lands	92,003	0	0	0	0
Wilderness Study Areas	0	2,291	29,360	49,799	27,473
TOTAL	221,854	149,617	172,623	188,019	177,183

Source: Forest GIS data
Notes: Eligible Wild River acres represent acres that do not overlap with one of the other management areas in this table. Unsuitable lands represent acres within management areas suitable for timber management that are unsuited due to inoperability or lack of productivity. These MAs include Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Moosalamoo Recreation and Education Special Area, and the Green Mountain Escarpment.

Alternative A

Alternative A has the largest number of acres within ecological reference area network designations at over 221,000 acres, or 55 percent of the Forest (Table 3.11-7), with 41 percent of the acres coming from the Newly Acquired Lands designation. These acres and the management area allocations are generally identical to the current condition, and there are no allocations to Wilderness Study Areas. All of the ecological reference areas designated in this alternative would develop into old forests over time, and would develop old growth characteristics given enough time. This alternative does present more risk than the others in terms of the long-term conservation of ecological values because it is anticipated that the lands within the Newly Acquired Lands designation would eventually be allocated to other management areas. Unless areas within these lands have ecological significance, they are not as likely to be designated in the future as part of the ecological reference area network.

Research Natural Areas

In Alternative A, all of the current cRNAs remain candidates, and no additional cRNAs or RNAs are proposed (Table 3.11-6). These designations amount to 1,546 acres (Table 3.11-7); none of the existing cRNAs or RNAs was expanded.

Areas in this designation would be managed by allowing ecological processes to dominate with minimal human intervention. They would be managed to protect against activities that directly or indirectly modify ecological processes outside of the expected range of variability for these sites. Under some circumstances, deliberate manipulation (such as prescribed fire) would be used to maintain the ecosystem or unique features for which the area was established, or to reestablish natural ecological processes. Management activities and consumptive or recreational uses that threaten or interfere with the objectives or purposes for designation of these areas would not be allowed.

The primary direct and indirect effects of maintaining areas as RNAs and cRNAs are that these areas and their values would continue to persist and develop older and more complex characteristics over the long-term. These areas would offer opportunities for research and monitoring of ecological conditions, serving as baseline reference areas for comparison to managed lands.

The effect of not considering additional areas for RNA designation in this Alternative is that the RNA network on the GMNF would be limited to a small number of areas, generally representing smaller and more uncommon natural communities on the Forest, and not representing the variety of ecosystems on the Forest. Designation as an RNA requires an area to meet fairly high standards for eligibility. These standards can be relaxed if an ecosystem is degraded, but represents the only example on the Forest.

Two existing cRNAs that are currently considered inappropriate for designation as cRNAs would maintain their cRNA designation under this alternative. These areas would appear in national databases as potential research sites for scientists studying unmodified natural conditions, while in reality they may offer less desirable prospects for such research. This is more likely to be the case in the Beaver Meadows/Abbey Pond area than for the Remote High Elevation Ponds, which all are known to be high quality and valuable for research. Beaver Meadows/Abbey Pond appears to have a complicated land use history (Cogbill 1995) that makes its value for baseline research less than desirable under RNA standards for designation. The primary reason for not continuing the high elevation ponds as cRNAs is that it is not clear if a subset of these ponds would be most appropriate as RNAs, some of which already occur in Wilderness or the NRA.

Ecological Special Management Areas

In Alternative A, all of the existing Special Areas identified as ecological SMAs in the 1987 Plan (Table 3.11-1) would continue to be managed for their special values in the Ecological Special Area designation (Table 3.11-6). This designation represents 796 acres (Table 3.11-7). None of the 25 recently identified areas having ecologically significant features that are not conserved within the reference area network were placed within any of the special designations, and no existing areas were expanded in size. Consequently, there are no differences between this alternative and the current condition for these areas.

The primary direct and indirect effects of maintaining the existing ecological SMAs in this type of designation are that their values would continue to persist and develop older and more complex characteristics over the long term, similar to RNAs and cRNAs. These areas would also offer research and monitoring opportunities, and most would offer opportunities for baseline research as well. Several of these areas have rare or sensitive species that would also be conserved by this designation. Some recreational uses in these areas, particularly at Grout Pond, may impact water quality and the rare plant features of this site. The rare plants are part of the significant ecological features identified for this site, however, and thus monitoring and mitigation measures would be employed to ensure that populations remain viable and habitat is not degraded.

The primary effect on the areas of ecological significance that weren't designated is that they would depend on project-by-project application of standards and guidelines for protection.

Old Growth and Developing Old Growth Areas

Alternative A provides the same areas and acreages designated in management areas designed to allow ecosystems to develop old growth characteristics under natural processes as the current condition (Tables 3.11-1; 3.11-7). This includes Wilderness, White Rocks NRA, Remote Backcountry Forest, Newly Acquired Lands, unsuitable lands, and Eligible Wild Rivers. Primitive areas are relabeled Remote Backcountry Forest. These designations amount to 219,512 acres (Table 3.11-7). Areas designated did not change in size from the current condition, and no new areas were added.

Inclusion of the Newly Acquired Lands management area within calculations for potential future old growth substantially increases the amount of acres in the reference area network as well as the acres in the old growth category (Table 3.11-7). There is no ecological basis for all Newly Acquired Lands to be placed in this category; rather, inclusion here simply recognizes that while they are in this designation, the lands are managed similarly to other lands considered likely to develop old growth characteristics. The assumed temporary nature of this designation means that over the short-term some Newly Acquired Lands would be allocated to other designations that would not emphasize old growth characteristics. With the acreages regularly fluctuating as new lands are acquired and other lands are reallocated, the amount and distribution of about half of the lands considered potential future old growth would not be stable. In comparison with other alternatives, while Alternative A appears to have the largest amount of potential future old growth, in reality close to half of this amount would likely change to other designations over the short term, and the remaining acres that are constant are actually smaller than in other alternatives. From this perspective, this alternative offers the least stable number of future old growth acres, and so the least opportunity to improve the abundance and distribution of this habitat across the Forest.

In addition to the management areas noted above, all of the lands designated as Ecological Special Areas or cRNAs in this alternative would eventually develop old forest characteristics, although it may be another century or two before old growth by strict definition may develop in these areas again.

The primary direct and indirect effects of maintaining these designations in this alternative, as for the other special designations discussed, is that large blocks of land in remote settings would continue to persist and develop older and more complex characteristics over the long term, certainly beyond the life of the revised Plan. These areas can also offer opportunities for research and monitoring of baseline conditions and ecological processes, as well as offering opportunities to study larger ecosystems and species that require larger landscapes. Research and monitoring would generally be restricted to non-manipulative forms, although some manipulation may be allowed in the NRA. Research on restoration activities may also be permitted within Remote Backcountry Forest. Some ground-disturbing activities may occur within White Rocks NRA associated with trail construction or timber harvesting, within unsuitable lands in relation to trail construction, and within Remote Backcountry Forest in association with restoration activities. In these cases, project-level mitigation and management area direction would help to ensure that ecological values are conserved, and risks are generally low.

The primary effects of not designating additional large blocks of land in areas that will develop old growth characteristics is related to ecosystem representation, and is discussed further under Indicator 2.

Alternatives B through E

The acreage of RNAs, cRNAs, ecological SMAs, and future old growth areas in these four alternatives varies from around 149,617 acres (37 percent) in Alternative B, the lowest of the four alternatives, to 188,019 acres (47 percent) in Alternative D, the greatest amount of these alternatives (Table 3.11-7). Alternatives C and E are close in total acreages, 172,623 and 177,183 acres respectively (43 and 44 percent of the GMNF). The acreage of RNAs/cRNAs, Wilderness, and White Rocks NRA do not change among Alternatives B through E.

The effects of designation of the existing RNAs/cRNAs, Wilderness, and NRA have been discussed under Effects Common to All Alternatives and Alternative A, and the effects of Alternatives B through E on these same designations are not different.

Research Natural Areas

The primary difference in the effects of these alternatives on RNAs/cRNAs from Alternative A is that two existing cRNAs would no longer be considered candidates for RNA designation. These areas would continue to be conserved through Ecological Special Area designation, and so impacts to these two areas would essentially not vary from those discussed for ecological SMAs under Alternative A. The high elevation ponds, among other ecological SMAs, would be evaluated as time and funding allow for RNA designation. Those ecological SMAs found to be eligible for RNA designation would be proposed as candidates over the next 15 years, and would be managed so as not to preclude such a designation.

The effects of not designating additional candidates RNAs for these alternatives are also as discussed under Alternative A. These alternatives offer a range in size and type of designation of large blocks of land in areas that will develop old growth characteristics. These areas would offer equivalent levels of protection to RNA designation, although there would be more limitations on research activities within the Wilderness Study Area designations.

Ecological Special Management Areas

Alternatives B, C, D, and E conserve areas with significant ecological values primarily through allocation to management areas within the ecological reference area network discussed in this section. Of the 61 areas considered ecologically significant, 52 were placed in one of the reference area designations, while nine were not, primarily due to size, adequate representation, or management needs (Table 3.11-6).

Alternatives B through E vary in the acreage assigned to the ecological SMA designation because in some alternatives, some of the ecologically significant areas are embedded within Wilderness Study Areas or Remote Backcountry Forest (Table 3.11-6). In those cases, these other designations were considered equivalent to ecological SMA designation. In Alternative E, additional acreage was added to the Grout Pond Ecological Special Areas to help protect its ecological values, and an area of developing old growth was located in 2005 adjacent to the French Hollow Ecological Special Area, to which it was added.

The direct and indirect effects of these alternatives on ecological SMAs are similar to those noted under Alternative A – these areas would continue to persist and develop older and more complex characteristics over the long term. These areas would offer research and monitoring opportunities, and most would offer opportunities for baseline research. Several of these areas have rare or sensitive species that would also be conserved by this designation.

There are small differences in how ecological SMAs would be managed, depending upon whether they are designated Ecological Special Areas, Remote Backcountry Forest, or Wilderness Study Areas. Wilderness Study Areas are likely to have more restricted research and monitoring opportunities, and restoration opportunities are generally not allowed. Ecological Special Areas and Remote Backcountry Forest are more similar to each other in this regard, allowing research, monitoring, and limited restoration activities. There are only four areas – Glastenbury Mountain, Little Pond, Lye Brook Headwaters, and portions of the Winhall River Headwater Flowage – that vary from one alternative to another in terms of management area designation (Table 3.11-6). Of these, two areas – Little Pond and Glastenbury Mountain – are allocated to a Wilderness Study Area under at least one alternative. Neither area is likely to require active management to restore or maintain its features, and other forms of management to protect the areas from impacts of recreational use would be allowed in such a designation. Consequently, this variation in allocation is not expected to make a difference in conservation of these areas. Little Pond is a research site, and so researchers would likely be required to modify their methods to be consistent with Wilderness values under Alternatives D and E.

The effects on the nine areas that were not allocated to the reference area network were also discussed earlier. These areas would depend on project-by-project application of standards and guidelines for protection. This should maintain the characteristics that are important at these sites, although it still entails a minor amount of risk. The four areas along the escarpment – Chandler Ridge, Mount Moosalamoo, Burnt Mountain, and Bryant Mountain – as well as Leicester Hollow Brook, have features that are described as part of the emphasis and desired future condition for the management areas to which they are allocated under Alternatives B through E (Table 3.11-6). Consequently, the features at these sites are likely to receive a similar level of conservation as if they were designated within the reference area network. Modifications are likely to occur at these sites, however, and so baseline research opportunities at these sites will be limited.

Old Growth and Developing Old Growth Areas

Alternatives B through E provide the most variation in acreage allocated to areas designed to provide potential future old growth conditions (Table 3.11-7). Of these four alternatives, Alternative B would provide the least number of acres, Alternative D the most, and Alternatives C and E in the middle and similar to each other. While Alternatives B through E vary somewhat in the acres allocated to Remote Backcountry Forest, ranging from around 22,000 acres to 31,000 acres, they vary substantially in the number of acres allocated to Wilderness Study Areas, from 2,300 acres to 49,800 acres.

From the perspective of conservation of ecosystems for baseline research, monitoring, and representation, there are few effects associated with the difference in the types of special designations. Wilderness Study Areas

can be a somewhat long-term designation when compared to Remote Backcountry Forest. When Wilderness is designated periodically by the Congress, the law often releases existing Wilderness Study Areas, and thus designations may not be permanent. Wilderness Study Areas would not allow restoration activities, which can occur within Remote Backcountry Forest. Also, research and monitoring activities are likely to be more restricted in Wilderness Study Areas in order to protect potential Wilderness values. Fundamental baseline research and monitoring can occur under both designations, however, thus such activities are not precluded under any of the alternatives.

There are two primary direct and indirect effects of allocating various amounts of the GMNF to areas where old growth conditions would develop. First, all four alternatives provide for substantial increases in the amount of acres in these designations over Alternative A (with the Newly Acquired Lands excluded) and the current condition, from an increase of 14 percent in Alternative B to 44 percent in Alternative D. These increases provide more and larger blocks of land for ecosystem conservation and representation as reference areas where extractive uses are limited or prohibited. Alternatives C through E offer more connectivity among these designations than Alternatives B or A, which is an important consideration in enabling wildlife species to move among the habitats they require.

The second type of effect associated with these alternatives has to do with representation of ecosystems, which will be discussed further under Indicator 2. All alternatives ensure that the variation among ecosystems on the GMNF is represented within the reference area. .

Indicator 2 – Percentage of ecological units represented within RNAs, cRNAs, ecological SMAs, and old growth areas

Revised Forest Plan objectives for Goal 6 indicate a desire to manage at least five percent of each ecological type present on the Forest for old growth characteristics. This proportion was selected as a minimum because without an updated and field-validated inventory of ecological types on the Forest, it was not clear if a larger proportion was feasible as an objective. Some ecological units are uncommon and occur in areas with high levels of recreational development where none of the existing special designations would be appropriate.

Another target often used for representation in old growth designations is 20 percent of a particular ecological type. TNC (2004) prepared an evaluation and recommendations for conservation of biodiversity on the GMNF, and used 20 percent as a minimum target for conserving ecological types. Types that were rare were targeted for conservation at higher proportions. Thompson (2002) used 10 percent as a minimum conservation goal for occurrences of natural communities that were common or uncommon. This scaled approach for conservation targets is a commonly used by TNC and others in conservation planning. While the 20 percent target may be achievable for some ecological units, it is unlikely to be achievable for all. It can serve, however, as the upper end of a desirable range for minimum amounts of land conserved in unmodified conditions. Consequently, this analysis will compare and evaluate the extent to which the alternatives approach both the revised Plan objective for representation of LTAs, ELUGs, and forest communities, as well as the higher 20 percent objective, within areas that would become old growth.

LTAs, ELUGs, and forest communities are discussed together in the following analysis when results are similar, because they can be seen together as representing the variety and diversity of ecological types on the Forest at various scales. When there are differences in how well ecological types are represented in relation to the 5-20 percent range noted above, the effects may be discussed in relation to each type of ecosystem as necessary.

Effects Common to All Alternatives

The designations associated with the ecological reference area network, RNA/cRNA, ecological SMA, Remote Backcountry Forest, Wilderness, RNA, Wilderness Study Area, Newly Acquired Lands, unsuitable lands, and Eligible Wild River, would be managed similarly for natural forest ecosystem processes and development of old forest or old growth conditions. Consequently, the percentages are not broken out in this section among the three management area groupings (RNAs/cRNAs, ecological SMAs, and old growth areas). The effect of these designations would be similar in that all of the areas would allow limited to no extraction of commodities and limited recreational use. Snowmobile trails and limited harvesting near roads are allowed in the NRA, although this is not likely to have major effects on development of old forest conditions. Overall, any of these designations are considered equally effective at achieving objectives for representation.

Alternative A

Alternative A is identical to the existing condition described in this section because all of the existing RNAs, cRNAs, ecological SMAs, and old growth areas remain designated, and no new areas were added or existing areas expanded (Tables 3.11-3 – 3.11-5). When considering the Newly Acquired Lands as part of the ecological reference area network, all LTAs, ELUGs, and forest communities are represented at greater than the desired five percent objective in the revised Plan, with one exception (Tables 3.11-8). The exception is the alpine/krummholz ELUG, which is incorrectly mapped by the ELUG model and so this habitat is indicated as unrepresented, when it is in fact allocated to the Mount Abraham Ecological Special Area. In addition, of all ecological types, only one ELUG is represented at a level below 20 percent. Consequently, this Alternative appears overall to provide a high degree of representation of the diversity of ecosystem types across the Forest within lands where natural processes will dominate.

However, the inclusion of the Newly Acquired Lands as part of the old growth area grouping belies the assumed short-term nature of the management approach applied to close to half of the acres in the reference area network. While about 58 percent of the acres would likely remain constant for at least 15-20 years, and probably much longer, the remainder would likely be reallocated to other designations, some of which would not provide the ecosystem representation in old growth allocations indicated initially under this alternative.

If one were to exclude those lands allocated to Newly Acquired Lands, the effectiveness of this alternative at representing the diversity of ecosystem types across the Forest is somewhat reduced for many ecological types. Thirteen out of the 16 LTAs are represented within the reference area network at greater than five percent, with the low proportions in the Valley Bottom, Mountain Slope and Upper Mountain Slope and Mountain Top LTAs in the Taconics (Table 3.11-8). Ten of the LTAs are represented at 20 percent or greater. Most ELUGs and all vegetative communities are represented at greater than five percent, and many are close to or surpass 20 percent (Tables 3.11-9 – 3.11-10).

While the variety and diversity of many ecosystems on the Forest are well represented within this ecological reference area network when Newly Acquired Lands are removed from consideration, several important ecological units are not. The revised Plan objective of five percent representation would not be achieved for three LTAs, and a few other ecological units fall below 20 percent, particularly those LTAs and ELUGs associated with oak dominance, on lower, warmer slopes, in valley bottoms, and in the Taconics. Under this scenario, moving toward the objective would rest primarily on acquisition of new lands and allocation of some of those lands to these management areas. Because the lower elevation and valley bottom regions of the Forest make up a very small proportion of the lands on the GMNF, it may not take many additional acres in these areas to improve representation.

Alternatives B through E

For all measures of representation of ecosystems (LTAs, ELUGs, vegetative communities), all action alternatives have at least five percent of each type of ecological unit within an ecological reference area network designation where old growth would develop, except for one LTA (Tables 3.11-8 – 3.11-10), and in that case only in Alternatives B and C. The under represented LTA is the Mountain Slope LTA in the Taconics. In Alternatives D and E, this LTA is represented above 20 percent. The lack of representation of the mountain slope forests within the Taconics in two of the alternatives is of concern. The primary effects of this lack of representation are that areas of National Forest System lands within this LTA would not be conserved for research and monitoring of baseline ecological conditions, and the abundance and distribution of examples of these Taconics ecosystems where natural processes dominate would be minimal. The forested ecosystems of the Taconics, and their response to management, are not as well studied as the Green Mountains. Alternatives B and C would provide limited opportunities for this type of long-term research in ecosystems that are not likely to be modified in the future.

Across Alternatives B through E, most ecological types, including LTAs, ELUGs, and vegetative communities, fall at or well above 20 percent representation. Only five ecological types are represented below the 20 percent level, including the LTA mentioned above. In addition to this LTA, the Low Mountain/Small Hill LTA in the Taconics is represented at 17 percent in Alternatives B, C, and E, while in Alternative D it is represented at 21 percent. These differences are minor, consisting of about 30 acres of this LTA, and do not indicate poor representation. This LTA occurs on only about 940 acres of the Forest, and tends to be situated in areas that have had a long history of land use. Consequently, it is likely the best representation that can be accommodated at the current time. In addition, the Low Mountain/Small Hill LTA in the Northern Green Mountains is represented at 19 percent in Alternative B, about 150 acres short of 20 percent. This difference is inconsequential in terms of providing adequate representation of this LTA because it is close to the 20 percent threshold and well above the minimum five percent objective for the revised Plan.

The two ELUGs that fall below 20 percent include the rich transition-zone slope forest (8-18 percent across Alternatives B-E), and the low enriched slope and crest forest (14 percent across Alternatives B-E). These ELUGs are two of the six rarest ELUGs on the Forest, and tend to occur along the escarpment and the Vermont Valley. These types of ecosystems are more abundant off the Forest in these regions. Other patches of these ELUGs occur within the Escarpment management area, particularly in Alternatives C-E, and so the values associated with these uncommon types of ecosystems are likely to be more protected there than in other non-reference area designations.

Generally speaking, as far as overall representation is concerned, Alternative D provides slightly better representation of some types of ecosystems than the remaining alternatives, with Alternative E a little behind, and Alternatives B and C very similar and behind E. Alternative D doubles the representation of the rich transition slope forest in the ecological reference area network compared to Alternatives B and C, and helps to move representation of the Low Mountain/Small Hill LTA in the Taconics to greater than 20 percent. Alternatives D and E both provide representation of all ecological types above five percent, and most ecological types at greater than 20 percent.

Cumulative Effects

The cumulative effects of the Forest Plan alternatives on RNAs/cRNAs, ecological SMAs, and future old growth areas would be minor. Past actions in the cumulative effects analysis area influenced the identification of the current pool of areas of ecological significance. For example, the wide variety of land uses that have occurred in the last 200 years (such as timber harvest, agriculture, and road building) dramatically influenced the structure and composition of native

plant communities of the pre-European settlement landscape (Whitney 1994, Cogbill et al. 2002). These landscape-wide vegetation changes have narrowed the potential pool of representative native plant community types from which a relatively unmodified reference area could be identified.

Other past actions in the analysis area that influenced the identification of areas for reference area designation include designation of other public lands that prohibit or severely restrict ground disturbance, as well as past Forest Planning efforts on the GMNF. These public lands managed for natural processes or protection of biodiversity include existing cRNAs (designated through past Forest Planning efforts on the Forest), and other areas designated by the State, counties, towns, and conservation organizations.

Only about three percent of Vermont is represented within areas that are conserved where extractive and motorized uses are limited, and most of this three percent is on the GMNF. Most of the remaining lands conserved for baseline conditions and old growth development are small or not within the ecological regions of the GMNF. Consequently, the GMNF is the area with the greatest opportunity for conservation of many of the ecological types and their associated processes and species in the analysis area.

All of the alternatives would contribute to long-term conservation of biodiversity in the analysis area through reference area designations. If one considers the Newly Acquired Lands designation as part of the reference area network, then Alternative A, which represents the current condition, provides what appears to be the greatest abundance of lands conserved for natural processes. Increases in lands conserved for natural processes beyond what is in Alternative A only occur within the Northern Green Mountain subsection under Alternative D. Even there, increases are less than one percent. Within the Southern Green Mountain and the Taconic Mountain subsections, the proportion of lands in reference area designations decline in Alternatives B through E due to the large proportion of Newly Acquired Lands within these subsections.

If Newly Acquired Lands are excluded from consideration as reference areas, then all action alternatives provide an increase in the proportion of lands conserved for natural processes in each subsection. Within the Northern Green Mountain subsection, the total percentage of lands in special designations ranges from a low of seven percent in Alternative A to a high of nine percent in Alternative D. Within the Southern Green Mountain subsection, the total percentage within these designations ranges from nine percent in Alternative A, to 14 percent in Alternative D. Within the Taconic Mountains subsection, the action alternatives increase the proportion of the lands in these reference area designations by several orders of magnitude, but none raise the total proportion of the lands within these designations to one percent.

While the increases represented by these designations are small, particularly in proportion to the forestland within the analysis area, they represent a positive gain for long-term conservation of biological diversity and ecosystems across the analysis area.

It is reasonably foreseeable that extractive or ground disturbing activities would occur on Forest Service or private lands in the vicinity of RNAs/cRNAs, SMAs, or old growth areas in the alternatives. Such activities could lead to indirect effects on any riparian portion of these areas downstream, but the cumulative effects would be minor because Forest Service actions would be influenced by standards and guidelines for protecting ecologically significant areas as well as watersheds and riparian areas. These effects would be least noticed in Alternative D, where larger blocks of land are allocated to the reference area network and so provide substantial buffering to ecosystems.

In general, the areas receiving these designations across alternatives would experience minimal negative cumulative effects because of their protected status. In fact, it is likely that implementation of any of the action alternatives which all include multiple types of reference area

designations, would have small but beneficial cumulative effects to other resources such as watersheds, riparian areas, and some rare natural resources because of the management guidelines associated with these areas. Alternatives D and E provide the added benefit of representing the full variety of various ecosystems on the Forest within reference areas at the minimum five percent level, while the other action alternatives represent most but not all.

Table 3.11-8: Proportions of LTAs represented within RNA, cRNA, Ecological Special Area, or old growth area designations, across alternatives

LTAs[1]	Alternative A		Alternative B		Alternative C		Alternative D		Alternative E	
	acres	%	acres	%	acres	%	acres	%	acres	%
Northern Green Mountain Subsection										
VB	313	62	287	57	312	62	302	60	287	57
LM/SH	4,365	33	2,469	19	3,348	26	4,751	36	3,205	24
MS	22,993	42	15,356	28	20,394	38	21,111	39	19,127	35
UMS	23,980	71	25,283	75	25,694	76	27,437	81	26,141	77
AK	412	46	764	85	765	85	765	85	765	85
Southern Green Mountain Subsection										
VB	1,657	46	1,005	28	1,322	37	1,388	39	1,378	38
LM/SH	57,962	49	31,451	26	39,866	34	44,407	37	42,165	35
VE	20,849	61	19,016	55	18,872	55	19,044	55	19,043	55
PP	22,706	54	15,400	36	17,527	42	18,640	44	17,928	42
MS	27,741	59	16,201	35	21,056	45	22,118	47	21,315	45
UMS	22,918	71	18,626	58	20,077	63	22,465	70	20,647	64
Taconic Mountain & Vermont Valley Subsection										
VB	386	47	161	20	160	20	160	20	160	20
LM/SH	464	50	163	17	163	17	192	21	164	17
MS	5,400	100	167	3	167	3	1,717	32	1,496	28
UMS	1,889	100	393	21	393	21	1,678	89	1,517	80
Champlain Glacial Lake and Marine Plains Subsection										
VCP	173	65	107	40	107	40	107	40	107	40

Source: Forest GIS data
[1] LTA Codes: VB = valley bottoms; LM/SH = low mountains and small hills; MS = mountain slopes; UMS = upper mountain slopes; AK = alpine/krummholz; VE = Vermont escarpment; PP = Precambrian plateau; VCP = valley clayplain

Table 3.11-9: Proportions of ELUGs represented within RNA, cRNA, Ecological Special Area, or old growth area designations, across alternatives

ELUGs[1]	Alternative A		Alternative B		Alternative C		Alternative D		Alternative E	
	acres	%	acres	%	acres	%	acres	%	acres	%
AK	0	0	5	54	5	54	5	54	5	54
SAF	24,556	74	24,729	74	25,379	76	27,662	83	26,335	79
BAC	99	41	110	46	110	46	132	55	132	55
TAC	687	94	674	92	674	92	688	94	688	94
TCC	61	84	66	92	66	92	66	92	66	92
MCSF	65,515	62	47,482	45	55,547	52	60,630	57	57,488	54
MSF	92,959	49	54,427	29	67,736	36	74,872	40	69,242	37
MESF	953	39	653	27	762	31	745	30	744	30
MEWSF	198	23	184	21	238	27	253	29	246	28
MWSF	10,019	45	4,715	21	4,867	22	5,885	26	5,510	25
LCSF	7,163	36	4,777	24	5,218	26	5,242	26	5,099	26
LCESF	358	42	212	25	223	26	212	25	212	25
TSF	652	54	337	28	336	28	402	33	402	33
CTSF	399	60	244	37	244	37	249	37	249	37
RTSF	162	56	23	8	23	8	51	18	31	11
CRTSF	85	61	47	34	47	34	47	34	47	34
DTSF	948	51	558	30	552	30	593	32	593	32
LRSCF	728	61	395	33	399	33	430	36	426	35
LESCF	14	16	13	14	13	14	13	14	13	14
VWDF&W	725	64	657	58	660	59	665	59	662	59
MFC	3,543	56	2,512	40	2,893	46	3,079	49	2,938	46
Open/Wet	6,376	68	5,140	55	5,354	57	5,477	58	5,431	58

Source: Forest GIS data, Burbank (2004)
[1] ELUG abbreviations are based on the same order of ELUG names that appear in Table 3.11-6.

Table 3.11-10: Acres and proportions of the GMNF vegetative communities represented within RNA, cRNA, Ecological Special Area, or old growth area designations, across alternatives

Veg. Comm.	Alternative A		Alternative B		Alternative C		Alternative D		Alternative E	
	acres	%	acres	%	acres	%	acres	%	acres	%
Aspen & Birch	5,972	52	6,703	58	6,395	55	6,972	60	6,908	60
High Elevation Softwoods	10,704	49	11,671	53	12,341	56	12,638	58	12,240	56
Northern Hardwoods	151,876	52	102,170	35	122,809	42	137,633	48	127,281	44
Lower elevation softwoods	1,802	52	1,632	47	1,651	48	1,647	48	1,645	48
Mixed hardwoods & softwoods	16,540	42	11,233	29	12,854	33	13,315	34	13,393	34
Oaks	1,796	47	1,850	49	1,625	43	1,625	43	1,625	43
Open conditions	4,536	41	2,802	25	3,185	29	3,381	31	3,237	29

Source: Forest CDS & GIS data

3.12 WILDERNESS, WILD AND SCENIC RIVERS, AND NATIONAL RECREATION AREA

3.12.1 Wilderness

Issue Statement

Public concern is focused on how much designated wilderness the Green Mountain National Forest (GMNF) needs to have in order to provide for a range of recreation opportunities and ecosystem values. The public is divided on the subject of wilderness: while some desire more wilderness, others do not want additional wilderness proposed or designated. Issues also include the impacts of use in and around wilderness, buffer zones, and the level of management intensity in areas surrounding wilderness, and the consistent and appropriate management and use of wilderness. This section addresses the effects of the alternatives on the wilderness resource.

Another topic of public concern is that allocating land as wilderness may negatively impact other resources, such as timber management or wildlife habitat. These concerns about wilderness designation's impact on other resources can be found in the respective resource sections of this chapter.

Indicator 1 – The Number of Areas and Acres Recommended for Wilderness Designation

The first indicator to be used in this effects analysis is the number and acres of land allocated to the Wilderness Study Area (WSA) management area (MA). This indicator highlights the differences between alternatives because the primary variation in wilderness designation among alternatives is the amount and size of WSAs proposed. Wilderness Study Areas are areas that the Forest Service recommends to the Congress for future wilderness designation.

Indicator 2 – Configuration of Management Areas Adjacent to Wilderness and Compatibility with Wilderness Values

The second indicator to be used in this effects analysis is the configuration of management areas adjacent to the Wilderness and Wilderness Study Area MAs and their compatibility with wilderness values. This indicator highlights the differences among alternatives because each alternative proposes different management areas surrounding the wilderness resource, and activities allowed within these management areas may impact the wilderness resource to varying degrees.

Management areas that are more consistent with the Desired Future Condition for Wilderness and Wilderness Study Areas include, but are not limited to, Ecological Special Areas, National Recreation Area, and Remote Backcountry. Other management areas may be less consistent with the Desired Future Condition for Wilderness and Wilderness Study Areas. These areas include the Diverse Forest Use, Diverse Backcountry, Remote Wildlife, Escarpment, and Moosalamoo Management Areas. These outside areas may negatively influence the character of the adjacent wilderness due, for example, to conflicting desired Recreation Opportunity Spectrum goals, allowed motorized uses illegally crossing wilderness boundaries, potential impacts to solitude from motorized vehicles, developed recreation facilities, or timber harvest activities, and potential visual impacts to the wilderness, such as views of developed recreation facilities, wind towers, or utilities.

Management areas adjacent to wilderness are not buffer zones for the wilderness. Forest Service Manual 2320.3, #5 prohibits buffer zones around wilderness. Activities that take place on lands adjacent to wilderness, however,

can nevertheless impact the character of that wilderness. It may therefore be preferable, where possible, to surround wilderness areas with management areas whose activities and Desired Future Condition are more consistent with wilderness objectives.

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the Green Mountain National Forest. This area represents National Forest System lands where potential wilderness designation areas exist, and the lands that could receive impacts from wilderness designation.

The analysis area for cumulative effects includes all GMNF lands and the lands administered on other ownership in New England and New York, both public and private, which provide wilderness opportunities within and near the Green Mountain National Forest. Because wilderness is a unique resource and an interconnected system across the country, proximity to the GMNF is defined here in a regional context, and would include other wilderness resources such as the White Mountain National Forest in New Hampshire, or the Adirondack State Park in New York.

3.12.1.1 Affected Environment

Introduction

The Wilderness Act of 1964 defined a wilderness as an area of undeveloped federal land designated by the Congress that has the following characteristics:

- It is affected primarily by the forces of nature, where people are visitors who do not remain.
- It may contain ecological, geological, or other features of scientific, educational, scenic, or historic value.
- It possesses outstanding opportunities for solitude or a primitive and unconfined recreation.
- It is an area large enough so that continued use will not change its unspoiled natural condition.

The Eastern Wilderness Areas Act of 1975 further developed the National Wilderness Preservation System (NWPS) by recognizing that “areas of wilderness in the more populous eastern half of the United States are increasingly threatened by the pressure of a growing and more mobile population, large-scale industrial and economic growth, and development and uses inconsistent with the protection, maintenance, and enhancement of the areas' wilderness character.” Consequently, the Eastern Wilderness Areas Act designated 16 areas in the eastern United States as wilderness, including the Lye Brook and Bristol Cliffs Wildernesses in the GMNF.

There are 59,001 acres of wilderness on the Green Mountain National Forest (see Table 3.12-1), and 124,321 acres of roadless areas. Federally designated wilderness areas are a relatively scarce resource in the region. Other locations that provide this type of opportunity and level of protection in the region are the White Mountain National Forest, with 103,000 acres of wilderness in New Hampshire and 12,000 acres in Maine, 7,000 acres of US Fish and Wildlife Service wilderness in Maine, and the Adirondack State Park in New York, with approximately one million acres of wilderness-quality resource.

Outdoor recreation is one of the primary drivers of wilderness demand. The GMNF wilderness areas’ large, contiguous blocks of land are an important component of the Forest’s recreational appeal, and are well suited to trail-based activities in backcountry settings. National trends indicate outdoor recreation is growing in the United States. The National Survey on Recreation and the Environment (NSRE), a long-term survey of outdoor recreation participation patterns across the United States, shows that 94.5 percent of U.S. citizens 16 and older participated in some type of outdoor recreation in 1995, and 97.6 percent participated in 2000 (cited in Stokowski et al. 2004). Furthermore, according to national trend data collected from 1965 to 1994 (Cordell

1999), wilderness recreation visits have increased nationwide over time.

National Visitor Use Monitoring (NVUM) data indicated that in the year 2000, there were 49,848 visitors to wilderness areas on the GMNF (USDA 2001d). Furthermore, more than 70 million people currently live within a day's drive of the Green Mountain National Forest. As public land makes up only 17 percent of the land base in New England and New York, and regional populations are expected to rise, wilderness resources on the GMNF are under increasing pressure to serve a growing public.

The demand for wilderness, however, goes beyond recreation. The Wilderness Act of 1964 established the National Wilderness Preservation System for purposes beyond recreation use, in order to simply provide "an area where the earth and its community of life are untrammeled by man" (Wilderness Act 1964). For example, studies have shown that people value National Forests and wilderness simply for its existence value – the opportunity to know that a National Forest or a wilderness exists, regardless of a person's use (Morrissey and Manning 2000, Manning and Valliere 1996).

The "scientific, educational, scenic, or historical" values that the Wilderness Act describes are equally important components of wilderness value. Wilderness is important to many people as a way to preserve representative natural ecosystems and provide important local landscapes for research. It is important to understand these non-recreation components of American wilderness when analyzing wilderness and roadless values.

Wilderness designation, however, with its associated benefits and limitations, engenders passionate debate in the American public. The public is emphatically divided on this subject: while some desire more wilderness, others do not want additional wilderness proposed or designated. Various advocacy groups, members of the public, and towns have developed positions on this issue. For example, six towns in Vermont have stated they do not support additional wilderness in their town. These towns and others, however, also emphasize the importance of completing a thorough wilderness study process over any specific outcome.

In 1972, the Forest Service, and the Green Mountain National Forest, began identifying roadless areas for wilderness consideration through the Roadless Area Review and Evaluation (RARE I). In 1979, the GMNF completed RARE II as part of a more extensive national inventory of roadless areas.

Congress then passed the Vermont Wilderness Act in 1984, designating some of these inventoried roadless areas as wilderness areas. The Vermont Wilderness Act created the Breadloaf, Big Branch, Peru Peak, and George D. Aiken Wilderness areas. This Act also added acreage to the Lye Brook Wilderness.

The areas remaining from RARE II that were not designated wilderness were included in the 2004 roadless inventory, and considered with new inventoried areas for suitability as potential wilderness system candidates.

Roadless Area Inventory

The National Forest Management Act directs each National Forest to conduct a roadless inventory and evaluation during its Plan revision process in order to update and identify all roadless, undeveloped areas.

The first step in assessing the wilderness resource on the GMNF is a roadless area inventory. A roadless area inventory was completed in 2004 to determine if any roadless, non-wilderness lands on the GMNF should be considered for recommendation as potential wilderness. Direction for this inventory is found in the following areas: Regulatory (36 CFR 219.17); FS Handbook (FSH 1909.12); and Regional Guidance (1920/2320 August 13, 1997). Appendix C of the FEIS contains the steps taken in this process, as well as the outcomes of it.

Roadless Area Evaluation

The second phase of the potential wilderness evaluation process is the roadless area evaluation. In this phase of the process, the Forest Service assessed each roadless area according to the evaluation criteria for wilderness found in FSH 1909.12, Chapter 7, Section 7.2. Examples of criteria used in the evaluation process include:

- Natural integrity and appearance
- Opportunity for solitude
- Special features, such as ecological and historical features

The roadless area evaluations can be found in Appendix C of this FEIS.

Wilderness Study Area Recommendation

The Forest Service examined the roadless area evaluations and determined which would be allocated as Wilderness Study Areas in the revised Plan alternatives. The Wilderness Study Area MA includes the roadless areas the GMNF is recommending to the Congress as potential wilderness. The process by which Wilderness Study Areas were derived from the roadless areas involved several factors, including:

- The roadless area's roadless characteristics, such as the degree of isolation from busy roads
- The roadless area's potential to improve existing wilderness
- The roadless area's remoteness, i.e. amount of Semi-primitive Non-motorized (SPNM) land
- The ecological benefits of the roadless area
- Improved management opportunities, such as creating more identifiable boundaries, and facilitating enforcement of existing wilderness boundaries

It is important to note, however, that the result of Forest Plan revision will not be the designation of wilderness. Although the alternatives may, or may not, include Wilderness Study Areas, the Congress has the only authority to create wilderness areas. Wilderness Study Areas will be managed with their own set of standards and guidelines that are in keeping with prescriptions of potential wilderness areas.

Existing Forest Plan Management Direction

The 1987 Forest Plan provides several goals and objectives relating to wilderness experiences on the Forest. One goal of the 1987 Plan, for example, is to emphasize backcountry settings, such as wilderness, where more remote recreation experiences can occur. This goal directs the Forest Service to provide opportunities uniquely suited to large, public landholders that are unlikely to be provided by private lands. An additional goal of the 1987 Plan is to dedicate 22 percent of the Forest to large, remote areas, such as, but not limited to wilderness areas, where commercial timber harvest is not permitted.

The existing management direction for the Forest also discusses landownership within the National Forest boundary with respect to wilderness. The 1987 Plan prioritizes acquisition of lands within the Forest Proclamation Boundary that are within or adjoining existing wilderness areas, or where Primitive recreation could be emphasized.

The objectives concerning GMNF wilderness in the 1987 Plan focus on specific, measurable results expected from 1987 Plan implementation. The 1987 Plan wilderness objectives discuss site and trail construction and rehabilitation.

Finally, the 1987 Forest Plan addresses wilderness management through the standards and guidelines for the Wilderness Management Area. The MA standards and guidelines contain information about management of all activities, including recreation, pest management, and facilities development.

Proposed Changes in Management Direction Common to All Alternatives

The revised Forest Plan will continue wilderness management direction provided under the 1987 Plan. The revised Plan includes a goal (Goal 13) for the management of wilderness on the Green Mountain National Forest, which states: "Manage designated Wilderness to maintain an enduring resource that preserves biotic communities unique to northeastern forests while providing opportunities for solitude and unconfined recreation consistent with the Wilderness Act of 1964, and subsequent legislation."

Several objectives in the revised Forest Plan address various aspects of GMNF wilderness management. These objectives are to increase the number of acres of wilderness areas managed to national standards, to increase the field monitoring of wilderness resource values through scheduled visits, and to increase the annual information and education contacts with the public. These objectives are different from those in the 1987 Plan in that the 1987 Plan emphasizes isolated, quantitative measures, and the revised Plan focuses on the quality of the wilderness experience.

In addition, the revised Forest Plan will continue to provide management direction through Forest-wide standards and guidelines as well as MA descriptions. The revised Forest Plan creates a new management area for wilderness management, the Wilderness Study Area (WSA) MA. The WSA MA in the revised Forest Plan directs activities in Wilderness Study Areas. The focus of the WSA MA is on managing these areas to protect wilderness characteristics pending legislation as to their classification. It also provides for existing uses where compatible with protecting wilderness character. The WSA MA contains standards and guidelines that govern such uses as minerals, timber, openings, fisheries, recreation, trails, and fire.

The revised Forest Plan also updates standards and guidelines for the wilderness management area that direct activities in existing Wilderness MAs. The Wilderness MA has been updated in several categories in order to best protect wilderness character and improve management. For example, the standards and guidelines for wildfire management, Appalachian and Long Trail (AT/LT) corridors, and heritage resources have all been updated.

Existing Condition

The existing condition of the resource involves the condition of designated GMNF Wilderness MAs, as well as the condition of the Wilderness Study Areas.

Wilderness Areas

There are currently six existing wilderness areas on the Green Mountain National Forest, totaling 59,001 acres, as shown in Table 3.12-1.

Table 3.12-1: Designated Wilderness on the Green Mountain National Forest

Wilderness Areas	Acres	Year Designated	Enabling Legislation
Breadloaf	21,151	1984	Vermont Wilderness Act
Lye Brook	15,814	1975 and 1984	Eastern Wilderness Areas Act
Peru Peak	7,047	1984	Vermont Wilderness Act
Big Branch	6,505	1984	Vermont Wilderness Act
George Aiken	4,772	1984	Vermont Wilderness Act
Bristol Cliffs	3,712	1975 and 1976	Eastern Wilderness Areas Act

Source: GMNF GIS Data. These are GIS-based acreages, and may vary from legislative-based acreages.

Breadloaf Wilderness

The Breadloaf Wilderness is the largest wilderness on the Green Mountain National Forest. It is located east of the town of Middlebury in the North Half of the Green Mountain National Forest. The area takes its name from Bread Loaf Mountain, which, at 3,482 feet in elevation, is the highest point in the Wilderness. Vermont's Long Trail, a hiking

trail that extends the length of the State, follows the main ridgeline of the Breadloaf Wilderness for 17 miles, topping Mount Wilson, Mount Roosevelt, Mount Cleveland, and Mount Grant. Along the trail, four shelters and two tent pads provide semi-primitive camping opportunities. One of these, Skyline Lodge, overlooks Skylight Pond, which at 3,360 feet is the Wilderness area's only high-elevation pond. The east side of the Wilderness contains the headwaters for the White and Mad Rivers, and the west side contains the headwaters of the Middlebury and New Haven Rivers.

Breadloaf Wilderness receives a high amount of recreational day and overnight use, particularly from hikers on and around the LT and associated shelters. The Wilderness borders a mixture of GMNF land and private land, including parcels to the northwest and southwest of the Wilderness where timber management has recently occurred, or is presently occurring.

Lye Brook Wilderness

Lye Brook is the second largest wilderness in the Green Mountain National Forest. It is located east of Manchester Center in the South Half of the GMNF, and is named after Lye Brook, which flows through the western half of the Wilderness MA. Most of Lye Brook Wilderness lies above 2,500 feet in elevation on a high plateau, and contains several lakes, bogs, and streams. Lye Brook Trail and Branch Pond Trail provide access to the area's popular attractions, including Lye Brook Falls and Bourn Pond. Lye Brook Falls is one of the highest waterfalls in southern Vermont, and Bourn Pond is a high-elevation lake with dispersed camping opportunities. The AT/LT crosses the northeast corner of the Wilderness, where the Douglas Shelter provides hikers with a semi-primitive camping opportunity. These three areas, Lye Brook Falls, Bourn Pond, and along the AT/LT, receive the Wilderness' highest recreational use. The more remote southwest portion of Lye Brook Wilderness includes a network of beaver ponds known as Lye Brook Meadows, as well as an area called "The Burning," named after a fire that occurred around 1900. Furthermore, the Lye Brook Wilderness is the only designated Class I Air Quality Area on the GMNF. This designation imposes strict requirements for air quality and air quality monitoring.

Lye Brook Wilderness was heavily logged in the 1900s, when a network of railroad lines carried timber from the plateau down into Manchester. Remnants of railroad grades and old logging roads remain in the Wilderness today, although they are somewhat overgrown. Route 7 parallels the west boundary of Lye Brook Wilderness, with heavy vehicle traffic impacting the sense of solitude or remoteness in that area. Along the north, east and south boundaries, the Wilderness borders primarily GMNF land. Some private land, however, borders Lye Brook Wilderness in sections of the north and southwest, and illegal motorized use causes management concerns in and near these areas.

Peru Peak Wilderness

Deriving its name from the highest mountain in the area, Peru Peak Wilderness is part of the White Rocks National Recreation Area, and is located in the southern half of the GMNF. The AT/LT crosses the southern section of the Wilderness, passing over the summits of Peru and Styles Peak. The remote, northern half of the Wilderness does not have trails, encompassing Pete Parent Peak and two high-elevation ponds, Little Mud and Big Mud. The Wilderness also contains the headwaters of Ten Kiln Brook and Mount Tabor Brook.

Peru Peak Wilderness receives a considerable amount of summer recreational use, particularly along the AT/LT corridor. Peru Peak Wilderness is separated from Big Branch Wilderness by a narrow corridor of GMNF land that contains a popular recreational area, Griffith Lake, as well as a trail used heavily by both hikers and snowmobilers. The Peru Peak Wilderness is bordered by GMNF land on all sides except for a parcel of private land on the southeast boundary, known as Wild Wings Ski Trails, which is used for winter recreation.

Big Branch Wilderness

Named after Big Branch Brook, the Big Branch Wilderness lies within the White Rocks National Recreation Area and is located in the South Half of the GMNF. The area's steep western escarpment forms the south wall of the Big Branch Gorge, rising abruptly east of the Otter Creek Valley. The AT/LT runs north-south for approximately four miles through the northern half of the Wilderness, and provides access to the area's popular destinations: Baker Peak, Lost Pond Shelter, and Big Branch Shelter.

Big Branch Wilderness receives a considerable amount of summer recreational use, particularly along the AT/LT corridor. Big Branch Wilderness is separated from Peru Peak Wilderness by a narrow corridor of GMNF land that contains a popular recreational area, Griffith Lake, as well as a trail used heavily by both hikers and snowmobiles. Furthermore, as parts of Big Branch Wilderness were settled in the nineteenth century, the area's historical resources are unusually rich.

George D. Aiken Wilderness

The Aiken Wilderness is named after George D. Aiken, the late United States Senator from Vermont who was a leader in securing the Eastern Wilderness Areas Act of 1975. Situated on a high-elevation plateau in the South Half of the GMNF, this Wilderness area has many streams, ponds, beaver meadows, and boggy areas. The plateau rises abruptly east of the town of Bennington, and receives some of the heaviest snowfall in Vermont. Travel is generally difficult, with deep snow in winter, mud and bugs in summer, and thick brush and fallen trees year round.

The George D. Aiken Wilderness is managed to promote opportunities for solitude and primitive recreation. Although no designated trails or outfitter/guide opportunities exist within the Wilderness, the area is popular for winter recreation, particularly cross-country skiing. The Aiken Wilderness is mostly surrounded by GMNF land, with primary snowmobile corridors running along its east and south boundaries. The Wilderness also borders Woodford State Park and Prospect Mountain Ski Area along the north and west boundaries. Despite these neighboring recreational activities, the Aiken Wilderness has almost entirely escaped intense recreational pressure.

Bristol Cliffs Wilderness

Bristol Cliffs Wilderness is located in the North Half of the GMNF and takes its name from 1,500-foot cliffs and talus slopes along its western boundary. This quartzite escarpment forms a distinct boundary between the ridge of the Green Mountains and the Champlain Valley lowlands, and offers spectacular views of surrounding farmland, Lake Champlain, and New York's Adirondack Mountains. A bulge of quartzite known as Devil's Pulpit overhangs an area of loose talus boulders and forms a prominent landmark in the northwest corner of the Wilderness. North Pond and Gilmore Pond are located within the interior of the Wilderness, and attract a variety of wildlife.

Bristol Cliffs Wilderness has no established trails, and provides visitors with an opportunity for solitude and primitive recreation. The New Haven River, private land, and York Hill Road border Bristol Cliffs to the north and east. In addition, timber management is occurring on parcels of private land bordering the east and south boundaries. A mixture of GMNF and private land, along with Bristol Notch Road, forms the southern and western boundaries of the Wilderness.

Inventoried Roadless Areas

The current condition of the GMNF Wilderness Study Areas is derived from the roadless area evaluation process, where these areas were assessed in detail by an interdisciplinary team of resources specialists. The roadless area inventory process and the full roadless evaluations are documented in Appendix C.

The roadless area inventory produced 37 roadless areas for evaluation, for a total of 124,321 acres. Following evaluation, parts of the roadless areas were grouped together in various different configurations to become recommended Wilderness Study Areas. The

Wilderness Study Areas are described below in six categories: Breadloaf Expansion, Big Branch Expansion, Glastenbury, Lye Brook Expansion, Peru Peak Expansion, and Worth Mountain (Table 3.12-2). Each alternative proposes a different size and configuration of these WSAs, and not all Alternatives propose a WSA in each category. A varying degree of management activity has taken place in these Wilderness Study Areas.

Breadloaf Expansion

The Breadloaf Expansion WSAs are a recommended expansion of the Breadloaf Wilderness, in the North Half of the Green Mountain National Forest. They were derived from nine separate roadless areas of approximately 9,100 total acres. These WSAs would expand the Breadloaf Wilderness to the east, north, and west.

Worth Mountain

The Worth Mountain WSAs were derived from approximately 13,900 total acres of roadless areas in the North Half of the Green Mountain National Forest. Worth Mountain is among the largest WSAs being recommended. There are numerous peaks higher than 3,000 feet in elevation in the Worth Mountain WSA that are visible from many off-site vantage points. These peaks include Philadelphia Peak, 3,203 feet, Worth Mountain, 3,234 feet, Monastery Mountain, 3,224 feet, and Romance Mountain, 3,200 feet. The Long Trail traverses through the parcel on a ridgeline, offering numerous views through openings in the canopy**.** Although there are trails in the WSA used by hikers and cross-country skiers, interior portions of the WSA have low trail density and receive low use.

Big Branch Expansion

The Big Branch Expansion WSAs are recommended expansions of the Big Branch Wilderness in the South Half of the Green Mountain National Forest. They were derived from approximately 13,900 total acres of roadless areas, and would expand the Big Branch Wilderness to the west and to the south.

Peru Peak Expansion

The Peru Peak Expansion WSAs are recommended expansions of the Peru Peak Wilderness in the South Half of the Green Mountain National Forest. They were derived from approximately 3,600 total acres of roadless areas, and would expand the Peru Peak Wilderness to the north and to the east.

Lye Brook Expansion

The Lye Brook Expansion WSAs are recommended expansions of the Lye Brook Wilderness in the South Half of the Green Mountain National Forest. They were derived from approximately 10,000 total acres of roadless areas, and would expand the Lye Brook Wilderness to the south, east, and north.

Glastenbury

The Glastenbury WSAs were derived from approximately 43,500 acres of roadless areas in the South Half of the Green Mountain National Forest. Glastenbury is the largest WSA being recommended on the Green Mountain National Forest. The area's size contributes to the potential for solitude, primitive recreation, and other wilderness experiences and values. Glastenbury Mountain, at 3,700 feet, along with numerous ridgeline summits and an historic fire tower, provide panoramic views of an expansive forested landscape. There are about 28 miles of primarily ungroomed, secondary snowmobile trails in the area, and about 17.5 miles of the Appalachian Trail/Long Trail.

As previously discussed, the Wilderness Study Areas recommended in each Alternative were derived from the inventoried roadless areas. As shown in Appendix C, those portions of inventoried roadless areas not managed as Wilderness Study Areas are now in a variety of other Management Areas.

3.12.1.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Indicator 1 – The Number of Areas and Acres Recommended for Wilderness Designation

Effects Common to All Alternatives

In all alternatives, Wilderness Study Areas will be managed under the Wilderness Study Area (WSA) MA. The focus of the WSA MA is on managing these areas to protect wilderness characteristics pending legislation as to their classification, and on providing existing uses where compatible with protecting wilderness character. For the purposes of determining the effects of the alternatives on the wilderness resource in this analysis, however, the Wilderness Study Areas are examined as if they are managed as wilderness areas.

Alternative A

Alternative A contains no acres of Wilderness Study Area. Alternative A represents the current management alternative, with no additional wilderness areas proposed (Table 3.12-2).

One effect of this alternative is that the desire by a certain segment of the public for more wilderness on the GMNF will not be fulfilled. As Alternative A is the current management alternative, it keeps newly acquired lands as they are currently managed and does not consider them for wilderness. Alternative A therefore offers the least opportunity for expanded wilderness among the alternatives. Furthermore, Alternative A does not address the existing wilderness areas' need for boundary adjustments to improve management. Finally, this alternative may not satisfy the Forest Plan goal of balancing a mix of wilderness and non-wilderness values as well as other alternatives, as it provides for additional non-wilderness values, but does not provide for any additional wilderness values. Alternative A does, however, respond to the segment of the public that desires no additional wilderness and prioritizes competing, non-wilderness uses and values, such as timber harvesting and motorized recreation.

Table 3.12-2: Wilderness Study Areas by Alternative

Alternative A	No Wilderness Study Areas	0
Alternative B	Breadloaf Expansion	2,291
	Subtotal	2,291
Alternative C	Big Branch Expansion	175
	Breadloaf Expansion	4,031
	Glastenbury	16,766
	Lye Brook Expansion	155
	Peru Peak Expansion	867
	Worth Mountain	7,366
	Subtotal	29,360
Alternative D	Breadloaf Expansion	5,500
	Glastenbury	31,407
	Lye Brook Expansion	155
	Peru Peak Expansion	843
	Worth Mountain	11,894
	Subtotal	49,799
Alternative E	Big Branch Expansion	42
	Breadloaf Expansion	3,977
	Glastenbury	22,425
	Lye Brook Expansion	155
	Peru Peak Expansion	874
	Subtotal	27,473

Alternative B

Alternative B contains 2,291 acres of Wilderness Study Area in the Breadloaf Expansion, representing one percent of the total GMNF acreage (Table 3.12-2). This is approximately a four percent increase over the acres of existing congressionally designated Wilderness Areas.

The focus of allocating Wilderness Study Areas in Alternative B is to improve the boundary management of existing wilderness areas. This alternative does not recommend any new wilderness areas on the Forest, or any wilderness additions in the South Half of the GMNF. Alternative B will provide better management of existing Wilderness on the North Half of the Forest but will not have improved management opportunities on the South Half. Consequently, Alternative B does not address public concern for new wilderness areas, or for additional wilderness in the South Half of the GMNF. Furthermore, as the single Wilderness Study Area in Alternative B is less than 2,500 acres, it does not address a public concern for large-scale wilderness areas that meet the Wilderness Act's criteria of at least 5,000 acres in size. Alternative B addresses some of the concern with management of wilderness by improving boundary management. Not all wilderness boundaries are improved in Alternative B, however. This alternative also addresses the public concern that there should be minimal to no new wilderness allocation. Furthermore, Alternative B attempts to mix wilderness values with competing uses by creating WSAs only in towns that did not formally object to additional wilderness. WSAs were not created in towns that publicly prioritized non-wilderness uses.

Alternative C

Alternative C contains 29,360 acres of Wilderness Study Area, representing 7 percent of the total GMNF acreage (Table 3.12-2). This is approximately a 57 percent increase over the acres of existing congressionally designated Wilderness Areas. Alternative C adds 5,228 acres to existing wilderness areas, and creates 24,135 acres of new wilderness, including 16,766 acres in the Glastenbury WSA and 7,366 acres in the Worth Mountain WSA. The existing wilderness areas receiving additions in this alternative are Breadloaf, Big Branch, Peru Peak, and Lye Brook Wildernesses. The new wilderness areas proposed in Alternative C are the Worth Mountain and Glastenbury Wilderness Study Areas.

This alternative creates Wilderness Study Areas in the North Half and the South Half of the GMNF, with a mix of stand-alone and expansion WSAs. The configuration of expansion WSAs in Alternative C offers improved management opportunities by creating more identifiable boundaries and therefore facilitating enforcement of the existing wilderness boundaries. Alternative C offers increased management improvement from Alternative B because it expands wilderness in areas that are not included in Alternative B. Many of these additional expansions occur in towns that were officially opposed to additional wilderness, and thus were not included in Alternative B.

The WSAs in Alternative C also address various user groups' and individuals' desires for new wilderness in both the North Half and South Half of the GMNF by proposing the Worth Mountain and Glastenbury WSAs. An additional effect of the wilderness configuration in Alternative C is that including new stand-alone wilderness areas, Worth Mountain and Glastenbury, can help address the demand for such wilderness values as solitude and primitive experience. Alternative B does not address this demand, as it does not propose additional new wilderness.

The configuration of the Worth Mountain WSA in Alternative C, however, may pose a management challenge by including the Long Trail (LT) in the proposed wilderness. Including the LT in a wilderness can create management difficulties regarding such issues as replacing shelters and agreeing on the appropriate balance of providing for recreation uses while protecting and enhancing wilderness character.

Alternative D

Alternative D contains 49,799 acres of Wilderness Study Area, representing 12 percent of the total GMNF acreage (Table 3.12-2). This is approximately an 84 percent increase over the acres of existing congressionally designated Wilderness Areas. Alternative D adds 6,498 acres to existing wilderness areas, and creates 43,301 acres of new wilderness. Alternative D also recommends the largest Wilderness Study Area acreage of any of the alternatives. The existing wilderness areas receiving additions in this alternative are Breadloaf, Peru Peak, and Lye Brook Wildernesses. As in Alternative C, the new wilderness areas proposed in Alternative D are the Worth Mountain and Glastenbury Wilderness Study Areas. The proposed Glastenbury and Worth WSAs in Alternative D are larger than in Alternative C. In Alternative C, the Glastenbury WSA proposal is 16,769 acres, while in Alternative D it is 31,407 acres (Table 3.12-2). In Alternative C, the Worth Mountain WSA proposal is 7,366 acres, while in Alternative D it is 11,894 acres. The configuration of these areas also differs between these alternatives. For example, the eastern boundary of the Glastenbury WSA in Alternative C is the AT/LT, while in Alternative D the WSA includes the AT/LT, extending the northern and eastern boundaries further than in Alternative C. The Worth Mountain WSA has similar configuration differences: the Alternative D version of Worth Mountain extends further south than the Alternative C version, and includes more of the LT in it.

This alternative recommends Wilderness Study Areas in both the North Half and the South Half of the GMNF, with a mix of stand-alone and expansion WSAs. The WSAs in Alternative D include areas such as Glastenbury Mountain, which addresses various individuals' and user groups' desires for new wilderness in that area. By creating two new wilderness areas that are larger than in any other alternative, Alternative D helps address the public desire for large-scale wilderness areas, as well as provides for values such as solitude, as solitude is easier to find in more expansive wilderness areas. This alternative also provides more opportunities for primitive recreation activities than do any of the other alternatives, as Alternative D includes large sections of the Worth Mountain and Glastenbury WSAs with numerous trail opportunities. Alternative D also addresses boundary improvement issues better than Alternative B does. It does not expand the Big Branch Wilderness, however, as does Alternative C.

An additional effect of Alternative D is that it proposes the largest amount of additional wilderness, and thus does not satisfy those who feel wilderness designation adversely impacts other resources on the Forest.

Alternative D could also present management challenges regarding the AT/LT, as mentioned in Alternative C. As Alternative D's larger Glastenbury and Worth Mountain configuration includes more of the Appalachian Trail and/or Long Trail in wilderness than does Alternative C, it may pose more challenges with managing AT/LT uses. Finally, Alternative D proposes more Wilderness Study Areas in towns that officially opposed additional wilderness than the other Alternatives.

Alternative E

Alternative E contains 27,473 acres of Wilderness Study Area, representing seven percent of the total GMNF acreage (Table 3.12-2). This is approximately a 47 percent increase over the acres of existing congressionally designated Wilderness Areas. Alternative E adds 5,048 acres to existing wilderness areas, and creates 22,425 acres of new wilderness. As in Alternative C, the existing wilderness areas receiving additions in Alternative E are Breadloaf, Big Branch, Peru Peak, and Lye Brook Wildernesses. Additionally, the acreages and configurations of these expansions are approximately the same as in Alternative C. There is only one new wilderness area proposed in Alternative E, which is the Glastenbury Wilderness Study Area. The amount of acreage in the Glastenbury Wilderness Study Area is between Alternatives C and D. Its configuration includes the AT/LT corridor, while Alternative C does not. Finally,

Alternative E does not propose any WSA in Worth Mountain, as do Alternatives C and D.

This alternative creates Wilderness Study Areas in both the North Half and the South Half of the GMNF, with a mix of stand-alone and expansion WSAs. The WSAs in Alternative E include areas such as Glastenbury, which addresses various individuals' and user groups' desires for new wilderness in that area. Additionally, similar to Alternative C, the configuration of expansion WSAs in Alternative E offers improved boundary management by adding expansion areas that are not included in Alternative B. Many of these additional expansions occur in towns that were officially opposed to additional wilderness, and thus were not included in Alternative B.

Indicator 2 – Configuration of Management Areas Adjacent to Wilderness and Compatibility with Wilderness Values

Effects Common to All Alternatives

The compatibility of the MAs surrounding the Bristol Cliffs and Aiken Wilderness MAs is the same across all alternatives. In all alternatives, the Bristol Cliffs Wilderness, on the North Half of the GMNF, is adjacent to private land and a small block of the Escarpment MA. The Escarpment MA may be less than compatible with wilderness values due to the allowance, for example, of motor vehicles and timber harvesting. These are small blocks of Forest, however, and will be unlikely to influence the character of the adjacent wilderness. The Aiken Wilderness, on the South Half of the GMNF, is adjacent to less than compatible management types in all alternatives.

Alternative A

Alternative A contains no acres of Wilderness Study Area. Alternative A represents the current management alternative, with no additional wilderness areas proposed. In Alternative A, the boundary of the Breadloaf Wilderness MA is shared by the Diverse Backcountry MA, which is less compatible with wilderness values. In the South Half of the GMNF, the Wilderness MAs whose adjacent lands vary by alternative are Big Branch, Peru Peak, and Lye Brook. The Big Branch and Peru Peak Wilderness MAs share boundaries with the White Rocks National Recreation Area, which is compatible with wilderness values, and with the Diverse Forest Use MA, which is less compatible. The Lye Brook Wilderness boundary is shared by both compatible and less compatible MAs.

Alternative B

In Alternative B, the boundary of the Breadloaf Wilderness and WSA MA is shared by primarily by less compatible management types. In the South Half of the GMNF, the Wilderness and WSA MAs whose adjacent lands vary by alternative are Big Branch, Peru Peak, and Lye Brook. Approximately half of the Big Branch and Peru Peak Wilderness and WSA boundary is adjacent to less compatible management types, with the remainder bordering the National Recreation Area, a compatible land use. Lye Brook Wilderness is surrounded primarily by MAs less compatible with wilderness values, with a small section of compatible management, Ecological Special Area, to the east.

The configuration of adjacent management types in Alternative B is does not vary significantly from the configuration in Alternative A; the configurations of Alternatives A and B present a similar mix of compatibility with wilderness values.

Alternative C

In Alternative C, the Wilderness and WSA MAs in the North Half of the GMNF whose adjacent lands vary by alternative are Breadloaf and Worth Mountain. Most of the Breadloaf MA in Alternative C is adjacent to less compatible management, with an area of Remote Backcountry MA to the north, which is compatible with wilderness values. The Worth Mountain WSA is adjacent to private land and to Management Areas that are less compatible with wilderness values.

In Alternative C on the South Half of the GMNF, the Wilderness and WSA MAs whose adjacent

lands vary by alternative are Big Branch, Peru Peak, Lye Brook, and Glastenbury. Approximately half of the Big Branch and Peru Peak Wilderness and WSA boundary is adjacent to less compatible management types, with the remainder bordering the National Recreation Area, a compatible land use. The boundary of the Lye Brook Wilderness in this alternative is adjacent to both compatible and less compatible management areas, in addition to private land. Most of the Glastenbury WSA is adjacent to less compatible management areas and private land, with a section to the east bordered by management compatible with wilderness values.

The configuration of adjacent management types in Alternative C is generally more compatible with wilderness values than the configuration in Alternatives A or B, as it increases the amount of compatible land bordering Wilderness Areas.

Alternative D

In Alternative D, the Wilderness MAs in the North Half of the GMNF whose adjacent lands vary by alternative are Breadloaf and Worth Mountain. The Breadloaf Wilderness and WSA MAs are bordered primarily by less compatible management types, in similar configuration as Alternative B. The Worth Mountain WSA in Alternative D is also surrounded primarily by management types less compatible with wilderness values, as well as by private land. A small section adjacent to this WSA to the south is compatible with wilderness values.

In Alternative D in the South Half of the GMNF, the Wilderness and WSA MAs whose adjacent lands vary by alternative are Big Branch, Peru Peak, Lye Brook, and Glastenbury. Approximately half of the Big Branch and Peru Peak Wilderness and WSA boundary is adjacent to less compatible management types, with the remainder bordering the National Recreation Area, a compatible land use. The Lye Brook Wilderness and WSA boundary in this alternative is adjacent to a large section of compatible management types. The remainder of the boundary, to the north, south, and west, however, is adjacent to private land and management areas less compatible with wilderness values. The Glastenbury WSA is surrounded primarily by private land and by MAs less compatible with wilderness values. A small “tongue” of land at the southern end of the WSA is compatible with wilderness values.

The configuration of adjacent management types in Alternative D is similar to that of Alternative C, and generally more compatible with wilderness values than Alternatives A or B, as it increases the amount of compatible land bordering Wilderness Areas.

Alternative E

In Alternative E, the only Wilderness MA in the North Half of the GMNF whose adjacent lands vary by alternative is Breadloaf. The Breadloaf Wilderness and WSA MAs are bordered entirely by MAs that are less compatible with wilderness values.

In Alternative E in the South Half of the GMNF, the Wilderness and WSA MAs whose adjacent lands vary by alternative are Big Branch, Peru Peak, Lye Brook, and Glastenbury. Approximately half of the Big Branch and Peru Peak Wilderness and WSA boundary is adjacent to less compatible management types, with the remainder bordering the National Recreation Area, a compatible land use. The Lye Brook Wilderness and WSA boundary in this alternative is adjacent to a large section of compatible management types. The remainder of the boundary, to the north, south, and west, however, is adjacent to private land and management areas less compatible with wilderness values. The Glastenbury WSA is surrounded primarily by private land and by MAs less compatible with wilderness values. A portion of the northern boundary, however, is adjacent to AT/LT, which is a more compatible MA.

The configuration of adjacent management types in Alternative E is similar to that of Alternatives C and D.

Cumulative Effects

The cumulative effects discussion of potential Wilderness Study Area MAs occurs in the context of the National Wilderness Preservation System and other designated wilderness areas in the New England and New York region.

Alternative A

Viewed in the context of the Northeast's limited public land base, no new wilderness on the GMNF could have a spatial displacement effect, where people would find other locations for their wilderness experience because the GMNF did not offer the opportunity. Although this displacement could put pressure on the small number of other public land resources in the region that could provide such an experience, such as the White Mountain National Forest, the effect would likely be negligible. No new wilderness could also be viewed as maximizing the region's potential for roaded and motorized recreation opportunities as well as timber and other types of management.

Alternatives B, C, D, and E

The cumulative effects discussion of potential wilderness areas occurs in the context of public and private lands in New England and New York that provide wilderness opportunities. Alternatives B, C, D, and E all provide opportunities for expanding the wilderness resource on the GMNF. Outside the GMNF, there are approximately 125,000 acres in the National Wilderness Preservation System in New England and New York. These acres are located on the White Mountain National Forest (WMNF) in New Hampshire and Maine, and on US Fish and Wildlife Service land in Maine and Massachusetts. The Adirondack State Park in New York also provides a wilderness-quality resource, with approximately one million acres managed for its wilderness values. Public land in general, however, makes up only 17 percent of the land base in this region. The New England and New York area, with its long settlement history, is predominantly private and roaded. GMNF and WMNF lands are thus uniquely able to provide wilderness opportunities in the region. The question then becomes whether the region needs more wilderness opportunities, a topic on which the public is divided. While some would argue the current NWPS land base is sufficient and any additions would detract from other competing uses, others feel wilderness-quality lands are disappearing to development in the region, and adding potential wilderness now represents the only permanent option for preserving wilderness before it disappears. Alternatives B through E address this regional wilderness resource situation by offering a range of potential wilderness additions.

3.12.2 Eligible Wild, Scenic, and Recreational Rivers

Issue Statement

Public concern is focused on the determination of eligibility of streams and rivers for inclusion in the National Wild and Scenic River System (NWSRS) and protection of the rivers' and streams' outstandingly remarkable values.

Indicator – The Number of Eligible Wild, Scenic, or Recreational Rivers

The indicator to be used in this effects analysis is the number of eligible Wild, Scenic, or Recreational Rivers. This indicator highlights the differences between alternatives because the GMNF Forest Plan revision discusses eligibility of rivers for inclusion in the NWSRS.

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the Green Mountain National Forest. This area represents National Forest System lands where potential Wild, Scenic, and Recreational Rivers exist, and the lands that could receive impacts from Wild, Scenic, and Recreational River management activities.

The analysis area for cumulative effects includes all GMNF lands and the lands administered by other owners, both public and private, within close proximity to the GMNF. Because the National Wild and Scenic River System (NWSRS) is a unique resource, and an interconnected system across the country, proximity to the GMNF is defined here in a regional context, and would include other potential NWSRS locations, such as in New Hampshire and New York.

3.12.2.1 Affected Environment

Introduction

On October 2, 1968, the Congress signed the Wild and Scenic Rivers Act (the Act), establishing the National Wild and Scenic River System. The Act states that American rivers that possess "outstanding remarkable scenic recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in a free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations."

Federally designated Wild and Scenic Rivers are a relatively scarce regional resource. There are seven rivers or river segments in the NWSRS in New England and New York, for a total of approximately 240 miles. These rivers are located in New Hampshire, Maine, Connecticut, Massachusetts, and New York. There are currently no federally designated wild, scenic, or recreational rivers in the State of Vermont.

The Wild and Scenic Rivers Act directs federal agencies to identify eligible WSRs in their planning processes, stating that "In all planning for the use and development of water and related land resources, consideration shall be given by all Federal agencies involved to potential national wild, scenic and recreational river areas."

The assessment of a river's potential as a Wild and Scenic River follows a three step process:

1. Determination of Eligibility
2. Potential Classification (Wild, Scenic, Recreational)
3. Determination of Suitability

This process is briefly explained in this section, for more analysis information on the determination and eligibility processes, see Appendix D.

Determination of Eligibility

This eligibility identification process was started in January 2003 for the GMNF. As defined by the Act, a National Wild and Scenic River (WSR) must be free-flowing and must have at least one outstandingly remarkable value: recreation, scenery, wildlife or fish habitat, history, geology, cultural, ecological, or other related feature. Determination of eligibility was based on these criteria.

An interdisciplinary team of specialists from the Forest Service was formed to conduct the eligibility study, identifying rivers within the GMNF that were eligible to be added to the NWSRS. A public group representing watershed councils provided information on river outstanding remarkable values in the determination of eligibility phase.

Rivers were also considered eligible if they are listed on the Nationwide Rivers Inventory (NRI), a list of free-flowing rivers originally compiled in 1980 and maintained by the National Park Service.

Potential Classification

The second step of WSR assessment is a determination of the river's potential classification. The Act states that "if included [in the National Wild and Scenic Rivers System, each river] shall be classified, designated, and administered" as a Wild, Scenic, or Recreational river area. The Act requires that 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. These classifications are based on the level of existing watershed and shoreline development, as well as the degree of

accessibility by road or trail, and are described 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.

These classification determinations are needed to guide management of the river and surrounding lands during the period before the final step in the process, a WSR suitability study, is made. In addition to protecting and enhancing the river's outstandingly remarkable values, management and development of a river, and its corridor, identified as eligible for designation will not be modified to the degree that eligibility or classification will be affected.

Determination of Suitability

After a river segment is determined eligible and is classified, it must undergo a suitability study before it can be recommended for inclusion in the National Wild and Scenic Rivers System. A suitability study is a congressionally directed process involving assessment of potential alternative uses, significant public input, and extensive public/private exchanges of information. As these studies are lengthy and involved, they require their own process and cannot be included in Plan Revision. A suitability analysis can be initiated at any point by the Forest Service or by congressional authorization. Following the suitability study, a river that is recommended for inclusion in the NWSRS can then be voted on by the Congress for inclusion, or it can be included through direct appeal of a State governor.

Existing Forest Plan Management Direction

The 1987 Forest Plan originally addressed Wild and Scenic Rivers through a section in the General Standards and Guidelines. These standards and guidelines protected the values of NRI-listed rivers in order to maintain the option of adding these rivers to the NWSRS. Planning direction from the 1987 Plan also noted that the inventory and study of additional eligible rivers would occur during this planning cycle to determine which rivers would be suitable for inclusion in the national system.

As the result of settlement with the non-profit group American Rivers in 1988, the GMNF in August 1988 amended its 1987 Plan. This amendment (Amendment 1), created a category of rivers called "Significant Streams." Significant Streams was a term used for additional river segments on the Forest that would receive interim standard and guideline management until their eligibility for the NWSRS could be evaluated.

The management area created for these Significant Streams, the Potential Wild, Scenic, and Recreational Rivers MA, is designed to "protect the characteristics of land and water resources which may make certain sections of eleven streams eligible for inclusion in the National Wild and Scenic Rivers System, as well as protect the characteristics that may make 38 additional river sections potential wild and scenic rivers." This MA directed Significant Streams to be managed as recreational rivers. The 1987 Plan also directed the management of these eligible streams to be an overlay that run through a variety of other MAs, and thus the more restrictive standards and guidelines are used.

The WSR standards and guidelines discuss management of potential wild, scenic, and recreational rivers, and contain management standards and guidelines for vegetation, fire, and timber.

Proposed Changes in Management Direction

The revised Plan continues 1987 Forest Plan direction by allocating a management area for eligible Wild, Scenic, and Recreational Rivers designed to protect the rivers' outstandingly remarkable values. The Eligible Wild, Scenic, and Recreational (WSR) Rivers MA in the revised Plan also continues 1987 Plan direction by creating the MA as an overlay on other management areas.

The rivers managed under the revised Plan Eligible WSR MA are only those rivers determined to be eligible for the NWSRS, as previously described. The revised Plan no longer contains the Significant Streams category from the 1987 Plan, as these Significant Streams have all been evaluated and determined eligible or not eligible. The Significant Streams that were not determined eligible Wild, Scenic, or Recreational Rivers will continue to be protected under the revised Plan, as are all rivers on the GMNF, by improved water resource standards and guidelines (see Water Section (3.3)).

The WSR River MA in the revised Plan has been updated in several categories in order to best protect the rivers' character. For example, some of the standards and guidelines for timber management, trails, and recreation have been updated. Additionally, the 1987 Plan managed wild river segments to provide a primitive recreation opportunity, while the Desired Future Condition of wild river segments in the revised Plan is the Recreation Opportunity Spectrum (ROS) category Semi-primitive Non-motorized.

Existing Condition

Currently, there are no federally designated wild, scenic, or recreational rivers on the GMNF. There are 20 rivers with 28 segments on the Forest that have been determined to be eligible as wild, scenic, or recreational, and are awaiting a Congressional suitability study for inclusion in the NWSRS. These rivers, and the classifications for each eligible river segment, are listed in Table 3.12-3.

Table 3.12-3 lists the Outstandingly Remarkable Value(s) that led each river segment to be declared eligible. Although the categories for rivers determined eligible by the NRI differ slightly from the Significant Streams declared eligible by the GMNF, the outstanding remarkable value categories generally cover the areas of recreation, heritage/historic, wildlife, fish, geological, scenic, and botanical/ecological. A river declared eligible due to its wildlife value, for example, provides exceptionally high-quality wildlife habitat. A river declared eligible due to its recreation value provides unusual canoeing and boating opportunities, unusual fishing success rate, or visitors' willingness to travel to the river from outside the region to use the recreational resource. A full description of Outstandingly Remarkable Values can be found in Appendix D of this FEIS.

Table 3.12-3: Rivers Eligible as Wild, Scenic, and Recreational Rivers

Name*	Pot. Class.	Location	Outstandingly Remarkable Value
Batten Kill River	Rec.	NY/VT state line to Arlington	Historic, Geologic, Scenic
Batten Kill River	Rec.	Arlington to Manchester	Fish, Historic, Wild
Big Branch*	Scenic	Confluence of Otter Creek to Ten Kilns Brook	Heritage
Bolles Brook	Scenic	Last bridge to headwaters	Wildlife
Bolles Brook	Rec.	Roaring Branch Walloomsac Brook to last bridge crossing	Wildlife
Bourn Brook*	Wild	wilderness boundary to headwaters	Botanical/ Ecological
Bourn Brook*	Rec.	confluence of Otter Ck to wilderness boundary	Botanical/ Ecological
City Stream	Rec.	Confluence Roaring Branch Walloomsac Brook to Woodford	Wildlife
Deerfield River	Scenic	Searsburg Reservoir to headwaters	Hydrologic, Wild

Table 3.12-3: Rivers Eligible as Wild, Scenic, and Recreational Rivers

Leicester Hollow Brook*	Scenic	End of FS Rd 243 to headwaters	Botanical/ Ecological
Leicester Hollow Brook*	Rec.	Neshobe River to end of FS Rd. 243	Botanical/ Ecological
Lye Brook	Wild	wilderness boundary to headwaters	Fish, Historic, Wild
Lye Brook	Rec.	Confluence of Battenkill to wilderness boundary	Fish, Historic, Wild
Mad River	Rec.	Folsom Brook to headwaters	Recreation
North Branch Middlebury River*	Rec.	confluence of Middlebury River to confluence of Alder Brook	Botanical/ Ecological
New Haven River	Rec.	Within proclamation boundary	Geologic
Ottauquechee River	Rec.	Woodstock to headwaters	Recreation
Otter Creek	Rec.	Emerald Lake to East Ck in Rutland	Hydrologic
Roaring Branch (includes sections of Warm Brook and Branch Pond Brook)	Rec.	Confluence of Battenkill River to Branch Pond	Fish, Historic, Wild
Rock River	Scenic	End of Sherman Road (TH-18), in Dover, to headwaters	Geologic, Recreation, Scenic,

The rivers that are eligible for inclusion in the NWSRS based on the original National Rivers Inventory are:

- Bolles Brook (two segments)
- Deerfield River (one segment)
- Lye Brook (two segments)
- New Haven River (one segment)
- Otter Creek (one segment)
- Roaring Branch (one segment)
- City Stream (one segment)
- Wardsboro Brook (two segments)
- West River (one segment)
- White River (one segment)
- Winhall River (two segments)

Table 3.12-3: Rivers Eligible as Wild, Scenic, and Recreational Rivers

Rock River	Rec.	Confluence of West River to the end of Sherman Road (TH-18), in Dover, to headwaters	Geologic, Recreation, Scenic,
Stamford* Stream	Rec.	Confluence of City Stream to Woodford and Stamford town line	Botanical/ Ecological
Wardsboro Brook	Scenic	Confluence of West River to first bridge upstream on VT100 in Jamaica Town	Recreation, Scenic
Wardsboro Brook	Rec.	First bridge upstream on VT100, in Jamaica, to headwaters	Recreation, Scenic
West River	Scenic	Bridge on VT100 just east of JCT VT155 and VT100, in Weston, to headwaters	Recreation, Scenic
White River	Rec.	Stony Brook, in Stockbridge, to headwaters	Fish, Historic, Scenic,
Winhall River	Wild	End of Kendall Farm Road to headwaters	Recreation, Scenic
Winhall River	Scenic	Confluence of West River to end of Kendall Farm Road	Recreation, Scenic

*These rivers are eligible based on GMNF review, and their Outstanding Remarkable Value categories differ slightly from the NRI-based rivers.

The following rivers are also eligible based on NRI data. These river segments have been acquired since the 1987 Plan:

- Mad River (one segment)
- Ottauquechee River (one segment)
- Batten Kill River (two segments)
- Rock River (two segments)

The rivers that are eligible for inclusion in the NWSRS based on GMNF specialists' 2003 eligibility review are:

- Big Branch (one segment)
- Bourn Brook (two segments)
- Leicester Hollow Brook (two segments)
- North Branch of the Middlebury River (one segment)
- Stamford Stream (one segment)

The majority (17) of these 28 eligible river segments are classified as Recreational Rivers. Of the remaining 11 segments, 8 will be classified as Scenic Rivers, and 3 will be classified as Wild Rivers.

3.12.2.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Indicator – The Number of Rivers Proposed as Wild, Scenic, or Recreational Rivers.

Alternative A

In Alternative A, the current management alternative, the Significant Streams designation would be retained. Significant Streams would continue to be managed as recreational rivers, and NRI-designated rivers would continue to be managed to protect their Outstandingly Remarkable Values. Under this alternative, there would be no eligible rivers, and rivers would not be studied for suitability. Significant Streams and NRI-designated rivers would be protected, as all GMNF rivers are, under improved water resources standards and guidelines.

Although the effects of not including these rivers in a WSR MA may not significantly impact their values or free-flowing condition, not including them in such an MA would present a lost opportunity to fully study the river through the NWSRS suitability process.

Alternatives B, C, D, and E

The number of rivers proposed as Wild, Scenic or Recreational Rivers is the same across Alternatives B, C, D, and E. Seventeen rivers are proposed as Recreational Rivers, eight are proposed as Scenic Rivers, and three are proposed as Wild Rivers. The acreage in the Eligible Wild and Scenic Rivers MA is also the same across the alternatives. There are 24,743 acres in this MA.

Proposing these rivers as candidates for the NWSRS, and managing them accordingly, preserves the outstandingly remarkable values for which they were proposed. The Eligible Wild, Scenic, and Recreational Rivers Management Area which governs management of these rivers acts as an overlay over the management area that otherwise exist on the land surrounding the river. As preserving the rivers' Outstandingly Remarkable Values should be the main management priority, any conflicts that arise between the two management areas' directives should be resolved in favor of preserving the river's Outstandingly Remarkable Values.

Cumulative Effects

In all alternatives, the management of these eligible rivers depends on management partnerships with both State and private landholders. As the eligible rivers cross in and out of GMNF lands, managing these rivers and preserving their outstandingly remarkable values needs to be a coordinated effort both inside and outside GMNF boundaries.

The National Wild and Scenic River System is not well-represented in the Northeast, with only seven rivers designated as Wild and Scenic Rivers in New England and New York. Preserving the Outstandingly Remarkable Values of these nineteen GMNF rivers thus becomes important in light of the Northeast's representation in this national preservation system.

There are many other river protection programs in the region which also preserve water quality and river values. Currently there is a national

focus on water quality issues. On the thirtieth anniversary of the Clean Water Act, in 2002, the Environmental Protection Agency (EPA) initiated a nationwide campaign to educate the public about watersheds, water conservation, and water pollution issues. River programs also include partnership models, such as the EPA's American Heritage Rivers Initiative (AHRI). The AHRI is a federal program designed to foster community river conservation programs. The State of Vermont also has several programs designed to protect rivers, river corridors, and water quality, including the Basin Planning Process, an ongoing watershed planning initiative, and Vermont's Water Quality Standards, which classifies rivers and all other surface waters into either Class A or Class B. Finally, there are also federal and State programs for Outstanding Resource Waters (ORW). These programs protect navigable waterways that are determined to have exceptional values in such categories as recreation, cultural resources, or scenic values.

3.12.3 National Recreation Area

Issue Statement

Public concern is focused on management of the White Rocks National Recreation Area (WRNRA), particularly vegetation management in the WRNRA. Other concerns include designation of additional National Recreation Areas. While some may want to see more land allocated to National Recreation Areas, others oppose such allocations. Finally, there is additional public concern regarding a buffer zone around WRNRA.

Indicator – Potential Effects of Management Areas Adjacent to White Rocks National Recreation Area

The indicator to be used in this effects analysis is the configuration of management areas adjacent to the WRNRA and their compatibility with WRNRA values. This indicator highlights the differences between alternatives because each alternative proposes different management areas surrounding the WRNRA resource, and activities allowed within these management areas may impact the WRNRA resource to varying degrees.

The White Rocks National Recreation Area is surrounded by different management areas in each alternative. These configuration differences may have implications for management of the NRA. Management areas that have Desired Future Conditions more consistent with that of the WRNRA include Diverse Backcountry, Escarpment, and Recreation Special Area. Other management areas may be less consistent with the NRA management, due to less compatible DFCs. These areas include the Diverse Forest Use and Alpine Ski Area Management Areas. These outside areas may negatively influence the character of the adjacent NRA due, for example, to conflicting desired conditions or allowed uses, such as timber harvesting for purposes other than habitat management.

3.12.3.1 Affected Environment

Introduction

The White Rocks National Recreation Area was established by the Congress in 1984 by PL98-322 in order to preserve and protect the area's "existing wilderness and wild values and to promote wild forest and aquatic habitat for wildlife, watershed protection, opportunities for primitive and semi-primitive recreation, and scenic, ecological, and scientific values" (Vermont Wilderness Act of 1984). White Rocks NRA covers 36,400 acres, and includes all of the Big Branch and Peru Peak Wilderness Areas.

National Recreation Areas are a federal designation established by the Congress to protect important recreation, scenic, scientific, and natural values for public enjoyment. National Recreation Areas can be established in any federal land management agency, and are primarily located within the National Park Service and the USDA Forest Service.

Existing Forest Plan Management Direction

The 1987 Forest Plan references WRNRA in the goals and objectives. The goal for vegetation management is to manage an additional ten percent of the Forest as special areas, including White Rocks NRA, where timber will be managed only where needed to provide or maintain specific wildlife habitat.

The general standards and guidelines in the 1987 Plan state that pesticides will only be used when other methods are not adequate. They will only be used as a last resort in White Rocks NRA.

The 1987 Plan also manages the White Rocks NRA through the White Rocks National Recreation Area Management Area. The WRNRA MA only includes the White Rocks land outside of the two Wilderness Areas (22,758 acres). The standards and guidelines for the WRNRA MA guide the various activities in the NRA, such as recreation, fish and wildlife, timber, and roads, and minerals. It also regulates commercial logging, maintenance of permanent openings, management of deep interior and edge wildlife species, and cultural resources.

Proposed Changes in Management Direction

White Rocks will continue to be managed under the White Rocks Management Plan. There are no proposed changes in management direction for the White Rocks National Recreation Area.

3.12.3.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Effects Common to All Alternatives

During the Plan revision process, the adequacy of the current NRA designations on the GMNF was considered. After examining the current recreational resources on the Forest and the intent of NRA designations, it was determined that National Recreation Area designation is recognition of a nationally significant recreation resource, that there are currently no additional resources of that significance to consider on the Forest, and therefore, that no new NRAs would be proposed for designation at this time. In response to public interest, however, the Moosalamoo region was considered for proposal as a National Recreation Area. It was decided that the public concerns regarding this region were best addressed through management area designations under all alternatives, focusing on the values it is designed to provide. Not proposing any new NRA designations would not impact the GMNF recreation resource. Recreation management as proposed in the revised Plan would adequately protect GMNF recreation opportunities.

Indicator – Potential Effects of Management Areas Adjacent to White Rocks National Recreation Area

Alternatives A, D, and E

In Alternatives A, D, and E, the WRNRA is bordered by a combination of Diverse Forest Use and either the Diverse Backcountry or the Escarpment MA. Although the Diverse Backcountry and Escarpment MAs are compatible with the NRA, in that these MAs' Desired Future Condition (DFC) ROS classes are Semi-primitive Motorized, the Diverse Forest Use DFC is less compatible with the NRA. This configuration is more desirable than

that of Alternative B, but less desirable than that of Alternative C.

Alternative B

In Alternative B, the WRNRA is completely surrounded by the Diverse Forest Use MA. This surrounding management configuration is the least compatible with NRA management of any of the alternatives, as it is the only alternative that completely surrounds the NRA with a less compatible MA.

Alternative C

In Alternative C, the WRNRA is surrounded by similar configurations of Diverse Forest Use, Diverse Backcountry, and Escarpment MAs. The addition of both Escarpment and Diverse Backcountry MA in these Alternatives, both with a Semi-Primitive Motorized DFC, makes Alternative C generally more consistent with the Desired Future Condition of the WRNRA, Semi-Primitive Motorized, than Alternatives A, D, E, or B.

Cumulative Effects

Effects Common to All Alternatives

The White Rocks National Recreation Area is one of the only National Recreation Areas in the New England and New York region. White Rocks NRA represents a unique regional resource designed to preserve recreation opportunities for future generations. White Rocks will continue to be protected in its existing condition in the revised Forest Plan, and would likely not be negatively impacted by the alternatives.

3.13 TIMBER MANAGEMENT

This section focuses on the effects of the timber management program on the Green Mountain National Forest (GMNF) in terms of the quantity of timber harvesting that could occur and the mix of silvicultural harvest methods that could be used to achieve desired resource objectives. The effects from timber management on vegetation composition and socio-economic resources of the GMNF are discussed in the respective Chapter 3 sections (Vegetation 3.5 and Socio-Economic 3.21). The effects from timber management on the other physical and biological resources are discussed in relevant sections of Chapter 3. The impacts of timber management on forest type composition and age classes are discussed in the Vegetation (3.5) section.

Issue Statement

Public concern is focused on the role of timber harvesting, the amount of timber harvested, harvest methods, and management intensity. In addition, impacts of timber management activities on natural and socio-economic resources are a concern.

Public concerns are addressed through various alternatives. This analysis will compare how the alternatives address:

- Levels of timber harvesting (intensity)
- Methods and uses for timber management
- Desired mixes and locations of various forest type composition and age classes

Indicator 1 – Acres of Land Identified as Suitable for Timber Production

The first indicator to be used in this effects analysis is the acres of land identified as suitable for timber production. Suitable land for timber production is the basis for determining the maximum amount of timber volume that could be harvested sustainably over the long-term on National Forest System (NFS) lands. Forest inventory data was reviewed to ensure that only appropriate productive land was identified for timber production. Newly acquired land was also assessed for its suitability for timber production.

This indicator highlights the differences between alternatives because the acres of land suitable for timber production vary between each alternative. This is because the amount of land identified as suitable for timber production varies based on management area direction and management area allocation. The following management areas (MAs) include lands that are considered suitable for timber production in the revised Plan: Diverse Forest Use, Remote Wildlife Habitat, Escarpment, Moosalamoo Recreation and Education Area, and Diverse Backcountry.

Indicator 2 – Timber Sale Volume (Allowable Sale Quantity)

The second indicator for this analysis is the volume that could be sustainably harvested each decade through commercial timber sales. Timber sale volume reflects the maximum amount of timber volume that could be harvested from the GMNF under each alternative and is referred to as the allowable sale quantity (ASQ). The ASQ includes all wood products, including sawtimber, pulpwood, commercial firewood, and chipwood, and is measured in millions of board feet (MMBF). There would be varying amounts of timber volume (ASQ) that could be harvested under each alternative to achieve different resource objectives and contribute to public and economic needs. This indicator highlights the differences between alternatives because the ASQ would vary depending on the amount of land identified as suitable for timber production.

Indicator 3 – Silvicultural Prescriptions: Acres by Timber Harvest Method

The third indicator for this analysis is the amount of even-aged and uneven-aged management used to meet short and long-term vegetative composition and age class objectives. Generally, tree species that require more sunlight to survive and grow, do better with even-aged management. Species that can survive under shade can be managed with either even-aged or uneven-aged management. This indicator highlights the differences between alternatives because the opportunity for even-aged and uneven-aged timber harvesting varies by management area.

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the GMNF. The analysis area for cumulative effects includes all GMNF lands and the lands administered by other owners, both public and private, within the State of Vermont.

3.13.1 Affected Environment

Introduction

The Weeks Law, enacted by the Congress in 1911, authorized the federal government to purchase land for national forests in the eastern United States with the consent of the State in which the land is located. The intent of the Weeks Law was to protect the watersheds and to assure a supply of timber to meet the needs of the nation. The GMNF was established under the Weeks Law in 1932 and its first timber sale occurred that same year. Timber management plans were prepared for the GMNF in the 1940s, 1950s, 1960s and 1970s. Natural resource management plans including timber harvesting to achieve multiple-use objectives were incorporated into the 1987 Forest Plan.

The Forest Service recognizes the need to manage sustainable forest ecosystems as part of meeting natural resources objectives. The principle reason for harvesting timber is to meet resource management objectives, including desired conditions for scenery, vegetative composition, wildlife habitat, timber products, and integrated pest management. Achieving sustainable forest ecosystems involves the conservation and restoration of ecosystem structure, composition and processes. Timber management is an important tool in managing sustainable forest ecosystems.

Historically, the timber volume sold by the GMNF has been a small portion of the total volume harvested in Vermont. The amount of forest land managed for timber has declined in Vermont, however, making GMNF timber resources more valuable due to the long-term forest stewardship possibilities. The decline of private lands being managed for timber in Vermont and New England has resulted from several factors. Since the 1960s, Vermont's population has grown to where private individuals, owning 82 percent of the State's timber land, do not emphasize timber production in land management. One third of Vermont's timber lands are in tracts less than 100 acres and forest tracts less than 50 acres in size have nearly doubled since 1983. These small ownerships are primarily sites for homes, where timber production is often a secondary landowner objective (Birch 2000).

From the 1970s to the 1990s, large tracts of industrial timber lands in northern New England were liquidated of timber and the land was sold (Northern Forest Lands Study 1990). In northern Vermont, large clearcutting occurred and the land was subdivided into building lots. In contrast, large tracts of southern Vermont previously owned by International Paper Company and located within the NFS lands proclamation boundary were acquired by the GMNF.

In southern Vermont, most timberland is owned by private individuals. These woodlots are typically less than 100 acres which adjoins a residence. Sixty percent of the woodlots have a forest management plan while the smaller ownerships do not have plans. A landowner survey by the University of Vermont (Gilbert,

Newton and Polansky, 1996) indicated that 84 percent of the woodlot owners had no plans for clearcutting. The typical harvest method indicated in the survey was diameter limit cutting to generate revenue to pay the property tax. While "selection harvesting" was prescribed in the management plans, property tax liability or inheritance taxes forced landowners to conduct liquidation harvests. The survey also indicated that landowners were concerned on keeping the woodlots under good stewardship, subdivision was more frequent, making stewardship more difficult. While private forest lands could contribute to meeting regional timber demands if managed properly, the trend is that less private land is being managed with long term objectives.

Pulpwood markets have traditionally been poor in southern Vermont, resulting in limited market potential for GMNF pulpwood production. Northern Vermont is within economic hauling distances to pulp mills in Berlin, New Hampshire and Rumford, Maine.

Between 1960 and1986, an average of 12 to 18 MMBF of timber was offered annually for sale on the GMNF. Before 1987, eight sawmills, located within or adjacent to the GMNF, utilized the majority of the sawtimber harvest of the GMNF. Their total mill capacity was 41 MMBF per year. GMNF sawtimber accounted for approximately 20 percent of the total lumber produced by these mills. Through the removal of low value trees on GMNF lands, the Forest Service has focused on producing high value sawtimber dating back to the 1930s. The steady supply of available high-quality sawtimber and veneer in the local market place not as frequently available on private lands resulted in the creation of a key market niche for GMNF timber products. Although the volume of timber harvested has not been high relative to the overall timber market in Vermont, the high-quality sawtimber products supplied by the GMNF continues to be important for the local economy (Wharton 2001). The GMNF role as a public agency has been to provide a non-declining, even-flow of timber over the long term which can contribute to the stability of timber supplies in southern Vermont.

Timber harvest volumes have steadily declined on GMNF managed lands since 1987 (see Table 3.13-1). The decline in the supply of local sawtimber on the GMNF as well as surrounding non-NFS lands has resulted in local mills shifting to other sources of sawlog-sized timber. Many of the mills have had to import sawlogs from other states, or foreign countries which tend to come from smaller diameter trees. This has resulted in the closure of Vermont mills that were not able to afford the more efficient, sophisticated, and expensive processing equipment needed to process smaller logs. It has also resulted in an increased competition for high-quality sawlogs for all ownerships (Vermont State Forest Plan, 1997).

Timber Sale Volume (Allowable Sale Quantity)

Allowable Sale Quantity (ASQ) is defined as the quantity of timber that may be sold from the area of suitable land covered by the Forest Plan for a time period specified by the Plan. This quantity is usually expressed on an annual basis as the average annual allowable sale quantity (36 CFR 219.3). The ASQ is the sum of all the wood products and expressed in millions of board feet (MMBF) or millions of cubic feet (MCF).

Although a national forest may exceed the annual ASQ in a given year, the sum total of timber volume sold over the ten year planning period cannot exceed the overall ASQ. ASQ is not a goal for production; it is a maximum amount that could be harvested sustainably. The ASQ can increase and cannot decline. The National Forest Management Act (NFMA) limits the amount of timber to be sold to a quantity that is equal to, or less, than which can be removed annually in perpetuity on a sustained-yield basis, this is referred to as "Non-Declining Yield."

Lands Suitable for Timber Production-Suitable Forest Lands

Suitable forest land constitutes the land base for determining the ASQ where management for timber production occurs on a regulated basis. Land is considered tentatively suitable forest land when it has the capability of producing 20 cubic feet of commercial wood per acre per year.

The process for determining forest land suitability is described in 36 CFR 219.14. There are four major steps in determining suited forest land:

1. The first step separates forest land from non-forest land (roads, power-lines, wildlife openings and water).
2. The forest land is then reduced by lands withdrawn by an Act of Congress, the Secretary of Agriculture or the Chief of the Forest Service; lands which the Forest Service cannot assure restocking (reforestation) within 5 years; and lands where irreversible damage to the soils or watersheds would occur.
3. The remainder is considered tentatively suitable forest lands.
4. The tentatively suited forest land is further reduced by site-specific issues and land allocation decisions made during the Forest planning process to determine the suitable forest land acres. These reductions include management area designations, areas that require excessive logging costs, designated recreation sites, and Threatened, Endangered, and Sensitive species habitat, among others.

Existing Forest Plan Management Direction

The 1987 Forest Plan directs the Forest Service, through goals and objectives, to manage timber to maintain and enhance the vegetation diversity, wildlife habitats, and vistas; to improve the health and condition of the forest ecosystem; and to produce high-quality sawtimber and other wood products. Timber harvesting through commercial timber sales can be done if it helps achieve these conditions and other objectives assigned to management areas, and if the environment can be adequately protected. Standards and guidelines associated with timber harvest activities are designed to minimize adverse effects to resources. GMNF timber sales serve as demonstrations of sustainable forest management in Vermont.

The 1987 Forest Plan allocated 153,600 acres in management areas that are managed for timber production on a regulated basis. The Forest Plan further determined that only 122,000 acres in those management areas would be considered suitable forest land (Table 3.13-1).

Management Areas Suitable for Timber Production on a Regulated Basis

The 1987 Forest Plan determined that the following management areas have forest lands that are suitable for timber production:

<u>Management Area 2.1A and 2.2A - Continuous Forest Cover</u>
These wooded areas are predominately managed to emphasize uneven-aged silviculture that maintains continuous forest canopy cover. The main intent of these management areas (MAs) is to provide natural-appearing, vigorous stands of trees in areas that are visually sensitive. Approximately six percent of the GMNF is managed as MA 2.1A and 2.2A.

<u>Management Area 3.1 - Mosaic of Vegetative Conditions</u>
These wooded areas are predominately managed to emphasize a variety of stand ages across the landscape. Even-aged silviculture is used to maintain oak, aspen, paper birch, conifers, and northern hardwoods. Uneven-aged silviculture is practiced in areas where conflicts may occur with other resources and MA objectives. Approximately twelve percent of the GMNF is managed as MA 3.1.

Management Areas 4.1 and 4.2 - Deer Wintering Areas
These wooded areas are predominately managed to emphasize habitat for wintering deer. Timber production is designed to primarily provide conifer cover and hardwood browse for deer. Approximately five percent of the GMNF is managed for MAs 4.1 and 4.2.

Management Areas 6.2A - Semi-Primitive Recreation
These wooded areas are predominately managed to emphasize opportunities for recreation and wildlife requiring moderate solitude. The timber management emphasis is long rotation even-aged silviculture. Uneven-aged silviculture is practiced in areas where conflicts may occur with other resources and MA objectives. Approximately fifteen percent of the GMNF is managed as MA 6.2A.

Table 3.13-1 displays the acres of land suitable for timber production by MA allocation under the 1987 Plan.

Table 3.13-1: Management Area Suitability for Timber Production (1987)

Management Area	Total Acres	Suited Acres	Not Suited Acres
2.1A	19,300	15,300	4,000
2.1B	3,400	0	3,400
2.2A	5,100	4,100	1,000
2.2B	17,800	0	17,800
3.1A	48,800	38,800	10,000
4.1	14,500	11,500	3,000
4.2	5,800	4,600	1,200
5.1	58,400	0	58,400
6.1	12,100	0	12,100
6.2A	60,100	47,700	12,400
6.2B	17,500	0	17,500
7.1	3,200	0	3,200
8.1	31,500	0	31,500
9.2	27,300	0	27,300
9.3	600	0	600
Totals	325,400	122,000	203,400

Source: 1987 GMNF Forest Plan: Table A.02

Management Areas that Allow Timber Management but are not Suitable for Timber Production

The Alpine Ski Areas (MA 7.1) and the White Rocks National Recreation Area (MA 8.1B) use timber management as a tool to accomplish other resource objectives. The tentatively suitable forest lands within these MAs are not appropriate for sustained yield timber management because of other resource objectives. Timber harvesting within these MAs does not contribute to the Allowable Sale Quantity.

Management Area 7.1- Alpine Ski Areas
The wooded areas within the Alpine Ski Areas are managed to enhance the highly developed recreation values. Timber harvesting is incidental and primarily used for ski slope clearing and maintenance, removing hazard trees, and maintaining forest health. Uneven-aged silviculture is primarily used to achieve objectives consistent with the recreation emphasis of this MA. Approximately one percent of the GMNF is managed as MA 7.1

Management Area 8.1B- White Rocks National Recreation Area (NRA).
Timber management is conducted in the non-wilderness portions of the White Rocks NRA only to improve recreation and wildlife habitat objectives. Even-aged silviculture is primarily conducted on a small scale to promote wildlife habitat for reclusive species. Commercial timber harvesting often is the most cost-effective tool to accomplish vegetative composition and age class objectives in the NRA. Approximately six percent of the GMNF is managed as White Rocks NRA.

Timber Sale Volume (ASQ)

The 1987 Forest Plan determined the average annual ASQ to be 15.6 MMBF (2.7 MMCF) or 156 MMBF for the ten-year planning period.

Silvicultural Prescriptions (Timber Harvest Methods)

The 1987 Forest Plan provided vegetation management objectives that determined projected annual outputs by forest type and harvest method (Table 3.13-3). The Plan recognized the selection of the proper harvest method depended primarily on the desired management objective. The Plan provided definitions for the silvicultural systems to be used to manage the timber resource. Although there are many harvest methods used in managing forest lands, there are only two silvicultural systems discussed in the Plan: 1) even-aged management (including clearcutting, standard shelterwood, delayed shelterwood, and thinning); and 2) un-even-aged management (including individual tree and group selection). Direction on what system and harvest method to select given the desired management objectives are provided in the Forest wide and MA standards and guidelines, and an appendix to the Plan (Appendix A).

Even-aged Management

The 1987 Forest Plan provided for the use of even-aged management harvest methods to achieve resource objectives such as regenerating shade intolerant tree species or high-risk and sparse stands, preventing the spread of insect and disease, and meeting wildlife habitat composition objectives. The Plan indicated that the even-aged silviculture method of shelterwood would be the most common type of harvest implemented over the planning period. Shelterwoods accomplish desired even-aged resource objectives while retaining important stand attributes such as structure and visual quality.

Shelterwood cutting is normally conducted with two closely associated harvests. The first cut removes at least 50 percent of the overstory trees to create regeneration of seedlings. The removal cut is conducted three to seven years after the first cut to release the new stand of seedlings and saplings. Ideally, 40 to 50 years after the removal cut, thinning harvests are conducted every 15 to 20 years throughout the rotation to maintain healthy stand conditions and to favor desirable tree species.

A variation of the shelterwood harvest method is “shelterwood with reserves” harvesting. The Forest Plan referred to this method as “delayed shelterwood” and it is also known as “deferment cutting.” This method is similar to shelterwood harvesting, except the removal cut is delayed 30 to 40 years. Delayed shelterwoods are desirable for the regeneration of stands that are in visually sensitive areas where even-aged management is the preferred silvicultural system.

Clearcutting is a harvest method to create conditions for shade intolerant tree species. On the GMNF, the clearcuts are more correctly called clearcutting with reserves, according to the Society of American Foresters (SAF) terminology. The 1987 Plan provides direction to use clearcuts only when they are the optimum method to achieve stated management objectives such as regenerating aspen or paper birch stands, and salvaging stands damaged by insect or disease.

Intermediate cuts, referred to in the Forest Plan as thinnings, are to be used to improve the growth and quality of desirable trees in overstocked stands. Frequency of thinnings are to be conducted based on the type of trees being managed, the productivity of the site, and the overall resource objectives for the area.

Uneven-aged Management

The 1987 Forest Plan provided for the use of uneven-aged management harvest methods to achieve resource objectives such as providing continuous forest cover, providing vertical diversity within stands, providing a variety of age and type classes among stands, and maintaining visual sensitive areas of the forest. The individual tree selection harvest method is to be used primarily in Northern hardwood and hemlock stands where shade intolerant species and continuous forest cover are desired. The group selection harvest method is to be used in Northern hardwood stands where species are intermediately tolerant or intolerant to shade, white pine and spruce stands, and to facilitate the conversion of some even-aged stands to un-

even-aged. Uneven-aged management entries in hardwood stands are normally every 15 to 20 years.

Reforestation, Release, and Timber Stand Improvement

The 1987 Forest Plan provided direction to adequately regenerate harvested areas within five years after regeneration cuts by either natural or artificial means. Site preparation methods such as mechanical, hand, and prescribed burning is provided to ensure regeneration as well as direction for surveys to ensure minimal stocking levels to meet desired resource objectives. The Plan also provided direction for the non-commercial release of young desirable tree species to achieve objectives such as increasing the proportion of softwoods in deer wintering areas and enhancing the survival of oak stands.

Proposed Changes in Management Direction Common to All Alternatives

The revised Forest Plan continues the 1987 Forest Plan direction for the use of timber harvesting to achieve multiple resource management objectives but provides for considerable change in the goals, objectives, standards, guidelines, and MA direction.

Goals associated with timber management in the revised Forest Plan include providing for a sustainable supply of forest products (Goal 8), demonstrating sound management practices that can be applied to other lands (Goal 9), and providing other resource benefits through coordinated timber harvesting (Goal 10). Rather than providing for quantitative annual timber volume and harvest method output objectives, the revised Plan provides for the use of timber harvesting to achieve desired wildlife habitat composition and structural objectives through desired amounts of forest types, age class distributions, and rotation ages.

Forest-wide standards and guidelines have been updated and refined to provide direction for the selection of silvicultural systems, harvest methods, reforestation, and tree improvement. Key changes from the 1987 Plan include:

- Shelterwood with reserves harvesting will be used more frequently.
- Natural regeneration will be favored over planting.
- Emphasis will be added to maintain genetic diversity and local adaptation through silvicultural practices.
- Clarification of direction in the role of special forest products will be added.
- Clarification of meeting wildlife habitat objectives through timber harvesting.
- Clarification of the use of timber harvesting with the White Rocks NRA.

A major change in the revised Plan is the combining of MAs 2.1A, 2.1B, 2.2A, 2.2B, 3.1, 4.1 and 4.2 from the 1987 Plan into a single MA (Diverse Forest Use). This MA emphasizes a variety of forest uses and recognizes that silvicultural practices will be used to meet timber, wildlife, ecological, visual, and recreation objectives. Vegetation management emphasis is placed on production of high quality sawtimber and other timber products on a sustained yield basis. The use of a single MA for this land base provides for maximum flexibility to select the proper silvicultural system and harvest method to achieve management objectives based on site specific information obtained during project implementation.

Another change is the creation of the Remote Wildlife Habitat, Green Mountain Escarpment, and Moosalamoo Recreation and Education MAs that allow for timber harvesting to achieve specific desired conditions. The major emphasis of the Remote Wildlife Habitat MA is to provide a mix of different aged forest habitats, from early succession to old forests, for the primary benefit of reclusive wildlife species. Both even-aged and uneven-aged harvest methods are to be used to provide a mix of hardwood and softwood stands that vary in size, shape, age, height, and composition. The Green Mountain Escarpment MA emphasizes management of natural communities along the Green Mountain escarpment. Silvicultural prescriptions are to be

designed to maintain and enhance natural community diversity, especially the regeneration of pine and oak dominated communities found in this area. The Moosalamoo Recreation and Education Area MA have uncommon or outstanding recreational, scenic, cultural, or historical significance. Providing a showcase for national forest multiple use management, including timber harvesting, is part of the emphasis of this MA. All of these new MAs are included in the suitable for timber production land base.

The revised Plan also incorporates new information to determine suitable forest land and ASQ for the planning period. This new information includes the 1997 and 1998 National Forest Inventory and Assessment (FIA) data of Vermont, more reliable growth and yield models, and an updated, more intensive forest stand inventory than what was used in 1987. The stand inventories provided accurate measurements of lands suitable for timber production, including newly acquired lands.

Existing Condition

Forest Productivity

Forest productivity of lands varies across the GMNF. Forest productivity is measured by the number of cubic feet of wood per acre per year that can be grown (Table 3.13-2). The most productive sites are in the lower elevations where deep, moderately well drained soils are found. Generally, productivity decreases as elevation increases. The lowest forest productivity sites occur at high elevations where the soil is thin and rocky. A site must produce at least 20 cubic feet per acre per year to be considered as minimum productivity for commercial timber harvest purposes.

Table 3.13-2: Timber Productivity of GMNF

Site Quality	SI	Cubic Feet/Year	% of GMNF
High	60+	50+	26%
Medium	45-59	37-49	50%
Low	35-44	20-36	18%
Unproductive	< 34	< 20	6%

SI=Site index for sugar maple.

Culmination of Mean Annual Increment

The National Forest Management Act (NFMA) directs that stands shall have generally reached the culmination of mean annual increment (CMAI) before they are harvested using clearcutting or shelterwood regeneration harvesting methods. The age when a stand reaches the culmination of CMAI is generally greater than 50 years on the GMNF (Table 3.13-3).

Table 3.13-3: Culmination of Mean Annual Increment (CMAI) for GMNF Species

Species	Site Index	CMAI Age
Upland Oaks	50	35 years
	60	45 years
Northern Hardwood	50	59 years
	60	50 years
	70	44 years
Red Spruce	50	70 years
White Pine	40	80 years
	50	70 years
	60	60 years
	70	60 years
	80	50 years

Source: USDA Soil Conservation Service, Northeastern Technical Service Center Broomall, PA 1980

Suitable Forest Land

In 1987, a total of 27,300 acres of land had been acquired since 1982. There was insufficient information about those lands to determine their suitability. Since 1987, an additional 64,048 acres have been acquired and inventories have now been completed. In 2004, there are a total of

91,348 acres of newly acquired land. Analysis of the inventory data has shown that of all the lands acquired since 1982, a total of 70,390 acres are tentatively suitable for timber production.

Timber Sale Volume (ASQ)

The 1987 Plan determined the average annual ASQ to be 15.6 MMBF (7.4 MMBF of sawtimber and 8.2 MMBF of pulpwood) or 156 MMBF for the planning period. Table 3.13-4 displays the actual timber volume sold from 1960 to 2004. The actual average annual timber volume sold over this 45 year period was approximately 10.3 MMBF. The total volume sold was 462.2 MMBF. In 1965, a total of 19.7 MMBF was sold. The amount of timber sold has declined since 1987. From 2000 to 2003 no commercial timber sales were offered for sale primarily due to a halt on timber sales while the Forest Service conducted a Forest Plan amendment to address Indiana bat habitat.

Monitoring of the Forest Plan indicates that the amount of timber harvesting on the GMNF has been below what is necessary to create the desired future conditions outlined in the Plan. In addition, there has been difficulty meeting resource objectives that require utilizing timber management as a tool, such as creation of habitat diversity for wildlife species.

The ASQ was not achieved for many reasons. Since pulpwood markets have traditionally been poor in southern Vermont, marketing of sales composed of half pulpwood or more to achieve ASQ levels was not prudent. The ability to implement timber sales was another factor due to timber harvesting appeals, litigation, budgets, and staffing levels. As a result, a level less than half of the ASQ was obtained and it has not helped achieve Forest Plan objectives associated with timber management.

Table 3.13-4: GMNF Timber Volume Sold (1960-2004)

Year	MMBF	Year	MMBF	Year	MMBF
1960	5.0	1975	1.8	1990	7.8
1961	10.6	1976	14.0	1991	6.4
1962	12.0	1977	9.5	1992	6.9
1963	15.8	1978	12.6	1993	4.3
1964	19.2	1979	11.7	1994	6.4
1965	19.7	1980	16.4	1995	4.6
1966	19.0	1981	17.5	1996	5.5
1967	17.8	1982	10.7	1997	5.7
1968	17.3	1983	12.2	1998	5.8
1969	16.2	1984	15.9	1999	2.5
1970	15.0	1985	13.5	2000	0.1
1971	9.6	1986	10.7	2001	0
1972	16.7	1987	13.4	2002	0
1973	16.0	1988	12.1	2003	0
1974	14.1	1989	8.8	2004	1.4

Source: GMNF Cut & Sold Reports 1960 to 2004

Silvicultural Prescriptions

Actual average annual harvest treatment methods achieved on the Forest are shown in Table 3.13-5. Shelterwood regeneration has only been about 20 percent of the projected 1987 Forest Plan output. Although these figures include both the standard and delayed shelterwood methods, the use of the latter has been limited to very few applications on the GMNF.

Clearcutting has been 85 and 88 percent of the projected output for hardwood and softwood management, respectively, but only 34 percent of the projected output for aspen/paper birch. The use of clearcutting has primarily been limited to regenerate aspen and paper birch, convert hardwoods to softwoods or aspen, and create or maintain upland wildlife openings or scenic vistas. There has also been limited use of clearcutting to salvage stands that have a high risk of dying within the next ten years. Thinning harvests were 40 and 43 percent of the projected output for hardwood and softwood management, respectively.

Uneven-aged harvest methods, including both individual and group selection, were 76 percent of

the projected Forest Plan output. Uneven-aged management was most applied in highly sensitive visual areas such as roadsides, trails, and recreation areas. It was also used to remove individual trees in riparian areas to maintain shade along streams.

Timber Markets

The markets for pulpwood, firewood, and chipwood are limited in southern Vermont and are expected to remain weak over the short-term. In contrast, markets for sawtimber are considerably stronger and are expected to remain stable.

In 2002, within the counties surrounding the GMNF that include Addison, Bennington, Rutland, Windsor, Windham and Washington counties a total of 29.3 million cubic feet of timber was harvested from all ownerships. This included 15.7 million cubic feet of sawtimber (54%), 1.0 million cubic feet of veneer (3%), 6.0 million cubic feet of pulpwood (20%) and 6.6 million cubic feet of fuelwood (chipwood) (23%).

Table 3.13-5: Forest Plan Silviculture Objectives - Projected Annual Average Output, and Percent Accomplished (1987-2001)

Harvest Method	Projected Output	Percent Accomplished
Hardwood Management		
Selection	**470 acres**	**76%**
Shelterwood Regeneration	**950 acres**	**20%**
Shelterwood Removal	**320 acres**	**48%**
Clearcut	**100 acres**	**85%**
Thin Harvest	**885 acres**	**40%**
Softwood Management		
Selection	**260 acres**	**32%**
Clearcut	**35 acres**	**88%**
Thin Harvest	**100 acres**	**43%**
Conversion to Softwoods		
Clearcut Hardwoods	**90 acres**	**34%**
Aspen & Paper Birch Management		
Clearcut	**110 acres**	**16%**
Conversion to Aspen		
Clearcut Hardwoods	**60 acres**	**27%**
Create Upland Openings		
Clearcut Hardwoods	**40 acres**	**70%**
Source: USDA 2002c		

3.13.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Although there have been changes proposed in the revised Forest Plan goals, objectives, and Forest-wide standards and guidelines, the overall direction associated with timber management on the GMNF to meet different resource objectives would not be greatly altered. Each alternative, however, has a different level of opportunity for timber management over the short and long-term time period. The difference in the opportunity for timber management by alternative is highlighted by the indicators since each alternative has a different mix of MA allocations where timber harvest is emphasized.

Indicator 1 – Acres of Land Identified as Suitable for Timber Production

Effects Common to All Alternatives

The amount of land identified as suitable for timber production varies among alternatives by the amount of land allocated to management areas where timber production is appropriate (Table 3.13-9). The management areas that are appropriate for timber production include: Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Moosalamoo Recreation and Education Area, and the Escarpment. These management areas also contain some lands that are not appropriate for timber production such as inclusions of steep slopes, wet soils, and riparian areas. Although timber harvesting may occur in other management areas, such as Alpine Ski Areas and the White Rocks NRA, timber harvesting in these areas does not contribute to the ASQ.

Suitable forest land determination is a step-by-step process. Generally, once the tentatively suitable forest land is determined, the alternatives deviate from each other due to allocation of management area designations (Table 3.13-). The amount of suitable forest land has effects on the opportunity for timber harvesting to achieve desired vegetative objectives. Alternatives also deviate from each other by the amount of highly productive land they include in the suitable for timber production land base (Table 3.13-6).

Table 3.13-6: Forest Productivity on Lands Suitable for Timber Production

Alternative	Total Suitable Acres	Moderately Productive acres	Highly Productive Acres
Alt. A	157,673	85,675	71,777
Alt. B	216,430	122,242	92,802
Alt. C	193,791	106,889	85,610
Alt. D	180,381	96,888	82,207
Alt. E	189,616	103,100	85,226

Highly Productive Lands defined as having a Site Index > 60 Source: GMNF Timber Model GIS layer .

Alternative A

Alternative A would have the least amount of suitable forest land. This alternative reflects 1987 Plan direction and includes the acres that the Plan determined suitable. Alternative A also includes suitable forest lands from improved forest stand inventories and allocates 157,673 acres (39% of total Forest) of land within management areas that are suitable for timber production. Of this total, 71,777 acres are on lands considered highly productive. No acres of newly acquired lands are considered suitable for timber production in Alternative A.

Alternative B

Alternative B would have the greatest amount of suitable forest land. A total of 216,430 acres (54%) would be considered suitable for timber production. Of this total, 92,802 acres are on lands considered highly productive. Approximately 65,942 acres of tentatively suitable forest land that was acquired since 1982 would be considered suitable in this alternative. Approximately 1,958 acres of land suitable for

timber production would be determined unsuitable due to Wilderness Study Areas.

Alternative C

Alternative C would be intermediate in the amount of suitable forest land. A total of 193,791 acres (48%) would be considered suitable for timber production, an additional 36,118 acres than Alternative A has available. Of this total, 85,610 acres are on lands considered highly productive. Approximately 58,726 acres of tentatively suitable forest land that was acquired since 1982 would be considered suitable in this alternative. Approximately 16,314 acres of land suitable for timber production would be determined unsuitable due to Wilderness Study Areas.

Alternative D

Alternative D would be intermediate in the amount of suitable forest land. Alternative D would have 180,381 acres (45%) of forest land suitable for timber production. Of this total, 82,207 acres are on lands considered highly productive. Approximately 48,626 acres of tentatively suitable forest land that was acquired since 1982 would be considered suitable in this alternative. Approximately 31,409 acres of land suitable for timber production would be determined unsuitable due to Wilderness Study Areas.

Alternative E

Alternative E is very similar to Alternative C and is intermediate in the amount of suitable forest land. This Alternative would have 189,616 acres (47%) of forest land suitable for timber production. Of this total, Alternative E differs from Alternative C in that 85,226 acres are on lands considered highly productive. Approximately 55,058 acres of tentatively suitable forest land that was acquired since 1982 would be considered suitable in this alternative. Approximately 12,262 acres of land suitable for timber production would be determined unsuitable due to Wilderness Study Areas.

Indicator 2 – Timber Sale Volume (ASQ)

Effects Common to All Alternatives

The application of vegetation treatments and allocations to various management areas affects the potential volume of timber produced during a particular period under each alternative. For the purpose of this analysis, the short-term covers the first decade and the long-term reaches 15 decades into the future.

Table 3.13-7 displays each alternative's average annual ASQ for the short and long-term. The volumes are the maximum amount of timber products that could be sustainably harvested. The volume numbers are based on the Spectrum model outputs for the decade displayed in average annual units (See Appendix B for more information on the modeling process). Volumes are displayed in MMBF for all commercial wood products including sawtimber, pulpwood, commercial firewood, and chipwood. Major factors affecting achievement of the annual ASQ are the lack of existing and projected pulpwood markets and limited project funding.

The ASQ is composed of approximately 70 percent sawtimber that are expected to have strong markets and 30 percent pulpwood. There would be a 70/30 mix of pulpwood and sawtimber under all alternatives in the short and long-term.

Table 3.13-7: Proposed Average Annual Allowable Sale Quantity (ASQ) by Alternative (MMBF) for Decades 1 to 15.

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Proposed Avg. Annual ASQ (MMBF)	13.8	17.5	16.8	16.0	16.4

Notes: This analysis was run for each decade up to 150 years into the future. Each decade had the same proposed ASQ.
Source: SPECTRUM 2003- Ft. Collins Washington Office Service Center of the USDA-FS at http://fsweb.ft.col.wo.fs.us/tm

Alternative A

Alternative A would have the lowest timber volume that could be sold of all the alternatives. None of the newly acquired lands would be allocated as suitable forest lands with this alternative. Alternative A would average 13.8 MMBF annually over the short-term (next 10-15 years) and long-term (over the next 150 years).

The ASQ is less than the 1987 Plan ASQ. This difference is a reflection of the improved stand inventory, long-range yield tables for selection harvesting, and computer modeling.

Alternative B

Alternative B would have the maximum timber volume that could be sold of all the alternatives. A significant portion of the tentatively suitable forest lands would be allocated as suitable forest lands with this alternative.

This alternative would have a maximum timber volume of 17.5 MMBF annually over the short and long-term.

Alternative C

Alternatives C would have a higher ASQ than Alternative A and would be intermediate in the timber volume that could be sold of all the alternatives. The maximum timber volume would be 16.8 MMBF that could be sold annually over the short and long-term.

Alternative D

Alternative D would have a higher ASQ than Alternative A and would have a slightly lower ASQ than Alternatives C and E. The maximum timber volume would be 16.0 MMBF that could be sold annually over the short and long-term.

Alternative E

Alternative E would have a higher ASQ than Alternative A and would be intermediate in the timber volume that could be sold of all the alternatives, but slightly lower than Alternative C. The maximum timber volume that could be sold annually over the short and long-term would be 16.4 MMBF.

Indicator 3 – Silvicultural Prescriptions

Effects Common to All Alternatives

Table 3.13-8 shows the harvest methods that could be implemented under all alternatives. Thinning harvests could occur on 1,000 acres annually under all alternatives.

Table 3.13-8: Projected Average Annual Acres Cut in the Short-term (2005-2014) by Harvest Method

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Even-aged Management					
Thinning Harvest	1,000	1,000	1,000	1,000	1,000
Shelterwood Regeneration	1,161	1,475	1,537	1,451	1,431
Shelterwood Removal	280	376	323	307	324
Clearcut	257	358	311	298	319
Even-aged Management Subtotal	2,698	3,209	3,171	3,056	3,074
Uneven-Aged Management					
Selection	802	1494	863	778	981
Totals	3,500	4,703	4,034	3,834	4,055

Source: Spectrum 2003- Ft. Collins Washington Office Service Center of the USDA-FS at http://fsweb.ftcol.wo.fs.us/tm

Alternative A

Alternative A would have the least opportunity for even-aged timber harvesting and the second least opportunity for uneven-aged timber harvesting.

Alternative A could have an average of approximately 3,500 acres of timber harvesting annually. Seventy-seven percent would consist of even-aged harvesting. Clearcutting could occur on 257 acres annually. Shelterwood regeneration harvesting could occur on 1,161 acres annually while shelterwood removal harvest could occur on 280 acres annually. Uneven-aged harvests of individual tree and group selection could occur on 802 acres annually.

Alternative B

Alternative B would have the highest opportunity for both even-aged and uneven-aged timber harvesting. This alternative could have an average of 4,703 acres of timber harvesting annually. Sixty-eight percent could consist of even-aged harvesting. Clearcutting could occur on 358 acres annually. Shelterwood regeneration harvesting could occur on 1,475 acres annually and shelterwood removals could occur on 376 acres annually. Uneven-aged harvests of individual tree and group selection could occur on 1,494 acres annually.

Alternative C

Alternative C would have intermediate opportunities for both even-aged and uneven-aged timber harvesting. Alternative C could have an average of 4,034 acres of timber harvesting annually. Seventy-nine percent of the harvesting could consist of even-aged harvesting. Clearcutting could occur on 311 acres annually. Shelterwood regeneration harvesting could occur on 1,537 acres annually and shelterwood removals could occur on 323 acres annually. Uneven-aged harvests of individual tree and group selection could occur on approximately 863 acres annually.

Alternative D

Alternative D would have intermediate opportunities for both even-aged and uneven-aged timber harvesting and would have the least opportunity for timber harvesting except for Alternative A. Approximately 3,834 acres of timber harvesting could occur annually. Eighty percent of the harvesting could consist of even-aged harvests. Clearcutting could occur on 298 acres annually. Shelterwood regeneration harvesting could occur on 1,451 acres annually and shelterwood removals could occur on 307 acres annually. Uneven-aged harvests of individual tree and group selection could occur on about 778 acres annually.

Alternative E

Alternative E is similar to Alternative C and would have intermediate opportunities for both even-aged and uneven-aged timber harvesting. Approximately 4,055 acres of harvesting could occur annually. Seventy-six percent of the harvesting could be even-aged harvesting. Clearcutting could occur on 319 acres annually. Shelterwood regeneration harvesting could occur on 1,431 acres annually and shelterwood removal could occur on 324 acres annually. Uneven-aged harvests of individual tree and group selection could occur on about 981 acres annually.

Cumulative Effects

The markets for pulpwood, firewood, and chipwood are limited in southern Vermont. Pulp mills in northern New Hampshire and Maine influence pulpwood markets in northern Vermont. Chipwood markets in Vermont are restricted to economical haul distances to the electric generation plants in Burlington and Reyegate. While sawtimber markets will remain strong, there is little expectation that pulpwood markets will improve in the near future on the GMNF or in Vermont.

The GMNF timber program will emphasize the acres of vegetation which are treated to create desirable forest conditions. The amount of wood cut will mostly be a by-product of cutting to achieve other objectives and will increasingly be high quality sawtimber. According to the Vermont Statewide Forest Resources plan, the offering of high quality sawtimber will enhance and not hurt the regional timber market.

The production of high-quality sawtimber on well managed, older trees on the GMNF will have economic advantages to society now and in the future. Timber management on private land is becoming increasingly more challenging. Property taxes, smaller forest holdings by larger number of owners, and liquidation of timber will make public land including the GMNF more important for well-managed timber lands. The GMNF has the role to demonstrate sound forest management, while producing high quality sawtimber.

Table 3.13-9: Lands Suitable for Timber Production

Management Areas	Alt. A Current Management	Alt. B	Alt. C	Alt. D	Alt. E
	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)
Diverse Forest Use (Suitable)	95,081	162,365	100,012	88,003	102,463
Diverse Forest Use (Not Suitable)	15,190	33,038	20,766	16,024	16,254
Diverse Backcountry (Suitable)	62,592,	43,176	72,656	46,820	43,677
Diverse Backcountry (Not Suitable)	22,547	16,017	21,841	12,262	15,988
Remote Wildlife Habitat (Suitable)	0	9,421	5,268	31,272	22,447
Remote Wildlife Habitat (Not Suitable)	0	2,694	455	10,915	7,952
Moosalamoo Recreation and Education Area (Suitable)	0	0	9,842	0	9,613
Moosalamoo Recreation and Education Area (Not Suitable)	0	0	2,860	0	2,762
Green Mountain Escarpment (Suitable)	0	1,469	6,013	14,287	11,416
Green Mountain Escarpment (Not Suitable)	0	1,425	2,475	3,423	3,020
Total Suitable	157,673	216,430	193,791	180,381	189,616
Total Unsuitable	37,735	53,175	48,397	42,625	45,976

Source: GMNF GIS Alternatives A-E MA Layers

3.14 NON-RECREATION SPECIAL USE MANAGEMENT

Non-recreation special uses are all uses of National Forest System lands, improvements, and resources, except those involved in the disposal of timber, minerals, the grazing of livestock, or commercial recreation activities.

Issue Statement

There is on-going concern and debate about special use management on the Green Mountain National Forest (GMNF). Specifically, there is concern about what permit types are appropriate for the GMNF and the use of National Forest System (NFS) lands for development of wind power and communication sites. Forest Plan revision will determine where particular activities should be allowed and the standards and guidelines for these uses. Recreation Special Uses, including ski areas, and Special Forest Products are covered in the Recreation Opportunity (3.10) and Special Forest Products (3.18) sections of this chapter.

Indicator 1 – Acres in Management Area Allocations Allowing Wind Power Development and New Communication Sites

The first indicator to be used in this effects analysis is acres in management area allocations allowing development of wind power facilities or new communication sites. Wind power facilities involve a number of wind-driven power generating units spread over an area of consistent wind. The use is served by a power line, access road, and associated infrastructure. Larger sites that can accommodate more generator units with only small amounts of additional infrastructure are generally more efficient economically than the same number of units spread across more sites. Communication sites involve a tower sufficient to place antennas at the proper height, a building, a power line or onsite power supply, and an access route. Access is usually by road.

This indicator highlights the differences among alternatives because each alternative has a different mix of management area allocations allowing this type of use. These uses require a level of development, site alteration, and ongoing management that is not compatible with each management area.

Indicator 2 – Acres in Management Area Allocations Allowing New Discretionary Authorizations That Include Facilities or Development

The second indicator to be used in this effects analysis is acres in management area allocations allowing new discretionary authorizations that include facilities or development. Discretionary authorizations are forms of non-recreation special uses allowed by permit, easement, or lease from the Forest Service. Discretionary authorizations that include facilities or development allow uses such as water systems serving homes or communities, utilities, roads where other access might be possible over non-federal land, and activities such as commercial photography involving props, scenery modification, or large numbers of people requiring supporting infrastructure. Discretionary uses not involving facilities or development, such as research, are considered on a case-by-case basis throughout the Forest and are not included in this indicator. Hereafter, “discretionary uses” shall mean those including facilities or development. Discretionary uses may occur as a point feature, such as a sign; a linear feature, such as a road; or an area, such as a field under cultivation. Discretionary uses may vary in length of time from a one-day temporary event to thirty years or more. Effects of discretionary uses range from digging a posthole to excavating, reshaping, and revegetating land for a road or pond. The principle use that is not discretionary is access to private land that is surrounded by NFS land. Authorizing some form of access to these inholdings is mandated by the Alaska National Interest Land Conservation Act of 1980. This indicator is

appropriate because the amount of management area allocations that allow discretionary authorizations differs by alternative.

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the GMNF. The analysis area for cumulative effects includes all GMNF lands and lands administered by other owners, both public and private, that meet one of the following criteria:

- Public or private lands within the GMNF Proclamation Boundary
- Public or private lands within, or immediately adjacent to, the purchase units outside the Proclamation Boundary
- Public or private lands within, or immediately adjacent to, portions of the Appalachian Trail corridor that are outside the Proclamation Boundary but administered by the staff of the Green Mountain National Forest

Most non-recreation special uses are for the benefit of lands in other ownership, so they occur primarily near boundary lines and on both federal and non-federal land. Some non-recreation special uses, such as electricity transmission lines or communication sites, can have effects far from National Forest System (NFS) land.

3.14.1 Affected Environment

Introduction

The GMNF has been pieced together by the acquisition of numerous tracts of land since 1932. Some of those tracts came with facilities or activities on them that had to be authorized by a special use authorization. Changes in demographics over time have resulted in more development within the Forest and adjacent to the Forest Proclamation Boundary, as well as the increased demand for utilities and improved roads that accompanies new development. Changes in technology have increased pressure to use high-elevation NFS lands for communication sites since the 1950s and, more recently, for wind power production facilities. Other uses of note include community water supplies and waste treatment facilities.

Existing authorized uses of NFS lands and those that might reasonably be requested in the future can be dependent on several individual factors or a combination of factors including: topography or elevation; the presence of private land or existing infrastructure such as roads, trails, and power lines; or the presence of water or large openings.

Wind Power Facilities

Wind power facilities require high-elevation land or sites where the topography channels the wind to create a steady, dependable power source. These sites must be free of obstructions and are therefore highly visible. Generally, locations large enough to allow a large number of wind generators have more economic potential than smaller, more confined sites. Communication sites require high-elevation land from which broadcasters can reach large areas or populations, or wireless phone companies and other two-way communication users can reach significant numbers of travelers on main roads.

There is interest in the GMNF for wind power sites, with an existing site in operation on private land adjacent to NFS land. Evolving technology and increasing national concern over the nation's energy supply have caused more interest in this use on NFS and State lands. Government policy is to meet more of the demand for energy by using renewable sources.

Two studies of the Vermont wind resources were reviewed for this analysis. *Wind Resource Maps of New England* (True Wind Solutions 2003) includes maps of mean wind speed at 30, 50, 70, and 100 meters height and of mean wind power at 50 meters height on a 200 meter grid covering Vermont, New Hampshire, and Maine. A second study, *Estimating the Hypothetical Wind Power Potential on Public Lands in Vermont* (Vermont

Department of Public Service 2003), states that only those lands with winds of at least 15.6 miles per hour (7.0 meters per second) are commercially attractive for power development.

Communication Sites

Communication sites typically require high-elevation land free of obstructions and are therefore highly visible. To keep these sites free of obstruction, vegetation must be managed. This may mean the area occupied by the base and anchors of a communication towers must be cleared of trees, and antenna paths must not be blocked by tree growth. This is in addition to any clearing required for supporting purposes such as roads or power lines. Structures taller than a certain height, normally 200 feet, are required by the Federal Aviation Administration to have lights.

Communication sites do not require large geographic areas or high elevation locations and are therefore less restricted in placement than wind power facilities. Further, the GMNF's location on the spine of the Green Mountains, between population concentrations in the Connecticut River Valley and the Battenkill-Otter Creek Valley, and their accompanying primary transportation corridors, makes the Forest sought after for the placement of communication sites.

Communication sites for radio and television are likely to occur on high peaks that provide coverage of an area with a significant population. Two-way radio users, such as police and emergency service providers, highway departments, or fleet dispatchers for businesses, tend to be located at high elevation sites as well, but must be convenient to the users. Such sites can be, but are not limited to, the same ridge top and peak locations that are potentially suitable for wind power development. Microwave links require a line-of-sight to the links in either direction. Wireless telephone communications prefer high locations from which they can cover a large area, but several cell towers can be located at lower elevations to provide the same coverage.

All communication sites must have some means of access and a source of electricity. Access can range from road to trail to helispot. Electricity can be solar, on-site generator, or through a line from a commercial source.

Landownership Pattern

In areas where federal ownership is contiguous and consolidated, the need for authorizing special uses diminishes because most uses are in conjunction with adjoining private land. This includes uses such as access roads, water systems, and utility distribution lines. Conversely, in areas where the Forest is intermixed with private lands, the intermingled ownership means more demand for these kinds of uses.

Existing Forest Plan Management Direction

The 1987 Forest Plan recognized that requests wind power sites or electronic sites (communication towers) could occur almost anywhere in the National Forest, and that they would be highly visible. It set forth in Appendix G a process for siting visually prominent facilities. The 1987 Plan also states that special use corridors, such as utility lines or pipelines, should be used for new utility lines and pipelines.

Access to non-federal lands that are surrounded by NFS land is mandated by law and must be sufficient to allow the owner reasonable enjoyment of that land. Access to non-federal lands may occur across any management area.

Forest-wide standards and guidelines state that Special Use Authorizations will not be issued for spray application of effluent on National Forest System land for projects that are substantially new development. The 1987 Plan does not provide specific standards and guidelines for any other Special Uses other than minerals and utility corridors.

It is Forest Service policy not to approve any discretionary use of NFS land that can be accommodated on non-National Forest System

land. If they pass that threshold, proposals involving public benefit are viewed more favorably than those with private or exclusive benefit. An example of a proposal involving a public benefit is the relocation of a segment of town highway. An example of a valid proposal involving a private benefit might be a request for a spring box and water line on NFS land to supply water to a remote camp on private land. In the event of a conflict between proposals of those types of uses, the proposal involving the greater public benefit prevails. Valid requests for uses involving public benefit are processed before those involving more limited or private benefit. Within those groupings, requests are processed on a first-come, first-served basis. Simultaneous uses that do not conflict can be authorized. Conflicts are resolved in favor of the existing use, or by seniority. There may be situations where an assessment process that includes public participation may determine an existing use must be altered or terminated to accommodate a greater public need.

Proposed Changes in Management Direction Common to All Alternatives

The revised Forest Plan will continue management direction provided in the 1987 Plan with an emphasis to "provide opportunities for renewable energy use and development" (Goal 11). The revised Plan will provide direction for more types of non-recreation special uses by providing specific Forest-wide standards and guidelines to address them. Included will be general requirements such as ensuring there are no available alternatives using private land and the need to bring uses not compatible with the Plan into compliance at the next revision of the authorization as well as specific direction on maple tapping and other agricultural uses, First Amendment group uses, military training, research, and storage and disposal of hazardous materials. Specific standard and guideline direction is provided in these management areas: Wilderness, Remote Backcountry, Diverse Backcountry, Remote Wildlife Habitat, Alpine Ski Areas, Appalachian National Scenic Trail, Long Trail, White Rocks National Recreation Area, Alpine/Subalpine Special Area, Green Mountain Escarpment, Existing and Candidate Research Natural Areas, Ecological Special Areas, Recreation Special Areas, Moosalamoo Recreation and Education Area, and Wilderness Study Areas management areas.

Management area standards and guidelines address which special uses are appropriate on NFS lands, thus providing more specific direction than the 1987 Plan's limited reference to corridors, roads, and facilities. In addition, the revised Forest Plan differentiates between administrative uses and uses by others.

Existing Condition

Existing non-recreation special use authorizations are listed in Table 3.14-1. The agricultural uses include maple tapping areas and cultivated fields such as those along the White River where one objective is to preserve the State's rural character. The liquid waste disposal use is in conjunction with a commercial property on private land surrounded by NFS land. Such uses are not routine.

There are currently no wind power sites on the Forest, but there is a site located adjacent to the Forest in Searsburg. An estimated six to sixteen percent of the GMNF meets the criteria for being commercially attractive for wind power development, having winds of at least 15.6 miles per hour (Vermont Department of Public Service by Vermont Environmental Research Associates, Inc. 2003 and TrueWind Solutions, LLC 2003).

There are two designated communication sites on the Forest that are used by permittees. These sites are on Lincoln Peak and Mount Snow. There is one authorization for all the facilities on Lincoln Peak. On Mount Snow, facilities are owned by three different entities, and each has an authorization.

The demand to approve new uses is expected to increase as more land is purchased for addition to the National Forest and development of adjacent private land continues. Technological developments may also lead to more requests, such as for placement of fiber

optic cable. Existing demand for fiber optic lines is east-west across the Forest, along existing utility or highway corridors, to connect population centers. Similarly, north-south lines on the edge of the Forest may cross some NFS land. As development of private land within the Forest Proclamation Boundary leads to population growth, demand will increase for the infrastructure necessary to provide high-speed internet access and multiple telephone lines per house.

The GMNF annually processes three to six requests for temporary use. These temporary uses include non-commercial group events such as weddings and family reunions, and activities such as commercial photography. Forest Service policy is to emphasize administration of existing permits over processing new requests.

Table 3.14-1: Existing Non-recreation Special Use Authorizations for the GMNF

Authorization Type	Number of Auths.	Total Acres
Agricultural	14	267
Liquid Waste disposal	1	11
Electric lines	7	125
State or Town Highways	32	215
Private Roads	26	22
Communication facilities	4	1
Telephone lines	8	36
Community water supply	1	1
Water systems or reservoirs	15	5
Total	**108**	**683**[1]

Source: INFRA/SUDS database
Notes: [1] Some authorizations are a combination of authorization types and acreages may not reflect this accurately.

3.14.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Indicator 1 – Acres in Management Area Allocations Allowing Wind Power Development and New Communication Sites

The following management areas allow wind power and communication site development:

- Diverse Forest Use
- Moosalamoo Recreation and Education Area
- Remote Wildlife Habitat
- Alpine Ski Area and Alpine Ski Area Expansion

See Table 3.14-2 for a display of allocated acres by management area per alternative. See Table 3.14-3 for a display of GMNF acres potentially suited for wind power development.

Effects Common to All Alternatives

A wind power development site is defined as a contiguous area of NFS land that has Class 4 or better winds. They were determined by overlaying the map data from the TrueWinds Solutions (2003) study onto maps of the management areas for each alternative. Use of other data may result in different numbers of sites, but the relative ranking of each alternative is expected to remain the same. Unless noted in the discussion, sites are not screened for actual wind speed, physical size, or other specific economic suitability factors.

Potential new communication site development was determined by reviewing the alternative maps to determine the relative amounts of land in management areas allowing wind power and communication sites that are located near major highways and along ridge tops and on peaks. There has been no screening for viability of specific sites.

The suitability of a communication site depends on elevation and surrounding topography for the ability to cover a specific population center or road network. There are many acres of GMNF land along highways and near towns that could be considered for such sites. It must first be demonstrated, however, that no site on private land can meet the need.

Alternative A

In Alternative A, 113,647 acres (28%) can be considered for the development of wind power and communication sites (Table 3.14-2). Of the total acreage, 8,760 acres (2%) of the Forest are potentially suitable for wind power sites (Table 3.14-3). This is the fewest acres available for these uses of any of the proposed alternatives primarily due to presence of 92,003 acres of lands in the Newly Acquired Lands Management Area. These lands are not available for consideration for these uses.

Of the lands identified in the TrueWind Solutions (2003) study as being commercially viable for wind power generation, 27 sites on the GMNF are available for consideration of development under this alternative. This is the fewest under any alternative. When reviewing the mapped areas commercially viable for wind power generation available across the entire Forest under this alternative, their small size and comparative remoteness, in addition to the low number, rank this alternative last.

This alternative has a moderate amount of land available for low elevation communication sites for such uses as wireless telephone. Such lands are available on the east side of the US Route 7/State Route 116 corridor west of the Forest, and the key east-west routes across the Forest including State Routes 125, 73, and 9. However, the restrictions on the availability of newly acquired lands limit such use along US Route 4 and State Routes 11 and 30 crossing the Forest, and along the State Routes 100, 155, and 8 corridor on the east side of the Forest.

Alternative B

Alternative B allocates 211,103 acres (53%) to be considered for the development of wind power and communication sites (Table 3.14-2). Of the total acreage, 24,570 acres (6%) are potentially suitable for wind power (Table 3.14-3). Of the lands identified in the TrueWind Solutions (2003) study as being commercially viable for wind power generation, 60 sites on the GMNF are available for consideration of development under this alternative. This is the highest amount of any alternative, and is nearly three times the amount of available land as Alternative A. While many of these sites are also small, some of them are in close proximity to one another. There are also some larger sites such as the Hoosac Range in Readsboro and Stamford, Dorset Mountain in Dorset, the Rice Hill area in Dover, and the Blue Ridge in Chittenden and Mendon.

This alternative has the most amount of land available for low elevation communication sites for such uses as wireless telephone. Such lands are available on both sides of the US Route 7 corridor west of the south half of the Forest, and along State Routes 100 and 155 corridors east of the Forest, and the key east-west routes across the Forest including: State Routes 125, 73, 11, 30, and 9, and US Route 4. However, there are fewer such lands available along the US Route 7 and State Route 116 corridor west of the north half of the Forest than in Alternative A.

Alternative C

Alternative C allocates approximately 142,788 acres (36%) to be considered for the development of wind power and communication sites (Table 3.14-2). Of the total acreage, 14,490 acres (4%) are potentially suitable for wind power (Table 3.14-3). This is 65% more than the area available under Alternative A, but less than any other alternative. Of the lands identified in the TrueWind Solutions (2003) study as being commercially viable for wind power generation, 33 sites on the GMNF are available for consideration of development under this alternative. While most of these sites are relatively small and scattered, the Hoosac

Range and some areas in Searsburg, Wilmington, and Dover have the potential of supporting a larger project.

Alternative C has less land available near transportation corridors for low elevation communication sites than Alternative A, although it does have potential sites along US Route 7 on the west side of the south half of the Forest, and State Routes 8 and 125.

Alternatives D and E

Alternatives D and E range from 149,799 acres (37%) in Alternative D to 164,898 acres (41%) in Alternative E to be considered for the development of wind power and communication sites (Table 3.14-2). Alternatives D and E are intermediate in the amount of lands available for wind power and communication site development, however, both alternatives provide more available land for development than Alternative A. Of the total acreage, 18,770 acres (4.69%) in Alternative D and 19,700 acres (4.93%) in Alternative E are potentially suitable for wind power (Table 3.14-3). Both alternatives offer more than twice the area available under Alternative A.

When considering wind power sites, Alternatives D and E are virtually identical. Alternative D has 33 sites that are potentially both viable and suitable, while Alternative E has 37. Both have several large contiguous sites available for consideration, including the entire potentially viable area of Corporation Mountain - Round Mountain - Wilcox Peak site in Chittenden and Pittsfield, the Rice Hill area in Dover, and the area from Mount Snow south to State Route 9 in Dover, Somerset, Searsburg, and Wilmington. Alternative D has the Blue Ridge area available, while Alternative E has the Hoosac Range.

Alternatives D and E are also comparable in the amount of land available for low elevation communication sites along the key transportation corridors along and across the Forest. Alternative D ranks with Alternative B for the best potential availability for the busy US Route 4 corridor, is in the middle for State Routes 125 and the State Routes 110/155 corridor, and poor elsewhere. Alternative E offers the best potential availability for the State Routes 110/155 corridor, good potential for State Routes 11 and 30, and moderate potential for the other main roads except the US Route 7/State Route 116 corridor on the west side of the north half of the Forest, where it has no potential sites.

For this indicator, these alternatives rank second and third behind Alternative B and ahead of Alternatives C and A.

Indicator 2 – Acres in Management Area Allocations Allowing New Discretionary Authorizations That Include Facilities or Development

Management areas may allow a full range of discretionary special authorizations; prohibit discretionary authorizations except under those circumstances set forth in law, such as the Wilderness Act of 1964; or place limits on discretionary authorizations by allowing some or requiring specific types of mitigation. Each alternative varies by the amount of land assigned to each management area. Where a full range of discretionary uses is allowed, the greatest possible range of development opportunities for the benefiting private land exists. Where discretionary uses are prohibited, development of private land may be curtailed and its level of use diminished.

A full range of discretionary uses can be considered in the following management areas:

- Diverse Forest Use
- Recreation Special Areas
- Moosalamoo Recreation and Education Area
- Alpine Ski Areas and Alpine Ski Area Expansion

See Table 3.14-4 for a display of acres allocated to these management areas by alternative.

The following management areas place restrictions on discretionary uses:

- Diverse Backcountry
- Remote Wildlife Habitat
- Escarpment
- Remote Backcountry
- White Rocks National Recreation Area
- Appalachian Trail
- Long Trail
- Research and Candidate Research Natural Areas
- Ecological Special Areas
- Alpine/Subalpine Special Area.

See Table 3.14-5 for a display of acres allocated with restrictions in these management areas by alternative.

These restrictions may limit or prohibit certain kinds of uses or require certain mitigation measures on a management area-wide basis. The Significant Streams (Alternative A only) and Eligible Wild, Scenic, or Recreational Rivers Management Areas overlay other management areas. These overlays only affect the use of NFS land if they add additional limitations to the limitations imposed by the underlying management area. Discretionary uses are prohibited in management areas Wilderness and Wilderness Study Areas, although some may be approved by Presidential authority pursuant to the Wilderness Act.

Alternative A

Alternative A allocates 113,733 acres (28%) of the Forest in MAs available for discretionary authorizations, the second lowest of any alternative (Table 3.14-4). New discretionary authorizations are restricted on 135,955 acres (34%) of the Forest, primarily due to the presence of the undesignated lands of the Newly Acquired Lands MA, which are not available for new uses (Table 3.14-5). Opportunities for discretionary permits are minimal under Alternative A.

Alternative B

A full range of discretionary authorizations can be considered on 199,145 acres (50%) of the Forest. New discretionary authorizations are restricted on 140,255 acres (35%) of the Forest. Alternative B has the most acres available for discretionary authorizations, and provides more opportunities for development and use of adjoining lands of other ownership.

Alternative C

A full range of discretionary authorizations can be considered on 137,222 acres (34%) of the Forest. New discretionary authorizations are restricted on 175,109 acres (44%) of the Forest. These levels of opportunity are a moderate improvement over those in Alternative A.

Alternative D

A full range of discretionary authorizations can be considered on 107,769 acres (27%) of the Forest. This is the lowest level of opportunity of any alternative. New discretionary authorizations are restricted on 184,123 acres (46%) of the Forest. These levels of opportunity are a moderate improvement over those in Alternative A and very comparable to Alternatives C and E.

Alternative E

A full range of discretionary authorizations can be considered on about 134,656 acres (34%) of the Forest. New discretionary authorizations are restricted on 179,562 acres (45%) of the Forest. These levels of opportunity are a moderate improvement over those in Alternative A and very comparable to Alternative C and D.

Cumulative Effects

Effects Common to All Alternatives

All alternatives will have positive cumulative effects because the Forest Service allows non-recreation special uses that cannot be provided on private or non-NFS lands. The ownership pattern of the GMNF is one of large blocks of NFS land surrounded by a mosaic of intermingled NFS land and private land. Many of the large blocks of NFS land include inholdings of lands of other ownership. Most non-recreation special uses are in conjunction with adjoining private land, such as roads providing access, utility lines providing electricity and telephone service, and water systems. These uses relate directly to the opportunity to develop, use, and enjoy that private land. Such uses have direct effects on both non-federal and federal land.

The cumulative effects on all ownerships depend on the restrictions on types of discretionary authorizations allowed on NFS land. If a discretionary authorization is allowed on NFS land, the same effects will also occur on adjoining lands crossed by that use. Conversely, where discretionary authorizations are restricted on NFS land, there are no effects on adjoining lands and no enhancements of adjoining properties.

All alternatives allow a range of uses over a broad area, providing opportunities to meet needs for use and enjoyment of non-federal lands and for regional development. Both individual uses for individual properties and the more regional uses affecting a larger area are realized under these alternatives.

Table 3.14-2: Acres in Management Area Allocations that Allow Wind Power and Communication Site Non-recreation Special Uses

Management Area Where Uses Are Allowed	Alt. A (Current Mgt.)	Alt. B	Alt. C	Alt. D	Alt. E
	(acres)	(acres)	(acres)	(acres)	(acres)
Diverse Forest Use	110,271	195,403	120,778	104,027	118,717
Remote Wildlife Habitat	0	12,115	5,723	42,187	30,399
Moosalamoo Recreation and Education Area	0	0	12,702	0	12,375
Alpine Ski Area	2,822	3,067	3,067	3,067	2,889
Alpine Ski Expansion	554	518	518	518	518
Total	**113,647**	**211,103**	**142,788**	**149,799**	**164,898**
Percentage of Forest	**28%**	**53%**	**36%**	**37%**	**41%**

Table 3.14-3: Acres of GMNF Land Potentially Suitable for Commercial Wind Development

	Alt. A (Current Mgt.)	Alt. B	Alt. C	Alt. D	Alt. E
Area Potentially Suitable (acres)	8,760	24,570	14,490	18,770	19,700
Percentage of Forest Potentially Suitable	2%	6%	4%	5%	5%

Source: TrueWind Solutions, LLC; Connecticut Clean Energy Fund; the Massachusetts Technology Collaborative's Renewable Energy Trust; and Northeast Utilities, under subcontract to AWS Scientific, Inc., June, 2003. Wind Resource Maps of New England.
‡Notes: Wind resources with a mean speed of at least 7 m/s at 70 meters height or mean power of at least 400 W/m^2 at 50 meters height occurring in MAs allowing commercial wind development are considered potentially suitable. MAs allowing commercial wind development are Diverse Forest Use, Alpine Ski Areas, Alpine Ski Area Expansion, Remote Wildlife, & Moosalamoo Recreation & Education Area.

Table 3.14-4: Acres Allocated for New Discretionary Authorizations by Management Area

Management Area Where Uses Are Allowed	Alt. A (Current Mgt.)	Alt. B	Alt. C	Alt. D	Alt. E
	(acres)	(acres)	(acres)	(acres)	(acres)
Diverse Forest Use	110,271	195,403	120,778	104,027	118,717
Moosalamoo Recreation and Education Area	0	0	12,702	0	12,375
Recreation Special Areas	86	157	157	157	157
Alpine Ski Area	2,822	3,067	3,067	3,067	2,889
Alpine Ski Expansion	554	518	518	518	518
Total	**113,733**	**199,145**	**137,222**	**107,769**	**134,656**
Percentage of Forest	**28%**	**50%**	**34%**	**27%**	**34%**

Table 3.14-5: Acres Allocated with Restrictions for New Discretionary Authorizations by Management Area

Management Area Where Uses Are Allowed	Alt. A (Current Mgt.)	Alt. B	Alt. C	Alt. D	Alt. E
	(acres)	(acres)	(acres)	(acres)	(acres)
Diverse Backcountry	85,139	59,193	94,497	59,082	59,665
Remote Wildlife Habitat	0	12,115	5,723	42,187	30,399
Escarpment	0	2,894	8,488	17,710	14,436
Remote Backcountry	8,316	22,163	23,220	23,036	30,930
White Rocks National Recreation Area	22,758	22,758	22,758	22,758	22,758
Appalachian Trail	14,473	14,315	14,315	12,790	13,629
Long Trail	2,927	2,640	2,511	1,801	2,640
Research and Candidate Research Natural Areas	1,546	471	471	471	471
Ecological Special Areas	796	3,000	2,420	3,582	3,928
Alpine/Subalpine Special Area	0	706	706	706	706
Total	**135,955**	**140,255**	**175,109**	**184,123**	**179,562**
Percentage of Forest	**34%**	**35%**	**44%**	**46%**	**45%**

3.15 VISUAL RESOURCES

Issue Statement

The level of emphasis placed on managing the visual quality of the landscape continues to be a high priority. There is concern over the impacts of certain forest activities on visual quality and a concern that visual quality could hinder some activities. Major areas of concern include the following:

- Place more emphasis on managing the visual quality of the landscape.
- Protect undeveloped ridgelines from development such as wind power and communication sites.
- Consider the impact timber harvesting may have on visual quality.

Indicator 1 – Acres in Management Area Allocations Providing Similar Opportunities for Vista Management

The first indicator to be used in this effects analysis consists of groups of management areas (MAs) that affect vista management. This indicator groups MAs with similar management restrictions and similar abilities to create, maintain, or enhance scenery through vista management. Management areas were categorized into one of three groups including those with the greatest potential, moderate potential, or least potential to create, maintain, or enhance vistas. This indicator highlights the differences among alternatives because each alternative has different acreage amounts in each of the three vista management opportunity groups.

Indicator 2 – Acres in Management Area Allocations which Allow the Development of Wind Power and New Communication Sites

The second indicator to be used in this effects analysis consists of grouping MAs which allow lands to be considered for the development of wind power and new communication sites. These facilities are assumed to be large-scale wind turbine or communication sites that provide commercial service administered through a special use permit. Both uses have overlaps in siting requirements and infrastructure and can be highly visible due to preferred locations on ridgelines. Vegetation clearing and road access for maintenance are also common requirements. This indicator highlights the differences among alternatives because MA allocations that allow wind power and communication sites vary by alternative.

See the Non-Recreation Special Use Management section (3.14) for additional information and analysis on wind power and new communication sites.

Indicator 3 – Projected Average Annual Acres Harvested by Treatment Methods with Similar Effects on Visual Quality

The third indicator to be used in this effects analysis consists of acres of timber harvest treatment with similar effects on visual quality. Even-aged and uneven-aged timber harvesting have different impacts on the visual resource. This indicator highlights the differences among alternatives because each alternative has different management area allocations with different projections for even-aged and uneven-aged timber harvesting and therefore, the amount of acreage with the potential to effect visual quality differs by alternative.

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the Green Mountain National Forest (GMNF).

The analysis area for cumulative effects includes all GMNF lands and the lands administered by other owners, both public and private, which are located adjacent to, or provide views to and from, National Forest System lands. Haze, weather conditions, time of day, vantage point, and the activity or feature being viewed all play a role in determining the distance from which an activity or feature is visible on the landscape.

The Scenery Management System (SMS) subdivides the view shed into three zones (USDA 2000b):

1. Foreground – from the observer up to half mile away.
2. Middleground – from half mile to four miles from the observer.
3. Background – from four miles to infinity from the observer.

3.15.1 Affected Environment

Introduction

Vermont is known for its scenic beauty derived from natural features (land form, vegetation, water features), rural settlement patterns, small New England villages and associated cultural elements, and land stewardship. This natural and cultural landscape offers an attractive place to live, attracts tourism, and brings economic benefits to the State. The 2001 Visitor Use Monitoring Results ranked viewing scenery among the highest primary activities that brought people to the GMNF (USDA 2001d).

The GMNF provides a scenic backdrop to surrounding areas. The ridgeline and mountain terrain of the Green Mountains is a dominant feature visible in places more than 15 miles away. Much of the GMNF is visible from major tourism oriented travel routes such as Routes 100, 7, 4, 9, and 125. Routes 9 and 125 are designated State Scenic Byways highlighted as special roads to enjoy scenery. Local roads are used to access the Forest and view scenery on a more intimate scale. Here, water features and cultural elements, such as stone walls and apple orchards, add to the scenery.

The landscape visible today is a result of the land use history. Seventy-five percent of the landscape was harvested of vegetation more than 200 years ago. Today, much of the vegetation has grown back or been reforested to create a mosaic of continuous forested cover interspersed with a more open, rural landscape. Wildlife openings on the GMNF add to the rural landscape found on some adjacent private lands.

People have been, and continue to be, attracted to mountain tops through the centuries. The Abenaki Indians considered some of the ridgelines as sacred places and would go to the mountains to be closer to the sky and for the vistas they offered (Lacy 1994, Wiseman 2004). In more recent history, the Appalachian Trail and Long Trail (AT/LT) were located to traverse the ridgeline of the Green Mountains through the GMNF and provide opportunities for viewing near and distant scenery at vista locations.

Alpine ski areas were developed on ridgelines and mountainsides during the 1930s and 1940s and eventually expanded onto portions of the GMNF. As technology expanded, communication sites were developed on some mountain ridges bringing towers, antennas, and associated structures.

Currently, there are numerous proposals for wind power generation throughout the State of Vermont. The topic is controversial with some proponents in favor of harnessing a clean renewable energy and some opponents voicing concern over protection of ridgelines and visual quality.

Existing Forest Plan Management Direction

Direction for visual management can be found throughout the 1987 Forest Plan. The role of the GMNF, as stated in the 1987 Plan, includes "In conjunction with our role in outdoor recreation, we must preserve the scenery in areas that are visible to visitors."

The 1987 Forest Plan goal is to: "Protect the outstanding natural beauty for which Vermont and the GMNF are known by designing and conducting management activities which fit naturally on the landscape and will reflect the expectations of the people who see them."

The 1987 Forest Plan standards and guidelines provide direction for managing visual quality on the site, appropriate to the sensitivity of the location and the recreation opportunity being provided there. Guidelines provide the basis for determining visual sensitivity levels, specifically noting areas of high, moderate, and low visual sensitivity. Forest-wide standards and guidelines also display the relationship between recreation opportunities and visual condition and between timber management activities and visual quality.

The 1987 Forest Plan established visual quality objectives (VQOs) to guide management of the landscape's visual quality. These objectives are based on an adaptation of criteria defined in the National Forest Visual Management System Handbook (USDA 1974). The GMNF Visual Management System establishes criteria to determine VQOs for on-site (within half mile of the viewer) and off-site views (more than half mile from the viewer). These objectives vary depending on whether activities can be seen from certain areas, viewer sensitivity, and the recreation opportunity spectrum (ROS). The 1987 Plan identifies and defines five VQOs on the GMNF: Preservation, Retention, Partial Retention, Modification, and Maximum Modification. These objectives provide for a variety of management activities that allow varying degrees of change to the landscape.

Appendix G in the 1987 Plan offers direction on siting visually prominent facilities. Forest maps are zoned according to where visually prominent facilities will have high, moderate, and low impact on achieving the objectives of the Forest Plan. In addition, the 1987 Forest Plan provides management area specific direction related to visual quality. For example, the 1987 Plan includes an uneven-aged management MA (2.1) which was designed to provide continuous forest cover along certain travel ways and in visually sensitive areas.

Proposed Changes in Management Direction Common to All Alternatives

The goal for the visual resource in the revised Forest Plan is to "maintain or enhance visual resources such as view sheds, vistas, overlooks, and special features" (Goal 15).

The following three objectives were added under the visual goal:

- Complete a transition from the current Visual Management System to the Scenery Management System
- Maintain or enhance visual quality of special areas that contain scenic features
- Maintain or enhance visual quality on the Forest

The Forest Service updated the Visual Management System at the National Level to the Scenery Management System (SMS) (USDA 2000b). The SMS incorporates new computer technology and applies elements and objectives at the project level to incorporate the existing and desired landscape character. The GMNF has made a decision to convert to the SMS after the Forest Plan revision process is complete.

As part of the revised Plan Forest-wide standards and guidelines, visual condition guidelines were updated to replace the 1987 visual condition standards. Changes include making the visual conditions guidelines instead of standards, and separating the Semi-primitive ROS class to include visual guidelines for both Semi-primitive, Non-motorized and Semi-primitive, Motorized.

The revised Forest Plan combines the 1987 Plan MAs 2.1, 3.1 and 4.1 and instead offers the Diverse Forest Use MA which allows for both even-aged and uneven-aged management. Even-aged and uneven-aged harvesting have different impacts on the visual resource. This MA is designed to allow flexibility in management in choosing which harvest tool is most appropriate depending on the combined resource objectives over the short and long term.

The revised Forest Plan will not have the 1987 Plan Appendix G since site-specific analysis is needed at the project level to determine the siting of visually prominent facilities. Visual standards and guidelines will be applied to these proposals and developments.

Existing Condition

The GMNF consists of a mosaic of patterns across the landscape from wetlands and stands of low-growing grasses and shrubs to newly harvested stands of young saplings to mature forest throughout the GMNF. The GMNF is viewed from a number of highly sensitive sites including the Appalachian and Long Trail, town centers, State highways and some other local roads and developed recreation sites.

The Forest contains a predominantly natural appearing landscape. The dominant ridgelines on the Forest are natural appearing with notable exceptions of ski area development at Sugarbush, Bromley, and Mount Snow.

In addition, developments at recreation sites located throughout the GMNF add to the built environment. These include facilities such as shelters along the AT/LT, campground and picnic site developments, and administrative sites.

Other features that are readily apparent for the visual resource include transmission lines and small utility lines that run through and adjacent to the GMNF. The limited number of large lines that exist have wider corridors than the smaller utility lines that run adjacent to many State and Town roads. Much of the more remote parts of the GMNF, including along some Forest roads, have no visible utility lines.

Vermont's best lands for wind power development are north-south running ridgelines over 2,500 feet in elevation. Approximately 24,000 acres (6%) to 65,000 acres (16%) of the GMNF meets criteria for commercially attractive wind power development having winds of at least 15.6 miles per hour measured at the height of 50 (164 ft) and 70 meters (230 ft) from the ground to the hub (State of Vermont, Agency of Natural Resources 2004a, Vermont Environmental Research Associates, Inc. 2003, TrueWind Solutions, LLC 2003).

Four communication sites exist on the GMNF. With sites at Mt Snow and Lincoln Peak under special use permit and sites at Mt Moosalamoo and Philadelphia Peak under GMNF administrative use. The communication sites under special use permit are more visually prominent due to the on site visibility from public use areas as well as the overall size of the structures including tower heights and number of antennae. The communication sites under GMNF administrative use are not visible from off site and were sited to minimize on site visual impact. These sites have tower heights below tree line with only one antennae each and minimal clearing.

Although timber harvest is evident at some locations, this activity has been designed and implemented on the GMNF to meet VQOs and to maintain and enhance visual quality. Standards and guidelines and mitigation measures have been shown to meet multiple resource objectives while retaining the desired landscape character and VQO (USDA 2000b, USDA 2001b, USDA 2002b, USDA 2002c).

Vista Management

Vistas along numerous roads, trails, water bodies, open fields, and developed facilities, both on Forest and off, offer opportunities to view the GMNF. Some views are far-reaching, while others are on an intimate scale and allow views directly adjacent to the viewer. As the viewer moves along the landscape, visible ridgelines and landscapes shift creating vantage points from which to view the landscape.

Vistas on the GMNF can be categorized into four types. These vistas include a point or area along a travelway from which people view scenery and include the land that is managed to allow the view shed to be seen.

Type 1 – Vistas constructed and maintained by people. These vistas are created and maintained by people to provide a view from a particular vantage point. Some of these vistas are located at developed recreation sites such as the Robert Frost Trail, Voter Brook Overlook, and Big Branch Picnic Area. Type 1 vistas are also located along the AT/LT, both along the trails and at shelter sites. Maintained wildlife openings can also serve as vistas when located along travel corridors and public use areas. Some Type 1 vistas are in various stages of growing in and are in need of maintenance to perpetuate the view.

Type 2 – Permanent natural vistas. These are naturally occurring vistas such as those located on mountain tops with sparse vegetation, high-elevation rock outcrops, wetlands, or other features that provide a view. Because of their distinctive character, little or no vegetation cutting would be required to maintain them. Permanent natural vistas exist along travel corridors and other public use areas. Maintenance is sometimes used to enhance these vistas. The AT/LT was located in places to take advantage of these naturally occurring vistas from which panoramic views of the GMNF landscape can be seen.

Type 3 – Temporary vistas created by timber harvest. These vistas serve a short-term role in scenery enhancement and are created by vegetation management. Even-aged and group selection harvest may create temporary vistas when located along travel corridors and public use areas. Minimizing the appearance of slash is critical in these areas. Over time, vegetation in these areas will grow up to screen the view as new vistas are created elsewhere through timber harvest. These vistas are carefully chosen to enhance the ability to view scenery. Forest Road 101 in Granville has examples of Type 3 vistas located along the road to take advantage of the terrain that slopes away from the viewer and the benefits to viewing the scenery beyond.

In some cases, timber harvest may occur for other resource benefits such as insect and disease control. In those cases, although a vista may be created, the vista may not be located in an ideal location and could have non-pleasing visual impacts.

Type 4 – Temporary vistas created by natural events. These vistas serve a short-term role in scenery management and are the result of weather events, fire, and disease. These vistas often provide non-pleasing views. Although the temporary natural vistas can occur throughout NFS lands, some high elevations and ridgelines along the AT/LT were visibly affected by winter storm damage in the late 1990s and the visual effects remain evident today. Sometimes these vistas are converted to Type 1 vistas when the view is desirable and maintainable.

The landscape mosaic with diversity and pattern of vegetative types, water features, cultural elements, and varied terrain create the overall landscape character of the Green Mountain National Forest and is visible from locations both on and off NFS lands.

3.15.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Indicator 1 – Acres in Management Area Allocations Providing Similar Opportunities for Vista Management

See Table 3.15-1 for acreage of NFS lands grouped by MAs with similar opportunities for vista management. MAs were placed in three groups according to the ability to create, maintain, or enhance vistas. Alternative B would offer the greatest opportunity for vista management and Alternative A would provide the least opportunity.

Effects Common to All Alternatives

All alternatives meet the revised Forest Plan goal and objectives for the visual resource. All alternatives will provide for adequate opportunities to provide vista management. The ability to maintain vistas will be lost in the Wilderness Study Area MA, however, and will affect alternatives containing this MA.

Group 1: Greatest Potential to Create and Maintain Vistas: Diverse Forest Use, Moosalamoo Recreation and Education Area, Alpine Ski Areas, Escarpment, White Rocks National Recreation Area, Recreation Special Areas, Appalachian National Scenic Trail, and Long Trail.

The MAs in Group 1 offer the greatest potential to provide permanent and temporary vistas. These MAs were grouped by the likelihood that vistas would be created (Types 1 and 3), maintained (Type 1) or enhanced (Types 1, 2, 3, and 4). Group 1 provides the greatest opportunity to enhance Type 4 vistas.

Diverse Forest Use, Moosalamoo Recreation and Education Area, and Escarpment are MAs in Group 1 that include lands suitable for timber harvest. Although timber harvest can occur in other MAs, the term 'suitable forest land' refers to lands managed for timber production on a sustained yield basis (see Timber section (3.13) for more information). These MAs have the greatest opportunity for Type 3 vistas.

Alpine Ski Areas offer panoramic vistas due to the nature of the trail network combined with the steep terrain.

Appalachian National Scenic Trail, Long Trail, Recreation Special Areas, and White Rocks National Recreation Area focus on offering amenities for recreation visitors which include Type 1 vistas. The AT/LT was located in places to take advantage of naturally occurring Type 2 vistas from which panoramic views of the GMNF landscape scenery can be seen.

Group 2: Moderate Potential to Create and Maintain Vistas: Ecological Special Areas, Alpine/Subalpine Special Area, Alpine Ski Area Expansion, Remote Wildlife Habitat, Diverse Backcountry, Remote Backcountry Forest, and Newly Acquired Lands (Alternative A only).

The MAs in Group 2 offer some potential to create, maintain, or enhance vistas, but less than in Group 1 and more than in Group 3. Some Ecological Special Areas are located where naturally occurring Type 2 vistas exist, making the sites attractive to recreation visitors. Alpine/Subalpine Special Area management only allows for maintenance of existing Long Trail vistas and not the creation of new ones. Due to the naturally low-growing vegetation and locations of this MA, Type 2 vistas occur in this MA. Type 4 vistas are likely to continue to occur on a frequent basis due to the vulnerable vegetation and location of this MA. When trails are eventually developed in the Alpine Ski Area Expansion MA it is likely that vistas would be created and maintained.

Although the Remote Wildlife Habitat MA does not restrict vista management, recreation uses are de-emphasized to minimize continued disturbance to wildlife. Vista management, therefore, would also be de-emphasized. The Remote Backcountry Forest MA allows for maintenance of existing vistas but not creation of

new ones. Although the Diverse Backcountry MA allows for vista management, timber harvest intensity is low in this MA and therefore, there would be less Type 3 vistas created by timber harvest. The Newly Acquired Lands MA does not encourage vista creation, although maintenance of existing vistas is allowed.

Group 3: Least Potential to Create and Maintain Vistas: Wilderness, Wilderness Study Areas, and Existing and Candidate RNAs

The MAs in Group 3 offer the least potential to provide permanent and temporary vistas. Type 1 and 3 vistas are not allowed in Wilderness and Wilderness Study Areas. Where known Type 1 and 3 vistas currently exist in MAs proposed for Wilderness Study Areas, vistas would grow up over time with loss of maintenance. Since recreation use is incidental and will not be encouraged in Existing and Candidate RNAs, and vegetation management permitted only when needed to maintain or restore the unique feature or vegetation type(s) for which the RNA was established, Type 1 and 3 vistas are not likely to occur. Type 2 and 4 natural vistas may occur in all MAs. Although Type 4 vistas are naturally occurring and cannot be predicted to occur in a particular MA, when they create an unsightly condition on the landscape, mitigation would not be likely to improve the vista in this grouping of MAs.

Alternative A

MAs in Group 1 offer the most opportunities for vista management. Since a lower acreage (153,337; 38%) of NFS lands are located in Group 1 in this alternative than in the other alternatives, Alternative A would offer the least potential for vista management. In addition, higher acreage (247,355; 62%) of NFS lands are located in a combination of Groups 2 and 3 which combined, offer the least potential for vista management.

This alternative has the greatest number of acres (186,808; 47%) in Group 2 because of the acreage allocated to the Newly Acquired Lands MA that offers limited opportunities for vista management.

Alternative B

A higher acreage (241,234; 60%) of NFS lands is located in Group 1 in this alternative than in the other alternatives, therefore, Alternative B would offer the greatest opportunities for vista management.

This alternative is similar to Alternative A with the least number of acres (61,763; 15%) in Group 3 which offer the most limitations for vista management. Alternative B has a small amount of acreage (2,291; <1%) in the Wilderness Study Areas MA.

There are no known Type 1 vistas (vistas constructed and maintained by people) in the Wilderness Study Area MA in Alternative B; therefore there would be no loss of existing Type 1 vistas.

Alternative C

Alternatives C would offer opportunities for vista management that fall in between Alternatives A and B with 184,776 acres (46%) in Group 1.

For Alternative C, the primary difference from Alternatives A and B is that Group 3 contains a moderate amount of acreage (29,360; 7%) in the Wilderness Study Areas. Vista maintenance is not allowed in the Wilderness Study Area MA.

There are two known vistas within the Wilderness Study Areas MA in Alternative C along the LT. One of these is a Type 1 vista that would be lost over the long-term in the Wilderness Study Area as trees grow up with loss of maintenance. The other one was created from naturally occurring rock outcrops (Type 2 vista) but enhanced through maintenance. Over time the size and quality of the vista would be reduced with loss of maintenance.

Alternative D

Alternative D would offer the second least amount of opportunity for vista management and would offer the most restrictions on vista management, other than Alternative A, with only 162,310 acres (41%) in Group 1.

Group 3 in this alternative differs from the other alternatives in that there is the largest amount of acreage in Wilderness Study Areas MA (49,799; 12%).

There are 18 known vistas within the Wilderness Study Areas MA in Alternative D along the AT/LT and the LT. Eight of these are Type 1 vistas that would be lost over the long-term as trees grow up with loss of maintenance. The other ten were created from naturally occurring rock outcrop (Type 2 vistas) but enhanced through maintenance. Over time the size and quality of the vistas would be reduced with loss of maintenance.

Alternative E

Alternative E would offer opportunities for vista management that fall in between Alternatives A and B. Alternative E would offer the most opportunities for vista management, other than Alternative B, by allocating 187,601 acres (47%) in Group 1.

There are four known vistas within the Wilderness Study Areas MA in Alternative E along the AT/LT. Two of these are Type 1 vistas that would be lost over the long-term as trees grow up with loss of maintenance. The other two were created from naturally occurring rock outcrop (Type 2 vistas) but enhanced through maintenance. Over time the size and quality of the vistas would be reduced with loss of maintenance.

Indicator 2 – Acres in Management Area Allocations which Allow the Development of Wind Power and New Communication Sites

All alternatives allow for the development of wind power and communication sites on the GMNF. Alternative A has the least opportunity for potential sites and Alternative B offers the most potential for future sites.

All alternatives allow for NFS lands to be considered for siting wind power and communication towers. The alternatives differ in the amount, location, and degree of potential acreage for siting facilities. The placement of wind power facilities has the potential for more visual impact than communication facilities.

See Table 3.14-2 in the Non-Recreation Special Use Management section for acreage of NFS lands grouped by MAs which allow lands to be considered for the development of wind power and communication sites.

Effects Common to All Alternatives

The locations where wind power facilities are required to be located for maximum efficiency, the tops of north-south ridgelines over 2,500 feet in elevation, are often visually prominent, remote, and forested (State of Vermont, Agency of Natural Resources 2004a). These same lands are highly valued for scenery, being the visual backdrop to much of the surrounding lands, as well as offering places from which to view scenery. Although communication sites may require similar terrain locations, depending upon the particular need, sites may be found on lower terrain in less prominent locations and on smaller sites to allow for a single tower or small grouping of towers.

While there are many designs for wind power structures, the most common include a white or gray tower to best blend with the sky. The blades are black to reduce icing in winter (State of Vermont, Agency of Natural Resources 2004a). Current design of commercial scale wind towers, including blades, result in structures up to 350 feet in height.

Communication towers are often painted white, gray, or green and are sometimes camouflaged in tall structures such as silos or steeples, or made to appear like a tree to blend with the landscape. Although communication towers on the GMNF currently exist up to 90 feet, communication towers reaching up to the height of wind towers could be requested in the future.

Federal Aviation Administration (FAA) has lighting requirements on structures higher than 200 feet. It is likely that wind towers would be required to provide lighting to individual towers. Communication towers would need lights if tower heights were higher than 200 feet. FAA requirements could require strobe lights depending on site-specific needs. Night time effects of lights on towers would vary depending on factors such as:

- The darkness of the ridgeline: Is the tower light the only light on a dark ridgeline, or are there lights from other uses?
- The night time activity that is taking place such as camping, star gazing or walking versus driving or night-skiing on lighted slopes
- The degree to which the place where the ridgeline is viewed is lit: It is more difficult to perceive distant light in areas where there are street lights and other outdoor lighting (State of Vermont, Agency of Natural Resources 2004a).

People are drawn to look at the ridgeline and notice visual intrusions to an otherwise forested landscape. Some views have existing development that detracts from a natural appearing landscape such as ski area development and existing wind power and communication sites. Visual quality concerns can be subjective. Public preference can have an effect on acceptance of a development. For example, some people see ski development as a positive cultural attribute of the Vermont landscape while others see it as scarring an otherwise natural-appearing ridgeline. Intervening terrain, vegetation pattern, and rock ledges can also play a role in minimizing effects of developments that could impact visual quality.

Meeting VQOs for wind power and communication site facilities would be difficult in many locations because of preferred ridge top locations and the size of associated facilities. Siting for communication facilities, however, would be easier since associated facilities are less obtrusive overall. Visual Quality Objectives for viewing the upper part of the more noticeable peaks and ridges on the GMNF from off-site (more than ½ mile) should meet the Retention VQO (alterations made by people are not visually evident to the casual forest visitor) or Partial Retention VQO (alterations made by people must appear subordinate within the surrounding natural appearing landscape) depending on the ROS of the area being viewed. On other locations, the VQOs range from Partial Retention to Modification (alterations may dominate the original surrounding landscape, but constructed facilities must be compatible with the landscape) to Maximum Modification (alterations dominate the original surrounding landscape to a high degree, and do not relate completely to natural appearing form, line, color, or texture) depending on the ROS of the area being viewed and the location of the viewer.

Alternative A

Alternative A has the least number of acres (113,647; 28%) available to be considered for development of wind and communication tower sites, therefore Alternative A has the potential to have the least visual impacts.

Alternative B

Alternative B has the most acreage (211,103; 53%) available to be considered for development of wind and communication tower sites, therefore Alternative B has the potential to have the greatest visual impacts.

Alternative C

Alternative C falls in between Alternatives A and B and offers the least number of acres (142,788; 36%) available to be considered for development of wind and communication tower sites after Alternative A.

Alternative D

Alternative D falls in between Alternatives A and B for the development of wind and communication tower sites with 149,799 acres (37%).

Alternative E

Alternative E falls in between Alternatives A and B and offers the second highest number of acres (164,898; 41%) available to be considered for development of wind and communication tower sites after Alternative B.

Indicator 3 – Projected Average Annual Acres Harvested by Treatment Methods with Similar Effects on Visual Quality

All alternatives meet the intent of the goal for the visual resource. Alternative B would have the potential for the most even-aged timber harvesting and the most timber harvest of even-aged and uneven-aged combined; Alternative A would have the potential for the least even-aged timber harvesting and the least timber harvest of even-aged and uneven-aged combined.

Timber Harvest within MAs in the suitable land base is found in the following five MAs: Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Escarpment, and Moosalamoo Recreation and Education Area. All of these MAs allow for both even-aged and uneven-aged timber management. The amount of projected even-aged and uneven-aged treatment varies by alternative.

All alternatives have management areas where timber harvest in the suitable land base is allowed. The alternatives differ in the projected acreage and distribution of even-aged and uneven-aged timber harvesting.

See Table 3.13-8 in the Timber section for projected average annual acres cut by harvest method.

Effects Common to All Alternatives

Guidelines have been developed for meeting Visual Quality Objectives (VQOs) by placing limits on the location, amount, perceived size, and type of timber harvest that would occur. In addition, project level decisions are made to apply these guidelines and integrate site-specific mitigation measures that may be needed to meet the VQOs. As a result of standards, guidelines, and other site-specific mitigation measures, it is anticipated the short and long-term visual effects from timber harvesting would be minimal for all alternatives.

Even-aged management includes shelterwood and clearcut harvest types that are most visible on the landscape. Even-aged treatments have the ability to provide the greatest opportunity for creating temporary vistas. They also provide the most challenge for placement of harvest areas on the landscape and may require the most mitigation to meet the desired VQOs.

Even-aged harvest affects how the forest looks on the site and from a distance. The greatest change occurs in the appearance of the area when viewed from on the site. When a clearcut is used, all but wildlife reserve trees are removed. More trees are left when shelterwoods are performed but the change in appearance from forested areas to openings is still very apparent. The opening is a temporary change and gradually the scene will return to a more natural appearing forest landscape, thus the long-term visual effects on the site would be minimal as the area regenerates. The size and shape of even-aged harvests influences what people perceive as visual impacts as smaller sizes are potentially less noticeable than larger ones. The shape of the cut influences how much can be seen from particular vantage points (USDA 1985).

Uneven-aged management includes selection harvest types that are least visible on the landscape. These treatments include single tree selection and group selection and are more able to meet VQOs.

Uneven-aged harvest has relatively minor effects on how the forest looks from on and off the harvest site. Mixtures of different sized trees exist before and after the harvest. When viewed from a distance, the removal of some individual trees and small groups will cause slight change in the forest canopy over the short-term. The short-term change will be subordinate, or appear unnoticed, to the natural appearing view which is maintained (USDA 1985). The long-term visual effects on the site would be minimal as the area regenerates.

The GMNF has relied on timber harvest to create, maintain, and enhance visual variety on the landscape. Many of the permanent vistas and wildlife openings on the GMNF are created by harvest treatments. Temporary vistas may be created through shelterwood, clearcut, and group selection treatments. Some harvest prescriptions do not benefit aesthetics and are prescribed to meet other resource objectives. These treatments follow visual standards and guidelines and mitigation measures prescribed to meet VQOs and thus have minimal impacts to the visual resource. Mitigation measures may include slash treatments that minimize the visual effects of the remaining non-merchantable parts of the trees, leaving trees to act as a vegetative screen, using terrain to properly place harvest units, or feathering the edges of a stand to act as a visual transition.

Immediately following timber harvests, the potential visual effects would be most evident. In some cases, some of the slash would be chipped or treated by prescribed burn to reduce the visual effects. In other cases, time alone would bring the stand back to a forested condition.

Alternative A

Alternative A has the least amount of projected average annual acreage (3,500) harvested of all the alternatives and the least amount of even-aged acres (2,698) projected for harvest (Table 3.13-8). The acreage allocated to Newly Acquired Lands is not included in the suitable timber base and accounts for the low acreage in this Alternative.

The overall potential visual effects of timber harvest would be the least in Alternative A.

Alternative B

Alternative B has the most projected average annual acreage (4,703) harvested of all alternatives and the most amount of even-aged acres (3,209) projected for harvest and thus has the most potential negative effects on the visual resource (Table 3.13-8).

Alternatives C, D, and E

Alternatives C, D, and E are intermediate in the amount of projected average annual acreage harvested and the projected average amount of even-aged acres harvested. Alternatives C (4,034) and E (4,055) are nearly identical for total acreage projected for harvest (Table 3.13-8). Alternative D includes 3,834 acres.

Alternatives C (3,171) differs from Alternative B (3,209) in projected even-aged acres harvested by only 38 acres (Table 3.13-8). Alternative E (3,074) differs from Alternative C by only 97 acres and Alternative D (3,056) differs from Alternative E by only 18 acres in projected even-aged acres harvested.

The potential effects on the visual resource from these alternatives would be greater than Alternative A and less than Alternative B.

Cumulative Effects

The reforestation of old, agricultural fields has been a continued trend over the past 200 years since farms were first abandoned. Forest successional growth has affected the ability to view scenery yet, at the same time, has helped to create the landscape mosaic that people value today. Some old fields on private lands within view sheds that NFS lands share have been left to grow up as farming has continued to diminish. Some private lands continue to be maintained with haying and other agricultural activities.

Timber harvest will continue to occur on private lands surrounding the GMNF. As with timber harvest on GMNF lands, timber harvest can benefit the landscape with more opportunities for viewing. Timber harvest on private lands, however, can create non-pleasing visual impacts when mitigation measures are not applied to minimize visual disturbances. Vermont's land-use planning law, Act 250, created development restrictions over 2,500 foot in elevation which will continue to protect many ridgelines from visual impacts (Vermont Environmental Board 2003).

Alpine ski areas exist on private lands both within, and outside of, the Proclamation Boundary. Ski areas have expanded in the past and continued expansion is anticipated. On the GMNF the expansion potential is limited to the MA for Alpine Ski Area Expansion (9.3). On private lands the expansion potential is unknown. Views to and from the GMNF will increase in the short and long-term as ski areas expand and will add to a loss in natural appearing landscape over time. Land with wind resources similar to those on the GMNF can be found on private lands within the Proclamation Boundary, as well as on ridgelines surrounding the GMNF.

On private land in Searsburg, Vermont on a ridgeline directly adjacent to NFS land is a commercial-scale wind power facility consisting of transmission lines, eleven 200-foot tall wind towers, and a road network that provides access to the facility. In addition, outside the GMNF Proclamation Boundary within potential view from GMNF lands are a number of ridgelines on both private and public lands meeting criteria that would be sufficient for commercial wind power development (TrueWind Solutions, LLC 2003).

As demand for renewable energy and better communication grows, it is likely that over the short-term there will be increased pressure on NFS lands to provide wind power and communications sites. In the long-term, however, as technology improves, siting viable wind power sites lower on mountains in less prominent locations may be possible.

As demographics shift and population increases in Vermont, more development will occur on non-federal lands within the cumulative effects analysis area. This will bring additional roads, lighting, structures, and a loss of natural appearing landscape. People will look to the GMNF to provide the scenic backdrop and natural appearing landscape lost in some communities. Overall, incremental changes will continue to occur over time on many features of the landscape and management of the GMNF will have positive cumulative effects because of management standards and guidelines.

Table 3.15-1: Acreage of NFS Lands Grouped by MAs with Similar Opportunities for Vista Management

Management Areas	Alt A	Alt B	Alt C	Alt D	Alt E
Group 1:	(acres)	(acres)	(acres)	(acres)	(acres)
Diverse Forest Use	110,271	195,403	120,778	104,027	118,717
Moosalamoo Recreation and Education Area	0	0	12,702	0	12,375
Alpine Ski Areas	2,822	3,067	3,067	3,067	2,889
Escarpment	0	2,894	8,488	17,710	14,436
White Rocks National Recreation Area	22,758	22,758	22,758	22,758	22,758
Recreation Special Areas	86	157	157	157	157
Appalachian National Scenic Trail	14,473	14,315	14,315	12,790	13,629
Long Trail	2,927	2,640	2,511	1,801	2,640
TOTAL GROUP 1:	**153,337**	**241,234**	**184,776**	**162,310**	**187,601**
Group 2:					
Alpine Ski Area Expansion	554	518	518	518	518
Ecological Special Areas	796	3,000	2,420	3,582	3,928
Alpine/Subalpine Special Area	0	706	706	706	706
Remote Backcountry	8,316	22,163	23,220	23,036	30,930
Diverse Backcountry	85,139	59,193	94,497	59,082	59,665
Remote Wildlife Habitat	0	12,115	5,723	42,187	30,399
Newly Acquired Lands	92,003	NA	NA	NA	NA
TOTAL GROUP 2:	**186,808**	**97,695**	**127,084**	**129,111**	**126,146**
Group 3:					
Wilderness	59,001	59,001	59,001	59,001	59,001
Wilderness Study Areas	0	2,291	29,360	49,799	27,473
Existing and Candidate Research Natural Areas	1,546	471	471	471	471
TOTAL GROUP 3:	**60,547**	**61,763**	**88,832**	**109,271**	**86,945**

Notes: Eligible Wild, Scenic, and Recreational Rivers are distributed into the MAs they pass through as listed above for this analysis.

3.16 HERITAGE RESOURCES AND TRIBAL RELATIONS

Issue Statement

Public concern is focused on the need to protect and preserve significant Heritage Resource properties and values.

Indicator 1 – Acres in Management Area Allocations Most Subject to Ground Disturbing Activities that Have Potential to Affect Heritage Resources

The indicator to be used in this effects analysis is the number of acres by management areas (MAs) allowing ground disturbing management activities that have the potential to impact Heritage Resource sites. Known historic and archaeological sites, and areas with high potential to contain prehistoric archaeological sites, occur throughout the Forest. These sites occur in most MAs, although they are not distributed evenly. Much of the significance or value of these sites is imbedded in the spatial relationship between artifacts, features, and sites. Standards and guidelines are designed to prevent or minimize activities that can alter or destroy spatial relationships. Occasional human error in implementation, however, can result in damage to Heritage Resource sites. This indicator highlights the differences between alternatives because the potential for impacts to existing Heritage Resource sites from ground disturbing management activities varies based on management area allocations that allow these activities.

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the GMNF. This is the area potentially subject to ground disturbing activities that could impact Heritage Resources. The analysis area for cumulative effects includes all GMNF lands and the lands administered by other owners, both public and private, within the State of Vermont. This is the area that most often is considered the background context or area for determining the relative significance of Heritage Resources.

3.16.1 Affected Environment

Introduction

The Green Mountains have provided an important living, working, and spiritual environment for people since the glaciers melted more than 10,000 years ago. Euro-Americans first arrived in Vermont nearly 300 years ago, and though they and the subsequent generations of settlers shared some of the same values as indigenous Native people, they also saw the mountains as a source of timber, charcoal, iron ore, gravel, pasture, orchard lands, clean water, water power, and, most recently, recreation opportunities. Evidence of past land uses and activities, and their effects on ecosystems, is contained in archaeological and historic sites, Native American traditional use landscapes such as medicinal plant collection areas or sacred sites, travelways, buildings, structures, cemeteries, features, and artifacts. Taken together, these are considered heritage resources. Heritage resources which meet the National Register of Historic Places criteria for significance are referred to as “historic properties”.

The known Heritage Resources on the GMNF are primarily archaeological sites dating to the 19th century. There are relatively few identified pre-European, Native American sites due largely to the lack of intensive surveys. Archaeological sites of all ages on the GMNF exist on or just below the ground surface. Sites’ values, significance, and eligibility for the National Register of Historic Places are largely contained in the information that can be extracted from them about past peoples, events, environments, relationships to one another, and, to a lesser extent, importance as geographic markers informing us about past land-use patterns. In addition, pre-European Native American sites often have a meaningful

spiritual component which warrants the physical preservation of a site regardless of its "informational" value. The information embedded in sites is most meaningful, or most likely to be understandable, when the physical, spatial relationships between the sites' artifacts and features are preserved. Ground disturbing activities compromise or destroy the spatial relationships known as a site's "integrity."

Public benefits from heritage resource management can be realized through such things as the scientific study of past human activities and environments, traditional use by Native Americans, the development of interpretive materials allowing people to learn about and appreciate the diversity of past Forest land-uses, and preserving a personal or cultural sense of place.

Information on the ways Native American people used the Green Mountains in the past is still emerging. The existence of Paleo-Indian sites near the Forest indicates that people were in the vicinity by at least 10,000 years ago. Subsequent to these early occupations, the environment continued to warm, temperate forest plant and animal communities re-colonized the glacially scoured landscape, and the size and complexity of human communities grew.

The Archaic Period, from 9,500 to 2,500 years ago, saw the rise of more elaborate, ritual activity and diversification of subsistence strategies. Most of the archaeological sites from this time period are expected to reflect hunting, fishing, camping, resource acquisition, for example, stone quarries, and tool making activities.

The most recent pre-European cultural horizon, the Woodland Period, from 2,500 to about 400 years ago, is characterized by increasingly intensive agriculture, the introduction of the bow-and-arrow and pottery, a settlement pattern marked by larger, more-sedentary villages, and an increase in social complexity. Village sites associated with this period tend to be larger and reflect a correspondingly more diverse set of activities. Outlying camps, often at higher elevations, tend to be smaller, and reflect a single function, for example, a hunting camp or quarry site.

During the Contact Period, roughly the century following Champlain's 1609 "discovery" of interior New England and Lake Champlain, explorers, traders, missionaries, and settlers converged on the Green Mountains from the north (French), west (Dutch), and south and east (English). The Western Abenaki claimed most of what is now Vermont and surrounding pieces of Quebec, New Hampshire, Massachusetts, and New York, while the Mohican considered most of the upper Hudson drainage, or present Bennington County, to be their territory. The Mohican maintained an interest based on probable travel-and-trade routes in the Otter Creek north to Lake Champlain as well. Sites from this time period often show a mix of materials and behaviors derived from both Native and European cultures. New diseases, economic systems, military conflicts, religious beliefs, and technologies threw the indigenous peoples' societies into turmoil. The Mohican community was forcibly moved to reservation-life in the late 18th century, enduring several moves over a number of decades before finally arriving on their present Wisconsin reservation in the 1860s, where they are now known as the Stockbridge-Munsee Band of the Mohican Nation. They still have a strong interest in their ancestral homelands today. A core Abenaki community has largely remained in or near their traditional lands, although many people have moved away, as well. Over the last 25 years there has been a renaissance of cultural values and tribal pride among the Western Abenaki, particularly in northern Vermont.

In the lands that are now the National Forest, French and English exploration and limited homesteading occurred in the 1600s and early to mid-1700s, but permanent settlement increased dramatically with the relative security that came after the conclusion of the French and Indian War and American Revolution. In the early 19th century, farming and lumbering were the chief sources of income, and iron mines, mills, and charcoal kilns were well represented in the working landscape. The mid-19th century saw the introduction of the

railroad to Vermont, and an agricultural transition from subsistence farming to sheep and then to dairy production, while logging continued to be an important economic pursuit. The early 20th century marked the beginning of an increase in tourism and recreation.

By the Great Depression of the 1930s, many upland farms met their demise, after a long economic decline and a shifting population that followed the introduction of the railroads, the Civil War, and the opening of the West. The combination of available or abandoned upland farmlands, an increasingly strong conservation movement, and the devastating effects of the 1927 flood (attributable, in part, to the inability of deforested uplands to hold water) led to the establishment of the GMNF in an effort to protect watersheds. Among the first management acts on the new Forest was the establishment of Civilian Conservation Corps (CCC) camps. Remains of five Camps themselves, and the projects the CCC crews completed, are also considered part of the heritage resource base.

Existing Forest Plan Management Direction

Heritage Resources are protected from disturbance by federal and State law because they are considered valuable, unique, fragile, and non-renewable.

The 1987 Forest Plan established a goal to "Preserve all important physical remains of prehistoric and historic human activity and interpret some cultural resource sites to improve the public's understanding and appreciation of the past." An overview of the cultural resource program is provided in Appendix H. The 1987 Plan established that the Forest has, and will maintain, a master file of known site information about historic and prehistoric Heritage Resources.

Compliance with Section 106 of the National Historic Preservation Act has been integrated, into the Forest Service NEPA process, both in terms of public notification, timing of analyses, and documentation of results.

General standards and guidelines associated with Heritage Resources are described in the 1987 Plan, including specific reference to the National Register of Historic Places (NRHP) criteria for which a site may officially be established as significant or important by the National Historic Preservation Act (NHPA). Standards and guidelines also provide for the protection of sites which may not meet the exacting standards of the NRHP but which are valued as part of Vermont's cultural heritage.

The 1987 Plan stated that "Prior to planned land disturbing activities, a cultural resource survey will be conducted and all identified sites will be inventoried." The Forest Service inventories sites within each project's Area of Potential Effect, and makes recommendations to project designers and decision-makers about how to proceed. On occasion, through partners and/or consultants, the Forest Service has the opportunity to do broad-scale surveys in keeping with a legal mandate to achieve 100 percent inventory. Every significant Forest undertaking is subject to review by the Forest Archaeologist and subsequent concurrence by the State Historic Preservation Officer (SHPO).

The 1987 Plan offers some guidance on Native American affairs, although it does not specify which tribes should be consulted or under what circumstances. It states that the "GMNF will make every effort to consult with appropriate genetic and cultural Native American groups concerning management of Native American sites and cultural resources." The 1987 Plan acknowledges the presence of prehistoric sites on the Forest and recommends a study of relevant sites and travelways.

Consultation with Native American people over the life of the 1987 Plan consisted primarily of a long-term partnership with the Missisquois Band of the Western Abenaki Nation, an active, but not yet federally recognized tribe. The Forest Service recognized that this tribal group has a special relationship to the Forest-owned lands, and encouraged their input on management activities through the NEPA process as well as more informal and personal communications. In addition to this relationship, the Abenaki have legal standing in

regard to the Native American Graves Protection and Repatriation Act, a federal law which facilitates the return of human remains and graves' goods to appropriate genetic and cultural descendants.

Proposed Changes in Management Direction Common to All Alternatives

The revised Forest Plan will continue management direction provided in the 1987 Plan with an emphasis on providing protection and stewardship for significant heritage resources (Goal 16) and improving awareness about, and stewardship of, heritage resources by providing interpretation and education products and public participation projects (Goal 19). The revised Plan also provides more specific objectives consistent with Forest Plan goals, and a revised set of standards and guidelines that emphasize new or amended legal obligations.

A significant new objective in the revised Plan will be to address the backlog of unevaluated heritage sites. Very few Forest Service heritage sites have been studied to evaluate whether or not they are eligible for the National Register of Historic Places. By doing such evaluations, the Forest Service will be better able to identify where to focus protection and preservation activities, and efforts to interpret significant sites for the public.

The most significant changes in the revised Plan are in the area of standards and guidelines for tribal relations and the treatment of human remains. The revised Plan directs the Forest Service to formally consult with appropriate tribes, per the amended National Historic Preservation Act, and to adhere to the legal protocols established by the Native American Graves Protection and Repatriation Act (NAGPRA) in dealing with any human remains discovered or recovered on the Forest.

Existing Condition

The full extent of the heritage resources on the Green Mountain National Forest is unknown, but knowledge increases annually. What is currently known about the number and distribution of heritage resource sites is based on an original Cultural Resource Overview (Casjens 1978), numerous project or area-specific surveys undertaken by Forest Service archaeologists and consultants over the last 25 years, research and publications at a statewide level (Rolando 1992, Haviland and Power 1994), and town-wide overviews for several towns in the Taconic Expansion area (Charles 2002).

Understanding of the potential distribution of pre-European Native American sites has been informed by the evolving standards of the State's predictive model for the location of such sites, through oral history and consultation with Native American people (Lacy and Moody 2005), and by the work done by the Forest Archaeologist since the 1980s to demonstrate the presence of such sites on the Forest (Lacy 1994, 1999). As a result, knowledge of the number, distribution, and range of types of Heritage Resources increases annually.

The Green Mountain National Forest currently keeps representatives of the Abenaki and Mohican Tribes apprised of projects and programs, and is seeking to improve consultation. A long-term relationship with the Abenaki goes beyond the short-term compliance process, and there is an effort to maintain open communications and an exchange of views, concerns, and opportunities.

To date, 100 percent of National Forest System lands have been described by general overview studies, 14 percent of the land base has been surveyed in the field for historic period properties, and approximately 1 percent has received intensive survey such as digging test pits, for pre-European sites.

More than 1,100 heritage sites have been recorded. A small (30) but significant number of pre-European archaeological sites has been recorded. The small number of sites is largely due to the lack of intensive survey, not because these sites do not exist in larger numbers. The great majority of the sites inventoried to date are 19th century era homesteads and farmsteads. Because it is common to have locations where more than one type of activity was being pursued (for example, it would not be unusual for an upland farm to also have a mill, sugarbush, and family cemetery), records often reflect more than one site type at a single place. In addition to hundreds of farmsteads on the GMNF, more than 100 mill and logging sites, 25 sugarbushes, 35 small family cemeteries, and numerous historic roads have been recorded. Other sites include nearly 100 charcoal kilns and at least 2 lime kilns (Rolando 1992), a 19th century spa and hotel, the remains of 5 CCC camps, and more than 20 mines or quarries.

Finally, there are standing structures on the Forest that are considered historic properties. These include an 1850s-era, one-room school house, an 1860s-era barn, two mountain-top fire lookout towers built in 1927 and 1932, several Long Trail and Appalachian Trail shelters, standing structures at the Danby CCC camp, CCC-built structures at the Hapgood Recreation Area, and an historic dam.

Forest Plan standards and guidelines, and methods for protecting Heritage Resources, have been shown to do a good job of preserving the condition of sites once they have been identified. The Forest Service has found and maintained Heritage Resource sites in fair-to-good condition across the Forest. Forest Service monitoring indicates that implementation of Forest Plan standards and guidelines have resulted in protection and preservation of most sites within project areas (USDA 1998).

It is probable that the spatial integrity of any pre-historic archaeological site on Forest Service land has already been slightly compromised because of disturbances from a combination of natural processes and the long land-use history of logging and farming. That is almost always the case for pre-European sites in the Northeastern United States, however, and does not automatically diminish their significance. In fact, it is likely that sites on the GMNF in general are in better condition than those in similar settings in the private sector due to a lack of development activity.

When considering the significance of sites on Forest Service land, it is important and instructive to refer to the State's Historic Preservation Plan, which is structured around nine broad themes reflecting the history of Vermont. As part of application of the National Register of Historic Places (NR) criteria for significance, the Forest Service links evaluation of sites to these State Plan themes:

- Native American Pre-European History (9,000 B.C.-1609 A.D.)
- Contact, Exploration, Conflict and Early Settlement (1609-1790)
- Agriculture
- Historic Architecture and Patterns of Town Development
- Culture and Government
- Transportation
- Industry and Commerce
- Tourism
- War and Peacetime

To date, two sites have been listed on the NR, and four more are in the process of being nominated. A dozen more sites have been determined eligible for listing. The great majority of sites have not been evaluated against the criteria of significance for inclusion within the NR.

Opportunities for public education, participation, and partnerships have been extensive over the life of the 1987 Plan. The Forest Archaeologist delivers, on average, a dozen presentations each year to public and professional groups. A two-week summer archaeological camp, "Relics & Ruins," for children (fifth-through-ninth grades) has been held since 1997; and since 1999 the Forest has sponsored a one-week Passport in Time adult volunteer project entitled "Remember Me As You Pass By," which focuses on the maintenance of abandoned historic cemeteries. Other outreach activities have included the development of interpretive

posters, office exhibits, walking tours, publication of scholarly and popular papers, and active participation in the annual Vermont Archaeology Week.

Partnerships have been important in rehabilitation of the NR-listed Somerset Schoolhouse, running the Relics & Ruins camp, supporting Abenaki efforts to help evaluate sites on the Forest, and nominating the historic Green Road to the NR. Volunteer efforts have been invaluable in achieving additional evaluation and insights into particular parts of the Forest or specific industries, for example, the iron and charcoal industry (Rolando 1992), Silver Lake area (Powers 2001), Old Job villlage and Mt Tabor's "Danby CCC Camp" (Griffith 2004), and the Aldrichville logging village (Lacy and Charles 2000).

3.16.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Indicator 1 – Acres in Management Area Allocations Most Subject to Ground Disturbing Activities that Have Potential to Affect Heritage Resources

When considering the protection of Heritage Resources, ground-disturbing activities represent the greatest threat. When Forest Plan standards and guidelines are implemented properly, all sites are protected in their present condition, and in some cases enhanced through stabilization efforts. However, monitoring results indicate that human error in implementing protective standards results in occasional damage to sites (USDA 1998). While this error rate is low, the fact that archaeological sites are unique and non-renewable resources means that when a site is compromised or lost it cannot be "fixed," replaced or re-grown. Over time, the population of sites, or at least the population of undisturbed sites, has the potential to be reduced incrementally as a function of the frequency and/or amount of ground disturbing activities.

While MA definitions remain the same across alternatives in terms of the range of permissible activities and the mix of management practices, the acreage contained in each MA, and the inclusion of some new MAs, varies between alternatives. Alternatives that propose more acres in MAs that allow more ground disturbing activities are therefore likely to have more potential for short-term and long-term effects on Heritage Resources.

Although there is opportunity for soil disturbance within the MAs discussed, only a relatively small portion of the MAs would actually be subject to ground-disturbing activities in any given alternative. The estimated acreage for various ground-disturbing activities is provided in the Forest Plan Proposed and Probable Practices (revised Forest Plan, Appendix D). Although these acres are specific to Alternative E, they are not expected to vary by alternative except those associated with timber harvest activities. The Timber Management section of Chapter 3 (Table 3.13-6) provides the potential acres harvested under each alternative.

Effects Common to All Alternatives

All alternatives will do a good job of protecting Heritage Resources since standards and guidelines and in-field methods and measures for protecting sites are effective when implemented. Some alternatives will inevitably result in greater potential for incremental impacts to Heritage Resources over the life of the Plan and the long-term due to the variation in the total area allowing ground disturbing activities and human error in implementing standards and guidelines.

A possible potential indirect effect stems from special management designations (for example, Candidate Research Natural Areas and Wilderness Study areas). Such designations could potentially lead to "lost" or reduced opportunities to do maintenance, research and interpretation of Heritage Resources, especially in regard to clusters of related sites. Reductions in these opportunities would not

occur because they are prohibited but because the kinds of activities desirable from a Heritage Resource point of view would be restricted or inhibited. For example, achieving site inventory, getting access for necessary supplies and equipment, and using certain tools would all be more difficult. The Forest Service addressed this concern within the Roadless Analysis and concluded that while this is a legitimate concern at a general level, with the exception of a stretch of the Bolles Brook area in the Glastenbury Wilderness Study Area (as proposed in Alternatives C, D and E) there was no basis for concern in the specific configuration of any of the Alternatives. In the case of Glastenbury, the archaeological remains of a cluster of 19th century structures – including charcoal kilns, houses, a hotel, and railroad and trolley system features – known collectively as "The Glastenbury Railroad, Mining and Manufacturing Company District," exists inside the proposed boundary. With this exception, therefore, there would be no significant effects from special designations in any of the Alternatives.

A wide range of Forest Service management activities have the potential to result in direct impacts to Heritage Resources, generally through ground-disturbing activities (and occasionally through maintenance or adaptive re-use of structures). These activities include the management of timber, recreation, minerals, special uses, fire, roads and trails, and facilities.

Potential effects from timber management activities come primarily from the skid trails and landings associated with logging. These activities result in the greatest amount of ground disturbance and, therefore, potential damage to Heritage Resource sites. As a result, skid trails and landings receive greater attention and regulation in a project area, especially when they are proposed on or near known heritage sites.

Recreation management activities having the potential for direct and indirect effects on Heritage Resources include construction and maintenance of facilities, for example, campgrounds, support buildings, and parking areas.

Potential effects from mineral management activities result from drilling and excavation techniques for mineral extraction that involve varying levels of ground-disturbing activities.

Potential effects from special use management can result from maintenance activities within easements and utility corridors. There is also some potential that gathering special forest products may affect traditional tribal rights, uses, and interests.

Prescribed fire events have a relatively benign effect on subsurface Heritage Resources because of their short duration. However, fire management methods used to fight, control, or "mop-up" after a fire have the potential for direct effects, such as those resulting from bull-dozed fire breaks.

The potential effects from travelway management come from construction, reconstruction, and maintenance of roads and trails. Travelway management has the potential to affect Heritage Resource sites to the extent that these activities disturb Heritage Resource areas in proximity to the travelway or make site locations more accessible to a greater number of people. This is particularly true for historic period sites that have a direct association with the historical transportation network. Widening travelways or shoulders, or replacing bridges can have a direct adverse effect. Altering or replacing drainage structures, such as culverts or ditches, or tread/surface material can have the potential for both direct effects and indirect effects including erosion, undercutting sites, or sedimentation.

Potential effects from facilities management result from the maintenance, reconstruction, remodeling, and/or removal of facilities considered historic in nature, those sites listed or determined eligible for the National or State Register of Historic Places).

Alternative A

In Alternative A, 198,872 acres (50% of the Forest's land base) are included in MAs that are most subject to ground-disturbing activities (Table 3.2-2 in the Soil section, 3.2). This Alternative has the least potential for impacts to Heritage Resource sites over the short-term and long-term because the more potential for ground disturbance, the greater the potential for human error and resulting impacts to heritage resources.

A conservative estimate of Heritage Resource site density on Forest Service lands is one site per 150 acres; on this basis there are likely to be more than 1,300 sites present in this grouping of MAs (more than 700 sites have already been discovered). This density and number of sites means that it is unusual to have any kind of project which does not have at least one site within its area of potential effect. Because Alternative A has significantly fewer acres (and potential sites) in MAs with the potential for ground disturbing activities, this would be the most desirable alternative in regard to achieving Goal 16 of protecting Heritage Resources.

Alternative B

In Alternative B, 273,347 acres (68% of the Forest's land base) are included in MAs that are most subject to ground-disturbing activities (Table 3.2-2), 74,475 acres (and 500 sites) more than Alternative A. This difference is significant because it represents a large number of additional (and unevaluated) sites. It would therefore potentially provide for more human error in implementation of standards and guidelines and would be less able than Alternative A to meet Goal 16 of protecting Heritage Resources.

Alternatives C and E

In Alternatives C and E, 245,930 and 239,156 acres, respectively (61% and 60% of NFS lands) are included in MAs that are most subject to ground-disturbing activities (Table 3.2-2). These Alternatives have more acreage in MAs that allow ground disturbing activities than Alternative A (but less than B) and would therefore potentially result in more adverse effects to heritage resources, and be less able to meet Goal 16, than Alternative A in the short-term and long-term.

Alternative D

In Alternative D, 226,748 acres (57% of the Forest's land base) are included in MAs that are most subject to ground-disturbing activities (Table 3.2-2). This Alternative has the second-least acreage in MAs that allow ground disturbing activities, slightly more than Alternative A and less than Alternatives B, C and E. It would therefore result in more potential adverse effects than Alternative A, and less than Alternatives B, C or E, in the short-term and long-term and would be less able than Alternative A to meet Goal 16.

Cumulative Effects

When Heritage Resources are viewed as a population of sites cutting across ownerships and jurisdictions, implementation of any of the alternatives will achieve the goal of providing protection and stewardship for Heritage Resources on the GMNF. The Forest Service management approach will result in increased importance of Heritage sites on the GMNF over time, and there should be few or no adverse cumulative effects.

The Forest-wide standards and guidelines in the revised Plan will enable the Forest Service to meet the goal of providing protection and stewardship for Heritage Resources, and opportunities for related interpretation and education, under all alternatives. By comparison, site protection conditions on lands surrounding the GMNF will be generally poor given the relatively high level of development pressure and low level of site protection and preservation, with the exception of State-owned lands and private sector projects subject to the VT Historic Preservation Act (through Act 250 Reviews).

In addition, many of the sites on the GMNF will maintain or increase their level of significance at local, State, and national levels. Some sites,

for example, the structural and archaeological remains of CCC camps, high elevation pre-European sites, clusters of charcoal kilns, fire lookout towers, and well-preserved upland farms, are already potentially eligible to the NR because there were relatively few of them to begin with, or because they occur in environmental niches characteristic of the Green Mountains, and will maintain their value as they continue to be preserved. More common site types, for example, saw mills and lower elevation farms, will become increasingly significant as the population of such sites outside of Forest Service jurisdiction decreases through lack of maintenance, and/or increase in development pressure and vandalism. This is a clear benefit to the public.

3.17 WILDLAND FIRE MANAGEMENT

Wildland fire includes both wildfire and wildland fire use. **Wildfire** is defined as "unwanted wildland fire." **Wildland fire use** is defined as "the management of naturally ignited wildland fires to accomplish specific pre-stated resource management objectives in predefined geographic areas outlined in Fire Management Plans." **Prescribed fire** includes "any fire ignited by management actions to meet specific objectives." **Fire use** includes both wildland fire use and prescribed fire application to meet resource objectives.

Issue Statement

Concern is focused on defining the ecological role of fire on the Green Mountain National Forest (GMNF). The issue of fire ecology is part of the broad plan revision issue of restoring, protecting, maintaining, and enhancing biological and ecological diversity. The ecosystem and biodiversity issue is addressed in several sections of this chapter including the Vegetation section (3.5) and Soil section (3.2).

There is a desire to manage wildland and prescribed fire so that various vegetation types and species can be maintained, public and firefighter safety is assured, and improvements such as houses, buildings, administrative sites, campgrounds, and communication sites, are protected. Of particular concern is the interface between increased private development and public lands. This is referred to as the Wildland Urban Interface (WUI) and includes lands within a mile and a half from improvements, such as homes and power lines.

Indicator 1 – Acres in Management Area Allocations where Wildfire would be Suppressed

The first indicator to be used in this effects analysis is the acres in management area allocations where wildfire would be suppressed. This indicator shows what portions of the GMNF would be subjected to wildfire suppression activities for each alternative in the event unwanted wildfire was to occur either through natural or unnatural means.

Indicator 2 – Acres in Management Area Allocations where Prescribed Fire would be Allowed

The second indicator to be used in this effects analysis is acres in management area allocations where prescribed fire would be allowed to achieve vegetation management objectives. This indicator highlights the differences among alternatives because the amount of potential acres subjected to prescribed fire varies by management area allocations.

Indicator 3 – Acres in Management Area Allocations where Wildland Fire Use would be Allowed

The third indicator to be used in this effects analysis is the acres in management area allocations where wildland fire use would be permitted to return fire's ecological role as a disturbance factor that influences vegetation composition. This indicator highlights the differences among alternatives because the amount of potential acres where wildland fire use would be allowed varies by management area allocations.

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the Green Mountain National Forest. The analysis area for cumulative effects includes all GMNF lands and the lands administered by other owners, both public and private areas immediately adjacent to National Forest System lands. This area represents lands where wildlfire could cross ownership boundaries and may involve cooperative wildfire suppression activities. It also represents lands that could involve the use of prescribe fire to achieve multiple vegetative management objectives across a greater landscape area.

3.17.1 Affected Environment

Introduction

Wildfire has typically played a small-scale ecological disturbance role within the Green Mountain National Forest (GMNF). Large fires have occurred in the past but most were a result of human activities such as land clearing and logging slash. This section describes aspects of past fire history, fire as a natural disturbance factor, fire effects on certain forest types, and current uses of fire as a resource management tool, including wildland fire use.

Wildfire History

The GMNF has had 33 wildfires totaling 391 acres during the 20-year period from 1983 to 2002. This averages approximately 3.4 fires per year burning a total of 8.2 acres annually. Ninety-eight percent of the wildfires occurring on the Forest have been human-caused.

The largest wildfire on the Forest in the last 30 years was the 1992 “P3 Fire” that burned 270 acres on the South Half of the Forest as the result of an escaped prescribed fire. Although most current day wildfires are relatively small on the GMNF, there is a history of large fires during the early 1900s. Many of the large fires were a result of large fuel accumulations coupled with drought. Unnatural fuel accumulations were largely the result of huge quantities of slash left during the railroad-logging era. Ignitions were common from the wood burning locomotives, and then later, to a lesser extent, the coal-fired engines. The coal-fired engines would shoot out exhaust sparks and drop hot “clinkers” without discretion (Belcher 1980).

Wildland Urban Interface

The Wildland Urban Interface (WUI) is considered to be those areas where development and the "wildland" interface and intermix and which are prone to wildfires or the rapid spread of wildfires under certain climatic conditions. Factors including fuels, slope of the land, and climate are all taken into consideration when determining whether or not property is susceptible to wildfire. On the GMNF, factors that contribute to increased fuel loadings and potential fire hazards close to encroaching development include ice storm damage, logging slash and natural thinning from second-growth timber stands that are over-stocked.

The concept of the WUI has emerged after two decades of destructive wildland fire across the nation. Wildland fire has become a more frequent occurrence in WUI areas and has resulted in heavy loss to private property. The nationally accepted definition of WUI is an area within a mile and a half of two or more homes per forty acres. Given this definition, almost all of the GMNF is considered part of the WUI. Nearly all of the wildland fires that have occurred on the Forest have occurred within the WUI. Although not causing the widespread damage to property that occurs in western US forests, the potential for destructive wildland fire is increasing on the GMNF as development on private lands intermingled with NFS lands continues.

Ecological Role of Fire

The role of natural fire on the GMNF has historically been to create small patch disturbances with long fire-return intervals. Records from early surveys of northern New England suggest that fires might have been expected to burn any particular area of forest approximately every 1,500 to 2,500 years (the fire return interval) (Lorimer 1977, Fahey and Reiners 1981). Fire is not as significant a disturbance factor as other agents of change, such as wind. Wind dominated the natural disturbance regime and resulted in disturbances ranging from single-tree windfall gaps to large blow-downs caused by occasional hurricanes, most notably in 1815 and 1938. See the Vegetation section (3.5) of this chapter for more information.

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, and disease, landslides or wind throw of trees. Frequency and distribution of species that dominate a given site commonly change following a disturbance. For example, stands of paper birch owe their origin to wildfires 90 to 120 years ago (Goodale 2003). 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 and often patchy distribution of disturbance patterns across the landscape, including fire, creates a mosaic of vegetation sizes, ages, and composition. 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 not universal agreement that fire is rare in the forests of central and northern New England. 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).

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-caused fire. In contrast, dry lightning strikes and resulting fires are rare in the northern hardwood forests of New Hampshire and Vermont, so it is not surprising that humans have historically caused most of the large wildfires in New England.

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 parameters influence fire frequency beyond drought conditions and source of ignition. Fuel accumulation and flammability are important factors contributing to the occurrence of fire on the Forest. Historically, logging contributed significantly to increased fuel loads and the incidence of extreme fire behavior, which includes torching, crowning, and rapid fire spread, especially in conifers. Windstorms, ice damage (like that resulting from the 1998 ice storm in northern New England), and insect and disease outbreaks similarly may create fuel loads that could support intense fires. Disturbances coupled with locally intense drought can lead to conditions that will allow fire to burn in the otherwise non-flammable deciduous forests.

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 those of 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. 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 non fire-resistant competitors. The recent decrease in fire frequency due to human suppression may be a significant factor in the decline of red oak (Lorimer 1985).

Normally, fire is a natural disturbance agent capable of converting northern hardwood forests to aspen, paper birch, white pine, oaks 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, rate of fire spread and intensity are often sluggish even during periods of severe droughts.

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).

Fire in Softwoods

White and Red Pine

White and red pine ecosystems are often fire prone and regenerate well after a fire. This attribute often allows prescribed fire to be used as a management tool for regeneration and removal of competing vegetation.

Prior to 1900**,** full succession of plant communities was not possible because of the fire regime associated with white and red pine stands. Before fire protection, red and white pine stands were subject to a mixture of lethal and non-lethal fires. Recurrent non-lethal 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 (Brown et al. 2000).

Red Spruce

Usually, red spruce slopes and red spruce flat forests are considered a low fire risk 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 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 such as needles, dry twigs, and bark (insect-wildfire hypothesis). Fire potential is greatest 5 to 8 years after tree mortality. During this period, fires of great intensities 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 balsam fir and convert the forest to other tree species.

Prescribed Fire

Fires can be managed for resource benefits through the use of management-ignited prescribed fire.

On the GMNF, prescribed fire can be used to meet particular objectives in management areas that allow its use. Some of these objectives include:

- Reduce hazardous fuel loading in the Wildland Urban Interface to reduce the risk of intense wildfire
- Create, maintain, or improve wildlife habitat
- Prepare sites for restoration of species such as oak, pine, 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
- Control interactions between plant communities and insects and/or disease
- Promote blueberry production
- Create or maintain scenic vistas

The use of prescribed fire is an integral component of the GMNF fuels treatment program which started in earnest during the mid-1970s to achieve multiple vegetative management objectives. The program consists of both mechanical as well as prescribed fire activities. Mechanical treatment includes the use of chainsaws, brush saws, brush-hogs or related equipment to remove or reduce specific vegetation from a site. 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.

The prescribed fire portion of the fuels program has averaged approximately 300 to 500 acres per year over the past planning period (1989 to present). The mechanical portion of the fuels program has averaged 200 to 300 acres over the same period.

Wildland Fire Use

Wildland fire use (WFU) consists of the management of naturally ignited fire to achieve predetermined vegetative management objectives. The GMNF has not utilized this tool and has instead suppressed all wildland fires. The main objectives of using WFU includes restoring fire to its natural role in the ecosystem, such as allowing natural ignitions to burn without suppression in Wilderness, as well as to maintain the viability of fire-adapted vegetation communities such as oak. Objectives are accomplished in a manner that remains consistent with the safety of people, property, and other resources

Fire Regimes and Fire Condition Classes

A national assessment was completed in 2001 that quantifies land condition in the United States (Schmidt et al. 2002). The analysis 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 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.” Wildfire risk conditions are identified by the Fire Regime Groups (Table 3.17-1) and are measured by the Fire Condition Classes (Table 3.17-2). 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 3.17-1: Historical Natural Fire Regimes

Fire Regime Group	Fire Frequency (years)[1]	Fire Severity[2]
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

Notes:
[1]Fire frequency is the average number of years between fires.
[2]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 as a result of the departure from the historical fire regimes increases from Condition Class 1 (lowest risk) to Condition Class 3 (highest risk) (Table 3.17-2).

Table 3.17-2: Condition Class[1] 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

Notes:
[1]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.

Existing Forest Plan Management Direction

The 1987 Forest Plan has no specific goals or objectives related to fire management other than an objective stating there would be no unplanned fires on the GMNF.

General fire management standards and guidelines in the 1987 Plan stated:

- All wildfires will be suppressed and cooperative agreements are to be maintained.
- High hazard areas will be patrolled during high fire danger.
- Notification of local and State officials is to be done in advance of prescribed burning.

Wildland Fire Use as a management tool was not included in the 1987 Forest Plan management direction.

Proposed Changes in Management Direction Common to All Alternatives

The revised Plan provides greater focus through a new goal (Goal 21) to reduce hazardous fuels within the Wildland Urban Interface, and to use prescribed fire and wildland fire use as management tools to restore ecological conditions on the GMNF.

The GMNF proposes to manage lightning ignited fires as WFU under conditions that constitute low risk to firefighter and public safety. The purpose is to allow lightning-ignited fires to function as a natural ecosystem process within a maximum allowable area, such as a management area boundary.

Forest-wide standards and guidelines direct the Forest Service to use a Fire Management Plan to determine when to suppress fire, utilize prescribed fire, or utilize WFU. The revised Plan also states that fire planning should be integrated into resource management from an ecological and resource protection perspective. Finally, the revised Forest Plan provides direction for fire management within each management area.

Existing Condition

Nearly all of the GMNF is considered part of the Wildland Urban Interface (WUI). Development of secondary and primary homes on private land within the proclamation boundary of the Forest increases the risk of wildland fire within the WUI. This development occurs on lower and mid-slopes and intermingles with NFS lands.

The majority of the GMNF falls into Fire regime V (stand replacement severity, hardwoods and softwoods) and described by condition classes 1 and 2.

Description of Fire-Adapted Ecosystems, Communities, and Species

There are several natural community types that occur on the Green Mountain National Forest that are likely to be fire-adapted and require restoration of their fire regimes. They are lumped together into three broad types:

- Oak-pine types (including hemlock-oak-beech-pine forest, and dry transitional oak-pine forest)
- 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)

When oak/pine forest types are considered together, these natural communities constitute approximately 15 percent of the Green Mountain National Forest (based on 1999 data).

The forest is largely dominated by northern hardwoods. Since there is little evidence fire has played an important or frequent role in maintaining these forest types (Bormann and Likens 1979, Fahey and Reiners 1981, Lorimer

and Frelich 1994, Cogbill 2003), fire should be considered a small-scale natural process on the Green Mountain National Forest.

3.17.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Effects Common to All Alternatives

Restoring fire regimes on the National Forest through prescribed fire and wildland fire use will largely benefit small patch communities that are either disjunct or at the periphery (oak-pine types) of their distribution.

Indicator 1 – Acres in Management Area Allocations where Wildfire would be Suppressed

Effects Common to All Alternatives

The Forest-wide effects of wildfire, based on average and historical conditions, will generally be of small–scale across all alternatives. Natural wildfires may be managed under Wildland Fire Use when appropriate. All other wildfires would be suppressed within all GMNF management areas for all alternatives.

Indicator 2 – Acres in Management Area Allocations where Prescribed Fire would be Allowed

Although the actual intensity of the prescribed burning program in the short-term is not expected to vary by alternative, their allocation of Management Areas (MAs) would differ in the prescribed burning opportunities they would afford. Prescribed burning is allowed in all MAs except: Wilderness, Wilderness Study Areas and Alpine/Subalpine Special Areas (Table 3.17-3).

Table 3.17-3: Management Area Allocations where Prescribed Fire would be Allowed

Alternative	Acres (% of total)
Alternative A	341,691 (85%)
Alternative B	338,694 (84%)
Alternative C	311,625 (78%)
Alternative D	291,186 (73%)
Alternative E	313,512 (78%)

All management areas allow prescribed fire except : Wilderness, Wilderness Study Areas, and Alpine/Subalpine Special Areas

Alternatives A and B would provide the most opportunity among the alternatives for prescribed burning with 341,691 acres (85%), and 338,694 acres (84%) in MAs allowing this activity to achieve management objectives, respectively. Alternatives E and C would provide for an intermediate opportunity for prescribed burning with 313,512 acres (78%), and 311,625 acres (78%) in MAs allowing this activity, respectively. Alternative D would provide the least opportunity for prescribed burning with 291,186 acres (73%) in MAs allowing this activity.

Indicator 3 – Acres in Management Area Allocations where Wildland Fire Use would be Allowed

The allocation of MAs would differ in the level of Wildland Fire Use opportunity they would provide to achieve management objectives. The application of Wildland Fire Use would be allowed in the Wilderness, Wilderness Study Areas, Remote Backcountry, White Rocks National Recreation Area, Alpine/Subalpine Special Area, the Green Mountain Escarpment, Research Natural Areas, and Ecological Special Areas MAs (Table 3.17-4).

Table 3.17-4: Management Area Allocations where Wildland Fire Use would be Allowed

Alternative	Acres (% of total)
Alternative A	92,417 (23%)
Alternative B	113,284 (28%)
Alternative C	146,424 (37%)
Alternative D	177,063 (44%)
Alternative E	159,703 (40%)

Management areas that allow wildland fire use include: Wilderness, Wilderness Study Areas, Remote Backcountry, White Rocks National Recreation Area, Alpine/subalpine Special Area, Green Mountain Escarpment, Research Natural Areas, and Ecological Special Areas

Alternative A would provide the least opportunity to use Wildland Fire Use as a management tool to achieve desired objectives among all of the alternatives with 92,417 acres (23%) in MAs allowing this activity. Alternative B would provide the second lowest opportunity to use this management tool with 113,284 acres (28%) in MAs allowing this activity. Alternative C would provide an intermediate opportunity to use this management tool with 146,424 acres (37%) in MAs allowing this activity. Alternative E would provide the second highest opportunity among the alternatives to use Wildland Fire Use as a management tool with 159,703 acres (40%) in MAs allowing this activity. Alternative D would provide the highest level of opportunity to use this management tool with 177,063 acres (44%) in MAs allowing this activity.

Cumulative Effects

The occurrence of wildfire is infrequent on lands immediately adjacent to the GMNF. Local fire departments work with landowners to suppress any wildfires that occur. Cooperative suppression efforts between federal, State, and local agencies would occur for wildfires that would threaten multiple landowners within the GMNF WUI area. The potential for risk of wildfire should be reduced on lands adjacent to the GMNF as a result of Forest efforts to reduce hazardous fuels within the WUI.

The level of prescribed fire or Wildland Fire Use activities that occurs on adjacent private lands is also a rare occurrence. Since the amount of acres that would have prescribed fire or Wildland Fire Use as a management tool on the GMNF is relatively low, the cumulative effects associated with these practices over the life of the planning period would be considered minimal. It is important to note, however, that 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 that are located adjacent to or near improvements.

3.18 SPECIAL FOREST PRODUCTS

Introduction

Special forest products (SFPs) are defined by the Forest Service as a subset of forest products that the agency permits to be sold, or used, from National Forest System (NFS) lands. They include:

- Non-timber vegetative products, such as mosses, fungi, bryophytes, roots, bulbs, berries, seeds, wildflowers, ferns, and transplants of shrubs
- Non-convertible timber products that cannot be measured in cubic feet of wood, such as Christmas trees, tree sap, boughs, bark, cones, burls, and transplants of trees
- Convertible timber products that can be measured in cubic feet of wood, such as posts, poles, rails, shingle and shake bolts, firewood, fence stays, mine props, and bow staves

Issue Statement

Concern is focused on the need for more guidance on how to address permits for gathering of SFPs. There were also concerns regarding the need for more guidance on what types of products can be gathered, where they can be gathered, and the availability of SFPs in general.

Indicator – Acres of Management Area Allocations that allow the Collection of Special Forest Products (Acres of Availability)

The indicator to be used in this effects analysis is acres of availability. This indicator highlights the differences between alternatives because the availability of lands for SFP gathering varies by alternative based on management area (MA) allocations and compatible uses. This indicator can also serve as a means of general discussion on availability for various types of uses.

While gathering of several types of products, such as Christmas trees and sugar maple sap, are traditional uses within the GMNF, there were no public concerns raised regarding their sustainability and availability. In addition, data gathered since 1999 suggests that gathering of these products happens at a fairly low intensity. Consequently, specific products will not be discussed in detail.

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the Green Mountain National Forest. This area represents NFS lands where SFPs can be managed and where different management emphases can have effects on availability of these products. The analysis area for cumulative effects consists of GMNF lands and the lands administered by other owners, both public and private, within the GMNF Proclamation Boundary.

3.18.1 Affected Environment

Introduction

Gathering SFPs allows people to fulfill cultural needs, live off the land, and supplement their income (Emery 1997, 1999). It is a way of life for many people in economically depressed areas. It serves as one of many sources of income, and although the amount of money generated is small, it may be a critical part of some people's household income (Emery 1997, 1999).

Currently, the Forest Service is managing SFPs in response to an increased interest in gathering. National forests have been directed to design and implement programs that provide SFPs for public needs at sustainable levels. At the same time, the Forest Service is charged with providing these products without compromising the integrity of ecosystems.

The types of products gathered on the GMNF are varied. Based on interactions with gatherers, and infrequent requests for gathering information or permits, gathering of SFPs is assumed to be of limited quantity and extent. Maple tapping, gathering of conifers for Christmas trees, and firewood gathering are the most common traditional uses within the GMNF. Although the Forest Service is aware of a diversity of products in which the public has expressed interest, there is little known about the extent of interest or use of these or other SFPs on the GMNF.

Existing Forest Plan Management Direction

The 1987 Forest Plan does not list any goals, objectives, standards, or guidelines for the management or sustainability of special forest products as a group. Consequently, Forest Service policy governs how the gathering of special forest products is administered on the Forest.

Under Forest Service policy, permits are generally not required for gathering of minor amounts of products, such as cones, mushrooms, berries, acorns, or nuts, as long as these products are intended for personal use, and as long as they can be harvested sustainably. This type of gathering is described as incidental or free use. There is currently no requirement to track the incidental use of special forest products.

Permits are required for products that are gathered in larger amounts, involve improvements on the ground, are intended for sale by the gatherer, have value that can be appraised and recovered by the government, are in limited supply, or otherwise require controls on use in order to maintain viability of species or sustainability of gathering. Such permits are issued for either personal use or for commercial use (products intended for sale by the gatherer). When products are gathered for commercial use, both a special forest product permit and a special use permit are required.

Within the last five years, special forest product gathering that requires a permit also requires the development of a product plan that governs the sustainable harvesting of that product. Such plans specify any restrictions on amounts that can be gathered, location of gathering, time of year, and other related constraints, which are then entered into a database. Restrictions in these plans are built into the permits, and permittees are required to comply with them. Data on permits for special forest products that were issued before this new database was implemented are not readily available.

The 1987 Forest Plan includes a goal that identifies the desire to have wild fruits (for example, blueberries and apples) available for public use and enjoyment, and identifies standards and guidelines for fruit and berry management. There are currently no permits required for this type of personal use by individuals.

Collection of special forest products that require permits is generally inconsistent with Forest Service policies on management of Research Natural Areas (RNAs), candidate Research Natural Areas (cRNAs), and Wilderness (MA 5.1). Consequently, these activities would generally not be allowed in the five Special Areas on the Forest identified in the 1987 Plan as candidate RNAs (MAs 8.1D, 8.1E, 8.1I, 8.1K, and 8.1M). Permits may be allowed within RNAs/cRNAs for research collection. Changes to vegetation are to be left to natural processes in Primitive Areas (MA 6.1), and so collection of products requiring permits is generally inconsistent with this management area as well. New permits for collection are not allowed in Newly Acquired Lands (MA 9.2), although permits and uses that existed on the land at the time of purchase can generally continue. The remainder of the Forest is generally open to the collection of special forest products, depending on permit restrictions.

Collecting plants that are listed as Regional Forester Sensitive Species by the GMNF, or threatened or endangered by the State of Vermont, is prohibited by Forest Service policy.

Proposed Changes in Management Direction Common to All Alternatives

The revised Forest Plan seeks to address the lack of any programmatic direction for special forest products through Goal 8, which provides for a sustainable supply of forest products. An objective was added to this goal that seeks to provide sustainable opportunities for harvest of special forest products. In addition, a Forest-wide standard and guideline were added specifying when permits for collection of certain products will, or may be, required, in order to better monitor the uses on the Forest.

Management areas in the revised Forest Plan also specify when restrictions on gathering of special forest products exist. Gathering of special forest products for commercial sale is prohibited in Wilderness, Remote Backcountry Forest, Alpine/Subalpine Special Areas, RNAs/cRNAs, Ecological Special Areas, Recreational Special Areas, Wilderness Study Areas, and Newly Acquired Lands (Table 3.18-2). As noted earlier, Forest Service policy on management of Wilderness and RNAs/cRNAs further restricts collecting to incidental use in those areas, with limited exceptions allowed in RNAs/cRNAs for gathering by permit for research purposes. In addition, Remote Wildlife Habitat, Escarpment, Remote Backcountry Forest, Alpine/Subalpine Special Area, and Ecological Special Area management areas require that any collecting of special forest products be consistent with the desired future condition of the areas, which will place some limitation on the size and scale of gathering activities (Table 3.18-2). As in the 1987 Forest Plan, the Newly Acquired Lands management area typically allows for existing permit uses but not new permit uses.

The revised Plan removes language in objectives that emphasizes fruit or berry management for human uses, although there are no prohibitions to these uses.

Existing Condition

Introduction

Limited information has been gathered over the last 15 years on the amount of special forest products collected or the effects of collecting on various species and their habitats. The Forest Service currently issues permits for collection of eight products on the GMNF, including maple sap, Christmas trees, boughs, saplings, seedlings, dead/down wood, miscellaneous sawtimber/pulp, and firewood. While some of these products are gathered for commercial purposes, most are for personal use. Because these products require permits, they are tracked by the Forest Service, although data needed to estimate 15-year trends in use of these products has not been readily available.

Over the past five years, permits issued have declined from 289 issued in 2000, to 177 issued in 2004. The vast majority (>90%) of permits are issued for individual Christmas tree gathering and for firewood, with gathering of Christmas trees representing the greatest number of permits (60-70%). Firewood gathering has averaged about 154 cords per year over this five-year period, and appears to have declined slightly over that time. The Forest Service currently manages five tapping permits for sugar maple sap on the GMNF. Four of these permits are on the North Half of the Forest and one is in the South Half. Over the last 17 years, the number of sugar maple sap permits has varied from two to three in 1987, to a high of ten in the middle 1990s. Permits for remaining products tracked by the GMNF, such as boughs or seedlings, vary in number from year to year, but generally account for around 10 to 20 permits per year. Based on the limited amount of gathering of these products over the last 15 years and the fact that they are governed by product plans, the use of these products appears sustainable.

No tracking is currently done on incidental use of special forest products, which is likely due to the perceived low-level of use or interest on the Forest. It is known that there are a number of types of these “minor” products that are gathered from the GMNF, based on an informal survey of Forest Service staff. There is no information

available, however, to suggest quantities of products gathered or levels of use, although levels and amounts are perceived to be low. Consequently, no trends can currently be described for these special forest products on the GMNF.

It is known that gathering of ginseng (*Panax quinquefolius*) and other medicinal plants has increased greatly on national forests in the Lake States and Southern Tier over the last 15 years. Ginseng is known from the GMNF, and there is anecdotal information to suggest that it is collected at low levels on the GMNF due to its low abundance and limited habitat on the Forest. Ginseng is listed as a RFSS for the GMNF, however, and its gathering is prohibited on NFS lands. Limited monitoring of known populations of ginseng on the Forest has indicated that some populations are impacted by gathering. The effects of the revised Plan alternatives on ginseng are described in the Biological Evaluation (Appendix E).

Acres of Availability

Acres of availability depend on the administrative approval for use of a certain SFP, suitability of the land base for certain SFPs, and the actual desired location for the desired product. There are also two types of uses to consider in this analysis: those not requiring a permit and so described as incidental use, and those requiring a permit, either for personal use or commercial resale.

Incidental Use Gathering

Incidental gathering of small amounts of minor products, such as cones, mushrooms, berries, acorns, or nuts, is generally considered free use not requiring a permit. To the extent that use of these types of products does not cause notable damage to the environment or certain areas, the gathering of these products tends to be allowed across the entire Forest, and so is not constrained by administrative approval or to certain locations. The only constraint is how these products are distributed naturally across the Forest. Consequently, all 401,000 acres of the GMNF are considered currently available for incidental use of minor products (Table 3.18-1). Until a comprehensive assessment is completed, it is the assumption of the Forest Service that current use levels of products that do not require a permit are acceptable, are not causing damage, and are compatible with management direction for all areas of the Forest.

Personal and Commercial Use Permit Gathering

The types of uses requiring permits on the GMNF involve some level of wood or plant cutting and removal, and occasionally the products are intended for resale (for example, maple sap for syrup production; hardwood saplings for rustic furniture, and boughs for wreathes). All of the products sold for commercial use on the GMNF are sold to individuals that have small commercial enterprises, rather than moderate to large-sized businesses.

Uses requiring a permit involve a greater level of environmental alteration and so are further constrained by the management areas in which they may occur. Under the 1987 Plan, there is no distinction between commercial use and personal use for gathering that requires a permit. Due to MAs that restrict or prohibit SFP gathering (161,000 acres), there are approximately 240,000 acres available for gathering that requires a permit (Table 3.18-1).

Like gathering for incidental use, suitability for gathering that requires a permit on these acres may be constrained by the capacity of the land to produce the desired products sustainably, or the ability of the Forest Service to manage these uses.

Table 3.18-1: Current Acres Available for Various Types of Special Forest Product Uses

Special Forest Product Use	Acres
Incidental Use	400,692
Personal Use by Permit	239,826
Commercial Use by Permit	239,826

Source: GMNF GIS data

3.18.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Effects Common to All Alternatives

The effects of the changes in management guidance in the revised Plan will be the same across all alternatives, and will generally be positive. The 1987 Forest Plan has limited direction for special forest products management in general, and for fruit and berry management. The revised Forest Plan is designed to provide more general guidance and direction in the area of special forest products management. The objective under Goal 8 requiring sustainable opportunities for harvest of special forest products will necessitate an analysis of the products being used and their characteristics, values, and trends. Over the next planning period, this will help the Forest Service identify which species require permits and what permit rules should apply. This will lead to greater certainty both within the Forest Service, and among the public, regarding which products can be collected, in what locations, and what type of permit or restrictions are needed.

The removal of language in the revised Forest Plan regarding specific expectations for fruit and berry management provides increased flexibility for managers, which is also a positive effect. Public interest in certain forest products, and budgets for management of these products, can fluctuate widely over the planning period. Keeping Forest Plan direction for SFP management more general at this time recognizes these fluctuations and allows managers to adapt to changing public interests and program priorities. Management for these products is not curtailed or otherwise restricted by focusing on general management guidance, and so there are no direct or indirect effects to these products as a result of the changes in guidance in the revised Forest Plan.

Regardless of alternative, proposals for gathering that would require a permit for personal or commercial use would be governed by individual product plans that specify constraints on collection, as well as by Forest-wide direction for sustainability and resource protection. The level of gathering that requires a permit is fairly low on the Forest currently and is generally restricted to small areas and small quantities of products, such as firewood and boughs. Commercial uses are expected to remain small-scale and local. Ground disturbance from these activities is expected to be minimal because most activities disturb only vegetation and do not involve heavy machinery. Consequently, while there may be differences among alternatives in acres of availability, few environmental consequences are anticipated from these types of gathering.

Indicator – Acres of Management Area Allocations that allow the Collection of Special Forest Products (Acres of Availability)

Effects Common to All Alternatives

<u>Incidental Use Gathering</u>

The entire GMNF would be open to incidental gathering for personal use of SFPs, regardless of alternative (Table 3.18-3). Given the limited levels of such use that appears to take place on the Forest currently, free incidental use is not expected to have notable environmental consequences in any of the alternatives. Revised Plan direction to provide sustainable opportunities for gathering of special forest products would help to gauge whether any incidental uses are reaching thresholds of sustainability, which would lead to adjustments in management of these products.

Over the next 15 years, some products gathered for incidental use may become highly valued, enough to lead to the need for permitting. Such changes in administration of these products are usually documented in supplements to the Forest Service Manual system. If such a change were to happen, the effects associated with permit gathering would then apply. The Forest Service does not anticipate any products known to be gathered at this time to increase in value, enough to warrant a change from incidental use to requiring a permit for use.

Personal and Commercial Use Permit Gathering

Management areas vary in what types of permit gathering they allow, prohibit, or otherwise constrain (Table 3.18-2). Because management area allocation varies by alternative, the acres of land available for special forest products gathering also vary by alternative. This variation in acres of availability is expected to result in little to no variation in effects by alternative and effects are predicted to be inconsequential.

Acres of availability are shown in Table 3.18-3. Lands available for personal use permit gathering are similar across all alternatives, representing about 85 percent of the Forest. Additional restrictions may apply to some of these lands; lands with such restrictions range from around 10 to 30 percent by alternative, with the fewest restrictions in Alternative C and the greatest in Alternative A. Even under Alternative A, however, about 75 percent of the Forest would still be available for these types of uses without additional management area restrictions. Given the low level of current and historical use, it is likely that all alternatives would supply an adequate amount of land for personal use gathering.

Lands available for commercial use permits vary by alternative from approximately 66 percent to 83 percent of the Forest (Table 3.18-3). Alternative B provides the greatest acres available, but also has the highest number of acres with additional restrictions. Alternative D provides the least number of acres available, and the next highest number of acres with additional restrictions. Alternatives B and C provide the least number of restricted acres for commercial use. Even under Alternative D, however, more than half of the Forest remains open to commercial use without additional management area restrictions. Commercial use gathering is even less prevalent on the Forest than personal use gathering, and so it is likely that all alternatives would supply an adequate amount of acres available for commercial gathering.

Cumulative Effects

There is no comprehensive assessment or readily available data on special forest product gathering in Vermont. There also is no data on special forest product uses, ecology, values, or trends on the GMNF and within Vermont. Without this data it is difficult to determine the Forest's contribution to or importance in the region for this activity, as well as whether a particular product and its supporting habitat can sustain long-term gathering. It is clear that the GMNF represents a substantial proportion of public lands within Vermont and represents about all of the public lands in southern Vermont. Private landowners often restrict special forest product gathering on their property due to concerns for liability or for their natural resources. Consequently, the GMNF is an important provider of opportunities for special forest product gathering to the public.

Past actions that have contributed to the availability of SFPs on and off the Forest include creation and maintenance of open areas for berry picking, maintenance of historic orchards, and general forest management that creates a variety of habitats for plant species of different sizes, shapes, and quality. On the GMNF, these actions have produced a history of special forest product use, and expectations that these uses will continue. The lack of general guidance in the 1987 Forest Plan leads to the perception that these products are limitless and always available, when in fact this may not be the case.

The guidance provided in the revised Forest Plan for management of special forest products, which is the same across all alternatives, will ultimately lead to improved likelihood of sustainable management of SFPs on the GMNF. As more is learned about the SFPs gathered on the Forest, those products that appear to be at risk for sustainability will be identified, and their uses will be limited to sustainable levels. Some products that are currently gathered for incidental use may gain value over time, or may become more abundant and able to support additional gathering. Others may start to decline in abundance. In these cases, SFPs may be identified as needing permits due to these changes, and product plans will be developed to identify constraints and limits on collection.

While the alternatives vary in the proportion of the Forest available for SFPs gathering, all alternatives offer opportunities for most types of gathering on at least half of the Forest. Personal use permit gathering is available on more than 75 percent of the Forest across all alternatives, which is a substantial majority of the land. Given that the areas available are widespread across the Forest, it is likely that gatherers will find opportunities, and public expectations will be met, across much of the Forest.

Maintaining a substantial proportion of the Forest open for gathering of SFPs will also ensure that there are abundant opportunities for gathering provided in the GMNF Proclamation Boundary. With limits on availability of private lands for gathering, and with low levels of current use on the GMNF, there is much room for sustainable growth in this use of the Forest.

Table 3.18-2: Types of Special Forest Products Uses Allowed Within Each Management Area of the Revised Plan.

Management Area	Incidental Use	Personal Use Permit	Commercial Use Permit
Diverse Forest Uses	X	X	X
Diverse Backcountry Forest	X	X	X
Alpine Ski Areas	X	X	X
Appalachian Trail	X	X	X
Long Trail	X	X	X
White Rocks NRA	X	X	X
Moosalamoo Area	X	X	X
Alpine Ski Expansion Areas	X	X	X
Eligible/Potential Wild, Scenic and Recreational Rivers	X	X	X
Remote Wildlife Habitat	X	*x*[1]	*x*[1]
Green Mountain Escarpment	X	*x*[1]	*x*[1]
Recreation Special Areas	X	X	
Wilderness Study Areas	X	X	
Remote Backcountry Forest	X	*x*[1]	
Research Natural Areas/Candidate Research Natural Areas	X	*x*[1]	
Alpine/Subalpine Special Area	X	*x*[1]	
Ecological Special Areas	X	*x*[1]	
Newly Acquired Land	X	*x*[2]	*x*[2]
Wilderness	X		

[1] Use of Special Forest Products is restricted by specific management area direction.
[2] New permits are prohibited in Newly Acquired Lands; existing permits are allowed

Table 3.18-3: Acres Potentially Available for Various Types of Special Forest Product Uses by Alternative.

Types of Special Forest Product Use	Alt. A Current Management	Alt. B	Alt. C	Alt. D	Alt. E
	(acres)	(acres)	(acres)	(acres)	(acres)
Incidental Use[1]	400,692	400,692	400,692	400,692	400,692
Personal Use Permits (Restricted Acres)[2]	341,691 (102,661)	341,691 (40,643)	341,691 (40,322)	341,691 (86,986)	341,691 (80,164)
Commercial Use Permits (Restricted Acres)[3]	330,947 (92,003)	337,646 (15,009)	310,100 (14,211)	288,683 (59,897)	302,769 (44,835)

Source: GMNF CDS and GIS data
[1] Incidental use is allowed in all management areas
[2] MAs that allow gathering under personal use permits include: Diverse Forest Use (DFU), Diverse Backcountry Forest (DBF), Alpine Ski Areas and Expansion Areas (SKI), Appalachian Trail (AT), Long Trail (LT), White Rocks NRA (NRA), Moosalamoo Area (MRA), Eligible or Potential Wild, Scenic and Recreation Rivers (WSR), Recreation Special Areas (RSA), Wilderness Study Areas (WSA), Remote Wildlife Habitat (RWL), Green Mountain Escarpment (ESC), Remote Backcountry Forest (RBF), RNAs/cRNAs (RNA), Ecological Special Areas (ESA), and Newly Acquired Lands (9.2); MAs with additional restrictions include: RWL, ESC, RBF, RNA, ESA, and 9.2.
[3] MAs that allow gathering under commercial use permits include: DFU, DBF, SKI, AT, LT, NRA, MRA, WSR, RWL, ESC, and 9.2; MAs with additional restrictions include: RWL, ESC and 9.2.

3.19 MINERALS

Issue Statement

Public concern is focused on whether or not mineral and gravel extraction should be allowed on the Forest and the impacts of extraction activities. Other concerns expressed are the continuation of hobby extraction, including panning for gold. The impacts of mineral extraction activities on other resources are addressed in respective sections in this chapter.

Indicator 1 – Acres of Management Area Allocations Open to Surface Occupancy

The indicator to be used in this effects analysis is the number of acres of management area (MA) allocations that would be open to surface occupancy under each alternative. Surface occupancy is ground disturbance that occurs when conducting mineral extraction activities. The MAs open for surface occupancy and not restricted to administrative use only are Diverse Forest Use, Diverse Backcountry, and Moosalamoo Recreation and Education Area. Administrative use is permitted in Remote Wildlife Habitat and Recreation Special Area MAs. This indicator highlights the differences between alternatives because MA allocations allowing surface occupancy will vary by alternative.

An increase in the number of acres allowing surface occupancy would increase the potential opportunity for mineral and gravel extraction.

Analysis Area

The analysis area for direct, indirect, and cumulative effects includes all federal land managed by the Green Mountain National Forest. This area represents National Forest System (NFS) lands where gravel resources exist, and the lands that could receive impacts from surface occupancy.

3.19.1 Affected Environment

Introduction

The majority of mineral commodities produced in Vermont are industrial minerals. Vermont's rock and mineral based industries are important both historically and economically. The Vermont Limestone Marble belt is where the majority of marble, limestone, and dolomite resources occur in the State. This belt extends north from mid-Bennington County for approximately 100 miles. Most of Vermont's marble production comes from both Rutland and Bennington Counties. Limestone is quarried regionally for both crushed stone and dimension stone application (Romito 2004). Western Rutland County has a slate belt, and slate is quarried in the Poultney and Fair Haven areas.

Stream and glacial deposits of sand and gravel occur on the Green Mountain National Forest; however, there are no known large deposits on the Forest. The sand and gravel industry is not a major presence on the Forest, and therefore future production is expected to continue on a small-scale or for local uses only (Romito 2004). Types of sand and gravel operations that may occur are test pits, site preparation, extraction, crushing, and site reclamation. Towns have used gravel pits to a limited extent under permit on NFS lands over the past planning period.

Gold deposits in Vermont have been known since the 1850s. They have always been relatively small, erratically occurring, and economically marginal deposits, however. Some small amounts of gold-bearing quartz have been found, but the majority of Vermont's gold deposits are placer, deposited by glaciers and usually found in the gravel beds along stream bottoms (Romito 2004). Relatively small amounts of quartz crystals have been found on the Forest.

Mineral commodities do not occur, or have not occurred in commercial quantities, on the Forest. Large-scale commercial extraction, therefore, is not foreseen as occurring on the Forest in the near future (Romito 2004).

Existing Forest Plan Management Direction

The 1987 Forest Plan does not have a minerals goal. An objective of the 1987 Plan is to provide for mineral exploration on the Forest with special or standard restrictions. To ensure compatibility with use and management of surface resources, four categories of restrictions were established in the 1987 Plan:

- Category 1: Mineral extraction would not occur on Wilderness lands or National Recreational Area lands, as required by legislation.
- Category 2: On newly acquired lands, decision on minerals beneath these areas would be deferred until further study is done and a decision made how to best manage these lands.
- Category 3: No surface disturbing exploration or extraction would be allowed in areas managed for primitive recreation, ecologically sensitive areas, and the softwood component of deer wintering areas.
- Category 4: Limited occupancy for exploration and extraction of minerals would be allowed, following stipulations to ensure resource protection and additional National Environmental Policy Act review.

The collection of mineral specimens, including gold panning, is permitted for personal use and not as a commercial activity.

The 1987 Forest Plan standards and guidelines provided more specific direction pertaining to what lands would be open to surface disturbing mineral activities. Direction focused on leasable minerals (oil, gas, and hard rock deposits) and common variety minerals (sand and gravel). Management area standards and guidelines provided further direction on where, and under what conditions, mineral development could occur.

Proposed Changes in Management Direction Common to All Alternatives

Unlike the 1987 Forest Plan, the revised Forest Plan will not have a specific objective for minerals. The revised Forest Plan addresses mineral resources through Forest-wide standards and guidelines and management area standards and guidelines only. The standards and guidelines in the revised Forest Plan will not include regulatory direction that can be found in laws, regulations, and directive systems.

The revised Plan will follow 1987 Plan direction by prohibiting surface disturbing mineral activity in Wilderness and National Recreational Area MAs, as required by legislation. Management area standards and guidelines will now only allow surface occupancy in Diverse Forest Use, Diverse Backcountry, and Moosalamoo Recreation and Education Area. Administrative use could be permitted in Remote Wildlife Habitat and Recreation Special Area MAs.

The public will continue to be able to collect mineral specimens in all management areas, including gold panning, for personal use and not as a commercial activity.

Existing Condition

Many of the mineral commodities in Vermont do not occur, or have not been known to occur, in commercial quantities on the Green Mountain National Forest. Large-scale commercial extraction is not foreseen as occurring on the Forest in the near future (Romito 2004).

An insignificant amount of recreational gold panning occurs in streams throughout the Forest. The likelihood for any commercial interest in these deposits is minimal.

The Devils Den area on the South Half of the Forest was used for recreational mineral collecting of quartz crystals. Due to public safety and soil erosion, the Devils Den area was closed for the purpose of disturbing the ground surface or sub-surface, damaging vegetation, or removing any natural feature including mineral specimens and crystals. The area was rehabilitated.

There is a talc mine located on the North Half of the Forest which is a known winter hibernacula for the Eastern Small-Footed bat and other northeastern woodland bats. Presently this mine is closed to the public.

Presently the only sand and gravel pit under permit is in the Town of Goshen. This gravel pit is approximately five acres in size and the gravel extracted is used to maintain Town of Goshen highways.

There are five active, administrative sand and gravel pits on the Forest that vary in size from one to five acres. These pits are used by the Forest Service for the maintenance and restoration of National Forest System roads and parking areas that provide access to the National Forest. It is anticipated that future production will continue to be small scale for local uses only (Romito 2004).

3.19.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Indicator 1 – Acres of Management Area Open to Surface Occupancy

Effects Common to All Alternatives

Surface occupancy is allowed in five management areas: Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Recreation Special Areas, and Moosalamoo Recreation and Education Area (Table 3.19-1). Surface occupancy associated with leasable minerals is not expected to vary by alternative since they do not occur, or have not occurred, in commercial quantities on the Forest (Romito 2004).

There is a difference in the number of acres in each management area that allows for surface occupancy. This difference is negligible since the actual surface occupancy could only occur in areas geologically favorable for sand and gravel development.

Alternative A

Under Alternative A, surface occupancy could occur on 195,496 acres (49%). This alternative would have the most land designated in management areas that preclude surface occupancy.

Alternative B

Under Alternative B, surface occupancy could occur on 266,868 acres (67%). Alternative B would provide the greatest opportunity for development of mineral resources because it would have the most land designated in management areas that allow for surface occupancy.

Alternative C

Under Alternative C, surface occupancy could occur on 233,857 acres (58%). Alternative C would provide a level of opportunity for development of mineral resources between that of Alternatives B (highest development opportunity) and E (mid-range development opportunity).

Alternative D

Under Alternative D, surface occupancy could occur on 205,453 acres (51%). Alternative D would provide a level of opportunity for development of mineral resources between that of Alternatives E (mid-range development opportunity) and A (lowest development opportunity).

Alternative E

Under Alternative E, surface occupancy could occur on 221,313 acres (55%). Alternative E would provide a level of opportunity for development of mineral resources between that of Alternatives C and D.

Cumulative Effects

Cumulative impacts under all of the alternatives would be the combined effects of all phases associated with typical sand and gravel operations. Types of activities that may occur are test pits, site preparation, extraction, crushing, and site reclamation. Current and past extraction activities have been primarily for Forest Service and limited town use. Given that there are no known large deposits on the Forest and the sand and gravel industry is not a major presence on the Forest, it is anticipated that future production will continue to be small-scale for local uses only (Romito 2004). This limited historical use, combined with limited available resources on the Forest, is anticipated to continue with negligible cumulative effects.

Table 3.19-1: Acres Open To Surface Occupancy

Management Areas	Alt. A No Action	Alt. B	Alt. C	Alt. D	Alt. E
	(acres)	(acres)	(acres)	(acres)	(acres)
Diverse Forest Uses	110,271	195,403	120,778	104,027	118,717
Diverse Backcountry	85,139	59,193	94,497	59,082	59,665
Remote Wildlife Habitat[1]	0	12,115	5,723	42,187	30,399
Recreation Special Area[1]	86	157	157	157	157
Moosalamoo Recreation & Education Area			12,702		12,375
Total	**195,496**	**266,868**	**233,857**	**205,453**	**221,313**

Notes: [1] Surface occupancy allowed for administrative use only.

3.20 ROAD MANAGEMENT

Issue Statement

Public concern is focused on how the Forest Service plans for and manages roads and transportation systems on the Green Mountain National Forest (GMNF). Management includes road construction, reconstruction, closure, and usage (the purpose for which roads may be used). Management also implies maintaining the existing road system on the GMNF to provide safe and sufficient access to the Forest while minimizing harmful impacts to the environment. The impacts associated with management of the road system are addressed in respective sections in this chapter, for example, the Recreation Opportunities section (3.10), Soils section (3.2), Water section (3.3), and the Non-Native Invasive Species subsection (3.5.4).

Indicator – Acres by Management Area Allocation that Allow Road Development and Construction

The indicator to be used in this effects analysis is the number of acres by management area (MA) allocation that allow road development and construction. This indicator highlights differences among alternatives because management area (MA) allocations that allow for new road development, temporary road development, and road maintenance vary by alternative.

Analysis Area

The analysis area for direct and indirect effects includes all federal land managed by the GMNF.

The analysis area for cumulative effects includes all GMNF lands and transportation systems, and the adjacent lands administered by other owners, both public and private, with transportation systems that link to, or are directly affected by, actions taken on GMNF lands.

3.20.1 Affected Environment

Introduction

The transportation region surrounding the GMNF can be characterized as a rural road system. There are no freeways, interstates, or expressways that cross the area. Paved State roads and paved and graveled town roads typify the roadway network. The major roads are US 7, VT 7A, US 4, VT 125, VT 155, VT 116, VT 100, VT 73, VT 140, VT 11, VT 30, VT 8, and VT 9. The surrounding road system in connection with the Forest road system provides adequate access to public and private lands in and around the Green Mountain National Forest.

Roads may be used for a variety of purposes. Primary uses include recreation, forest management activities, and access across Forest Service lands to private inholdings. Recreation use is by far the largest category. It includes such purposes as access for hiking, hunting, fishing, skiing, camping, swimming, boating, visiting cultural sites, gathering forest products, reaching areas of quiet and solitude, and driving for pleasure. Access is needed for forest management activities including logging, wildlife habitat management and restoration, law enforcement, gravel extraction, special uses, and other forest administrative activities.

In January 2001, a new Forest Service road policy was adopted, the Transportation Final Rule and Administrative Policy, which was intended to prevent road development in inventoried roadless areas and required national forests to complete a thorough road analysis process (RAP) (USDA 2001c). The RAP would determine the minimum road system needed, establish transportation management objectives and priorities, and identify any unneeded roads.

The Forest Service completed an initial RAP in January 2003 (USDA 2003a). This analysis

was completed for higher-maintenance level roads, including Forest Service system roads, and State and townships roads. Subsequent Travel Analysis will be completed for lower-maintenance level roads at the project or watershed level. The RAP is not a binding decision-making process; it is intended to guide future project-scale analyses by identifying conditions, changes, and effects relevant to implementing forest plans. As such, it provides useful information for the GMNF Forest Plan revision process.

New road construction on National Forest System (NFS) lands has decreased in the past 10 to 15 years due to the amount of adequate road access already available to Forest users (USDA 2003a). Also, management area (MA) designations limited the amount of road-building that could be done overall. Many timber sales now use existing roads and/or create temporary winter log truck roads that need very little surface preparation due to frozen ground conditions that are most often required for their use.

Road construction and reconstruction has focused on remedying environmental problems and other concerns regarding recreation use and vegetation management. In the last ten years, no road construction has occurred to provide public access to isolated areas surrounded by private land, and no new temporary roads have been built. Some people have expressed frustration about not having road access to parts of the Forest for hunting or recreational purposes. Others have not agreed with the closure of existing roads for resource protection reasons.

Road maintenance is an important and necessary component for providing safe and durable access to the Forest. Some roads have been closed or access reduced due to lack of road maintenance funds or management decisions to limit visitors. Some roads are more expensive and difficult to maintain than others. These factors as well as resource impacts and level of use play a part in the road system planning process.

Existing Forest Plan Management Direction

In general, the 1987 Forest Plan management direction suggests the following:

- Analysis will be conducted to determine transportation needs and objectives.
- Items considered within transportation studies will include: access, transportation facilities, traffic volumes, timber and wildlife needs, and economic and environmental effects.

The 1987 Forest Plan outlines a number of goals that were set forth to determine the transportation system needs for the Forest. These goals call for a roaded but naturally appearing environment to provide safe, legal, and easily identifiable access and parking for recreationists. The vast majority of roads used by recreationists are single lane, local roads. Construction and maintenance of these roads is based on a priority that first, eliminates or controls resource damage, second, provides legal access to NFS land that is separated from roads by private lands, third, meets demands for roaded recreation, and last, allows access for timber management.

The transportation system objectives stated in the 1987 Plan are generally quantitative in nature, stating how many miles of road would be targeted annually, or over the life of the Plan, for activities such as maintenance, construction, and reconstruction.

Forest-wide and management area standards and guidelines for the transportation system in the 1987 Forest Plan provide direction for management of roads such as road design, road closure, visual concerns, surfacing materials, and road density. The level of road management varies depending on the purpose of the MA and desired condition.

Forest Service roads are each assigned a maintenance level from 1 to 5 and management of the roads is determined by the objectives for the road. The maintenance levels are:

- Level 1 – Basic Custodial Care (Closed)
- Level 2 – High Clearance Vehicles
- Level 3 – Suitable for Passenger Cars
- Level 4 – Moderate Degree of User Comfort
- Level 5 – High Degree of User Comfort

In the 1987 Plan, road management considerations are also based on the categories Open and Closed. An open road is available for public use, including motorized vehicle access and recreational use. Roads closed to wheeled, motorized vehicles are generally open to hiking, ski touring, snowmobiling, and horseback riding, depending on the recreation opportunities and resource management activities allowable in a specific area. Road closures are generally signed and access is often controlled to prevent resource damage and protection of wildlife. The GMNF requires temporary roads, built for timber harvesting, to be decommissioned after the sales are closed.

Proposed Changes in Management Direction

The revised Forest Plan will continue the management direction for transportation systems provided in the 1987 Plan. The conceptual goals of the 1987 Plan are carried forward in the revised Forest Plan Goal 14, which calls for providing a safe, efficient, and effective system of roads and access that meets Forest Service and public needs.

The quantitative 1987 Plan objectives have been replaced with concise objective statements. The revised Plan objectives emphasize using design elements and standards to maximize economy, while meeting management direction for resource and environmental protection, and user safety. This will be accomplished by constructing or reconstructing roads to accepted federal and State standards.

There have been only minor enhancements to Forest-wide standards and guidelines for the GMNF transportation system. Standards still mandate the use of Forest Service manual direction and AASHTO Policy for road design. Some additional standards regarding drainage structures, stream crossings, and in-stream structures will clarify mitigation for free movement of aquatic life and fish. There is also further clarification on year-round or seasonal road restrictions.

Management area standards and guidelines for transportations systems provide explicit direction regarding road construction and use for each MA. Some key changes to management area standards and guidelines include the following:

- Direction regarding decommissioning of roads
- Further direction regarding road prohibitions and decommissioning in Wilderness Areas and Remote Backcountry Forest MAs
- Clarifying that new permanent roads are prohibited in Diverse Backcountry, except for administrative use or to provide access to private land; and that temporary roads are permitted
- Providing direction for the new Remote Wildlife Habitat MA
- Providing explicit standards and guidelines for each of the individual special areas, including the new Escarpment, Moosalamoo Recreation and Education Area, Ecological Special Areas, and Alpine/subalpine MAs, and for the Wilderness Study Areas MA

Existing Condition

In general, the existing Forest road system, in conjunction with local, private, and State highways, provides adequate access to publicly managed lands. The Green Mountain National Forest road system is comprised of approximately 434 miles of road, with approximately 250 miles (58%) under Forest Service jurisdiction and 184 miles (42%) under private, State, or town jurisdiction (Table 3.20-1). The roads under other jurisdictions are scattered throughout the Forest and are

essential links in the road system that provides access throughout National Forest System (NFS) lands. Resolving issues of jurisdiction is a key recommendation of the RAP.

The RAP also highlighted areas where the transportation network could be improved. Improvements could include more access points for dispersed access, additional trailhead parking, improving access to water bodies for the elderly or disabled, inventorying and installing road signs that meet the Manual of Uniform Traffic Control Devices standards (USDOT 2004), and relocating or reconstructing sections of road that are prone to washouts or need more effective buffer strips. The RAP found that the existing transportation system would not require additional roads to meet the current and future access needs. The RAP concluded that "*…the transportation system on the Green Mountain National Forest is currently meeting the strategic intent of the guidance in the current Forest Plan.*"

The issue of decommissioning unneeded roads was also looked at in the RAP. Generally, residents and road system users oppose decommissioning roads (permanent closure) but would support closing roads and preserving them for future use should the need arise. Closing or decommissioning roads, or implementing any of the improvements noted above, would occur as a result of site-specific analyses and decisions.

Another key finding of the RAP is the GMNF's budget constraints. Funded at well below the most efficient level, the Forest Service cannot meet maintenance requirements of the existing road system within current budgets. This has a direct bearing on how well the Forest Service can meet its transportation system goals and respond to issues and concerns.

Road density within the Green Mountain National Forest ranges from 0 to 0.39 miles per square mile, with the highest road densities occurring on the North Half of the Forest.

On the GMNF, 73 percent of the roads are categorized as open, 27 percent are categorized as closed. Several closed roads, however, may be temporarily opened for the hunting season as hunter access is one of the primary uses of the transportation system. Closed roads, while perhaps not appropriate for re-opening to wheeled traffic, may sometimes be considered for horseback riding, snowmobiling, hiking, and cross-country skiing.

The type of surfacing material has been shown to be an indicator of the potential for erosion and sedimentation for a road. Most of the roads (61%) in the GMNF have graveled surfacing (Table 3.20-1). Gravel material has typically been used to mitigate the effects of road-caused erosion and sedimentation. Paved roads (3% of all roads) have the least potential for erosion and sedimentation while roads constructed with a native surface (36% of all roads) have the most potential for erosion and sedimentation concerns.

Table 3.20-1: Road surfacing type for all roads and Forest Service roads in the Green Mountain National Forest, 2004.

Road Surface Type	All Roads (miles) (%)	FS Roads (miles) (%)
Paved	14.5 (3%)	4.2 (2%)
Gravel	264.2 (61%)	141.8 (57%)
Native	154.9 (36%)	103.6 (42%)
Total Miles	**433.6**	**249.6**

Source: INFRA Travel Route Data 2005

Green Mountain National Forest roads under Forest Service jurisdiction are each assigned a maintenance level from 1 to 5. Currently, most of the roads in the GMNF (102.9 miles, 41%), are maintenance class Level 2 (roads for high clearance vehicles). In addition, there are:

- 68 miles of road (27%) in Level 1: closed roads receiving basic custodial care
- 38.9 miles of road (15%) in Level 3: roads suitable for passenger cars
- 40.6 miles of road (16%) in Level 4: roads with a moderate degree of user comfort
- 2.5 miles of road (1%) in Level 5: roads with a high degree of user comfort

3.20.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Indicator 1 – Acres by Management Area Allocation that Allow Road Development and Construction

The level of concern and environmental impacts regarding management of the transportation system range from the lowest opportunity for road-related activities in Alternatives A and D, to moderate opportunities in Alternatives C and E, to the highest opportunity in Alternative B. Realizing that some roads could be decommissioned and closed in each alternative, while new roads could be constructed, it is expected that changes that could occur in the transportation system would be relatively small. This is also supported by the recent history of the GMNF, in that the trend has been little new road development and construction, and that this trend will most likely continue.

The total number of roads under Forest Service jurisdiction has increased due to an active and ongoing land acquisition program. In many cases, purchased lands came with existing road systems. The majority of effort will most likely be expended on maintaining or making minor improvements to the existing system to remedy erosion problems and to work toward meeting the goal of providing a safe, efficient, and effective transportation system.

The major focus of transportation management will be expended on maintenance and minor improvements to comply with current design and safety standards and corrections of environmental problems. These actions will be undertaken to provide a safe, efficient, and effective transportation system under all alternatives.

Effects Common to All Alternatives

Although there are variations among alternatives, all meet the intent of the revised Plan goal to provide for a safe, efficient, and effective road system. All five alternatives allow for the development and construction of temporary or permanent roads and maintenance of existing roads within the following Management Areas: Diverse Forest Use, Escarpment, Moosalamoo Recreation and Education Area, the White Rocks National Recreation Area, Recreation Special Areas, Alpine Ski Areas, Alpine Ski Expansion Areas, and the Recreational segments of Eligible Wild, Scenic, and Recreational Rivers.

Conversely, in all five alternatives, the development and construction of temporary or permanent roads and the maintenance of existing roads is either strictly prohibited, or restricted to varying degrees, within the following MAs: Diverse Backcountry, Remote Backcountry Forest, Remote Wildlife Habitat, Wilderness, Wilderness Study Areas, Appalachian Trail, Long Trail, Alpine/Subalpine Special Areas, Candidate and Existing Research Natural Areas, Ecological Special Areas, and the Wild and Scenic segments of Eligible Wild, Scenic, and Recreational Rivers.

Some MAs that restrict new permanent road construction will allow for maintenance of existing roads, maintenance and relocation of trailheads, and construction of temporary roads needed to achieve MA desired future condition objectives. These temporary roads will generally be closed and rehabilitated after use. The Remote Wildlife Habitat MA encourages minimal impacts from roads and generally prohibits construction of new permanent roads except for administrative purposes that include timber harvest; it allows temporary roads and skid trails. The Scenic segments within the Eligible Wild, Scenic, and Recreational Rivers MA, allow for maintenance of existing roads and will be managed for semi-primitive motorized uses but limit new motorized trails to those needed to cross the river segment and corridor. In all the exceptions noted above, the amount of road construction and use, permanent or temporary, is expected to be of

such low levels as to provide no consequence to the effects of implementing any alternative.

The road maintenance figures in Table 3.20-2 are shown to be relatively equal, ranging from 77 to 89 percent, for all alternatives. This is because road maintenance, although not commonly occurring in all management areas, is "allowed" in almost all MAs for certain situations like preventing or repairing resources damage, and therefore contributes to the permitted road maintenance acreage amounts shown in each alternative.

The following discussions by alternative, summarized in Table 3.20-2, compare the amount of road development allowable in each of the alternatives and discloses what effects can be anticipated.

Alternative A

The Newly Acquired Lands (MA 9.2) in the 1987 Forest Plan will not exist in the revised Plan, and as such, those acres can only be considered in Alternative A, the current management alternative. Permanent and temporary road development and maintenance is restricted on Newly Acquired Lands; maintenance is allowed only to prevent or repair resource damage.

Alternative A represents the current management situation for the GMNF. As such, the amount of acres allowing the potential for new road development (136,491 acres, 34%), and new temporary roads (221,630 acres, 55%) (Table 3.20-2), would be less than what may occur in the other alternatives. The existing Forest road system has provided adequate access to public and private lands in and around the GMNF, and based on projections for resource program growth under continuation of the current management situation, there would be little need for expanding the transportation system.

Alternative B

Alternative B would provide the most acres allowing the potential for new road development (235,628 acres, 59%), and new temporary roads (306,936 acres, 77%) (Table 3.20-2).

Table 3.20-2: Acres in management areas that allow road development and maintenance

	New Road Development[1]	New Temporary Roads[2]	Existing Road Maintenance[3]
	Acres (%)	Acres (%)	Acres (%)
Alt. A (Current Mgt.)	136,491 (34%)	221,630 (55%)	340,145 (85%)
Alt. B	235,628 (59%)	306,936 (77%)	356,514 (89%)
Alt. C	179,299 (45%)	279,519 (70%)	329,445 (82%)
Alt. D	159,068 (40%)	260,337 (65%)	309,006 (77%)
Alt. E	182,681 (46%)	272,745 (68%)	331,332 (83%)

[1] Management Areas allowing new road development include: Diverse Forest Use, Escarpment, Moosalamoo Recreation and Education Area, the White Rocks National Recreation Area, Recreation Special Areas, Alpine Ski Areas, Alpine Ski Expansion Areas, and the recreational segments of Eligible Wild, Scenic, and Recreational Rivers.
[2] Management Areas allowing new temporary road development include: Diverse Forest Use, Diverse Backcountry, Remote Wildlife Habitat, Escarpment, Moosalamoo Recreation and Education Area, the White Rocks National Recreation Area, Recreation Special Areas, Alpine Ski Areas, Alpine Ski Expansion Areas, and the recreational segments of Eligible Wild, Scenic, and Recreational Rivers.
[3] Management Areas allowing maintenance of existing roads include all the areas in footnote 2 above in addition to: Remote Backcountry, Appalachian Trail, Long Trail, Ecological Special Areas, and the scenic segments of Eligible Wild, Scenic, and Recreational Rivers.
Source: GMNF GIS Alternative A-E MA Layers.

Alternatives C and E

Alternatives C and E would provide moderate amounts of acres allowing the potential for new road development (179,299 acres (45%) in Alternative C; 182,681 (46%) in Alternative E) and new temporary roads (279,519 (70%) in Alternative C; 272,745 (68%) in Alternative E), when compared to Alternatives A and B.

Alternative D

Alternative D would provide the second lowest opportunity for the potential for new road development (159,068, 40%) and temporary new roads (260,337, 65%).

Cumulative Effects

Analysis of cumulative effects looks at past, present, and reasonably foreseeable future actions. Following direction in the 1987 Forest Plan, there has been relatively little new road construction in the 18 years of Plan implementation to date. The 1987 Plan emphasizes reconstruction and maintenance of the existing transportation system, and restoring roads with environmental resource problems. Over the past 18 years, 19.9 miles of road have been restored to meet their approved road management objective, 10.1 miles have been reconstructed, and 6.6 miles have been constructed; these figures do not include parking areas (USDA 2004). No road construction or reconstruction has occurred since 1997 except to provide a small number of parking spaces where needed.

No temporary roads have been constructed d the past 10 years. Construction of logging roads for timber harvest by loggers has also been minimal. These roads are not generally open to the public and are rehabilitated after use. Miles of road maintenance have also been well below predicted levels because of reduced budgets.

Basing predictions for new road development in the foreseeable future on what has occurred over the past Plan period follows the logic that construction of new permanent or temporary roads is not expected to differ much from that of the recent past.

New road development and improvements on adjacent public and private lands have been minimal and are expected to continue as such. Access to the GMNF transportation system comes from a number of different directions, and occasionally these “gateways” see improvements. The western portion of the Bennington Bypass opened recently and helps facilitate access to the southern portion of the Forest. Additional segments of that project are planned for the future. A section of Vermont Route 9, west of Wilmington, Vermont, was recently reconstructed. There has been discussion and planning regarding other State and local projects such as the Wilmington Bypass, improvements to the north-south Route 7, and other improvements to various town roads. These types of improvements may make it easier to access parts of the Forest but are not likely to contribute to a measurable increase in use.

Based on the relatively minor potential increase in new road development, temporary new roads, and road maintenance, through current projects or in the foreseeable future, there would be no measurable cumulative impact in regards to the issue of planning for and managing roads and the transportation system in the short and long-term.

3.21 SOCIAL AND ECONOMIC FACTORS

Issue Statement

Public concern is focused on the social and economic costs and benefits of having National Forest System (NFS) land in fifty three municipalities in Vermont. Social concerns focus on community desires and the values and expectations of a changing population. Economic concerns focus on the adequacy of Forest Service contributions in lieu of tax loss from Forest Service land ownership; potential revenues and employment that could be generated from forest products, tourism, and other Forest Service-related activities; and the cost effectiveness of Forest Service programs and management.

Public concern specific to land acquisition is focused on determining priorities with input from other agencies, State and local governments, and the public; the impact of land acquisition on local taxes; and the potential removal of acquired lands from timber management and other uses.

Indicator 1 – Community Values

The social indicator to be used in this effects analysis is community values. This includes people's feelings, relationships, preferences, and expectations for their communities and for the Green Mountain National Forest (GMNF). Information on community values can be obtained from local and regional plans, surveys, newspaper articles, interviews, observations, community interactions with the GMNF staff, and public input on the planning process. This indicator highlights the differences between alternatives by determining how each alternative relates to community values.

Indicator 2 – Economic Impacts

This indicator measures the collective effects of Forest Service management on local economies by projecting the number of jobs in each employment sector and employment income by sector. This indicator highlights the differences between alternatives by displaying the potential difference in the economic contribution, as measured by jobs and employment income, provided by each alternative.

Indicator 3 – Forest Payments to Counties

Indicator 3 measures the Forest Service's financial contribution to counties made through direct payments including the Payment in Lieu of Taxes (PILT) and the Secure Schools Act. This indicator highlights the differences between alternatives by estimating the direct monetary contribution to counties expected under each alternative.

Indicator 4 – Present Net Value

Present Net Value (PNV) is the measure used to calculate the economic efficiency of managing the National Forest. PNV is defined as 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 National Forest. Discounted values are used to display the current values of future benefits and costs. This is based on the concept that the value of future benefits and costs are worth less than today's benefits and costs. PNV will be displayed in 2004 dollars. This indicator highlights the differences in alternatives because it measures the difference in the long-term value of management activities expected under each alternative.

Analysis Area

The analysis area for direct and indirect effects includes Addison, Bennington, Rutland, Washington, Windham, and Windsor counties in Vermont (Figure 3.21-1). These six counties contain NFS lands and the towns most directly affected by Forest Service management of the GMNF. The Forest Service also administers, in partnership with the National Park Service, Appalachian Trail Conference, Green Mountain Club, and Dartmouth Outing Club, portions of the lands containing the Appalachian National Scenic Trail (AT) and the Long Trail National Recreation Trail (LT). These portions include the lands between the North Half and South Half of the GMNF and the AT section that traverses from Killington, Vermont to the New Hampshire border. The AT and LT corridor lands are located in eight towns in Rutland and Windsor counties. Towns containing NFS lands are shown in Table 3.21-1

The analysis area for cumulative effects is the same as the analysis area for direct and indirect effects. This area was chosen because the cumulative social and economic impacts of Forest Service ownership and management are most strongly connected to the communities within these counties.

Data was gathered on both the town and county levels for this analysis. County data includes all towns in the county, not just those listed in Table 3.21-1. County and State level data are used to provide regional context and comparison to this analysis.

Table 3.21-1: Study Counties and Towns with National Forest System lands in Vermont

Addison County	Bristol	Hancock	Middlebury
	Goshen	Leicester	Ripton
	Granville	Lincoln	Salisbury
Bennington County	Arlington	Peru	Shaftsbury
	Bennington	Pownal	Stamford
	Dorset	Readsboro	Sunderland
	Glastenbury	Rupert	Winhall
	Landgrove	Searsburg	Woodford
	Manchester		
Rutland County	Brandon	Danby	Pittsfield
	Chittenden	Mendon	Wallingford
	Killington	Mt. Holly	*Shrewsbury
	*Clarendon	Mt. Tabor	
Washington County	Warren		
Windham County	Dover	Londonderry	Stratton
	Jamaica	Somerset	Wilmington
			Wardsboro
Windsor County	Rochester	Stockbridge	Weston
	*Bridgewater	*Pomfret	*Norwich
	*Woodstock	*Hartford	*Barnard

*Towns with only Appalachian Trail or Long Trail corridor lands administered by the Forest Service.

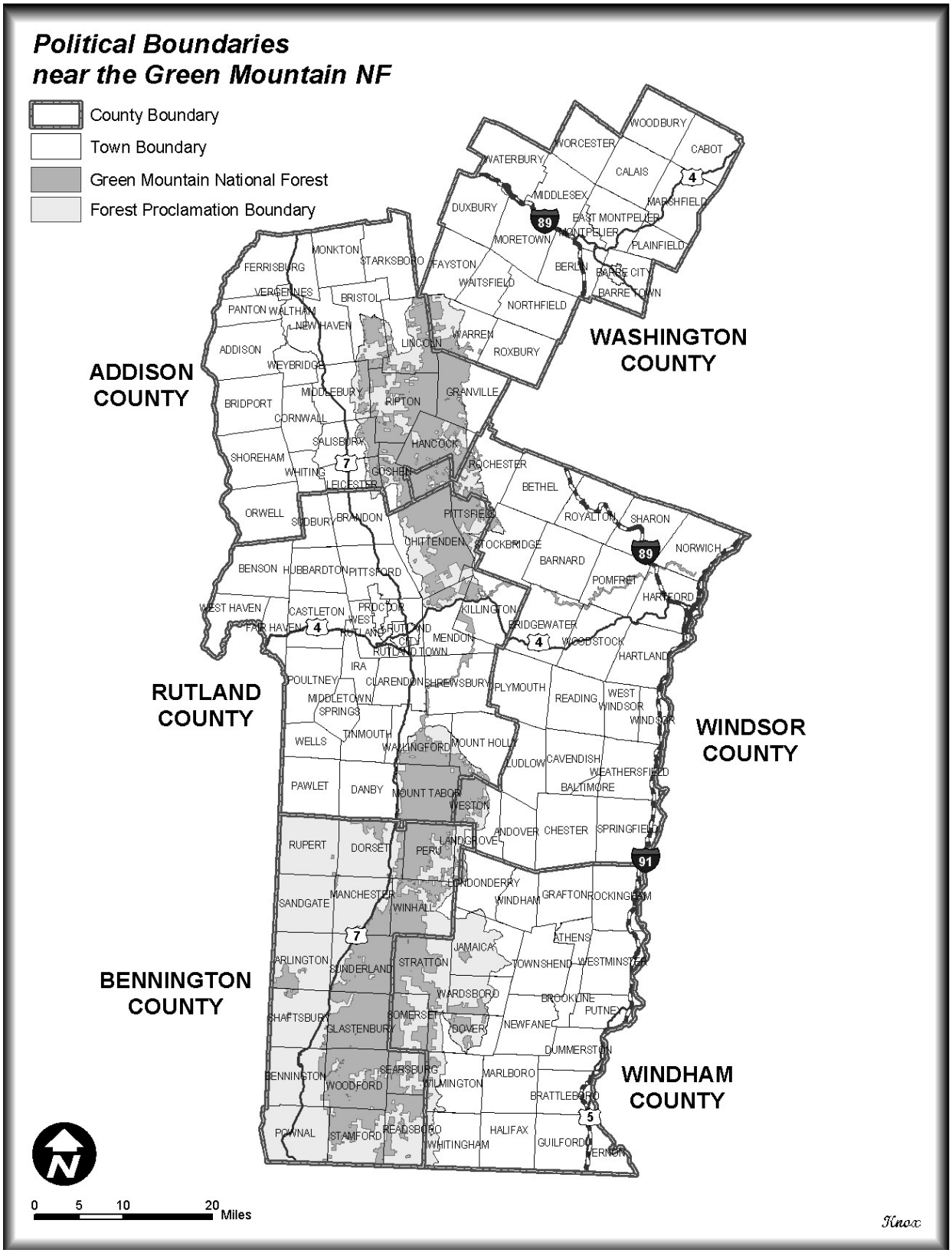

Figure 3.21-1: Counties and Towns in the Analysis Area

3.21.1 Affected Environment

Introduction

This section describes the social and economic environment in the analysis area and the potential social and economic effects of implementing the five Plan revision alternatives on the analysis area. Most of the material used in this section is taken either directly or indirectly from "Social and Economic Assessment: Green Mountain National Forest, VT and Finger Lakes National Forest, NY" prepared by the University of Vermont through a Forest Service Challenge Cost Share Agreement referred to as the Socio-Economic Assessment in this section. This document is referenced as Stokowski et al. 2004 throughout this document.

The data summaries and analysis in the Socio-Economic Assessment include the six counties and fifty-three towns in the vicinity of the Green Mountain National Forest (Figure 3.21-1). State of Vermont data was included in many of the tables for the purpose of comparison.

The GMNF is located in Addison, Bennington, Rutland, Washington, Windham, and Windsor counties in central and southern Vermont. The area includes the spine of the Green Mountains, for which the Forest takes its name, the Valley of Vermont, the Taconic Mountains, and a small portion of the Champlain Valley (see bioregion map in introduction to Chapter 3). Numerous small towns and villages, and a few larger towns and small cities, are located within the six counties.

Addison County is located in the central part of Vermont on the western side of the State. The county borders Lake Champlain on the west and contains large expanses of the Champlain Valley with its agricultural areas. The eastern part of the county is predominated by the Green Mountains. Addison County includes 32,953 residents, encompasses 770 square miles (492,800 acres) and has 90,000 acres (approximately18% of the county) of NFS lands in nine municipalities. NFS lands are located in the eastern part of the county in the Green Mountains.

Bennington County is located in the southwestern corner of Vermont. The county borders New York State and Massachusetts. The Taconic Mountains are located on the western side and the Green Mountains on the eastern side of the county. The Valley of Vermont, another important agricultural area, separates the two mountain ranges. Bennington County includes 35,845 residents, encompasses 676 square miles (432,640 acres), and has 148,675 acres (approximately 34% of the county) of NFS lands in sixteen municipalities. NFS lands are dispersed throughout the county. Bennington County is the only county that is wholly included in the GMNF Proclamation Boundary.

Rutland County is located on the west side of Vermont between Addison and Bennington counties. The county borders New York State and the southern tip of Lake Champlain. The Taconic Mountains are located on the southwestern side and the Green Mountains on the eastern side of the county. As in Bennington County, the Valley of Vermont separates the two mountain ranges. Rutland County includes 62,142 residents, encompasses 933 square miles (597,120 acres), and has 70,711 acres (approximately 12% of the county) of NFS lands in eleven municipalities. The county is the second most populous county in Vermont. NFS lands are located in the northeastern and southeastern parts of the county in the Green Mountains. The GMNF AT and LT corridor lands connect the North Half and South Half of the GMNF traversing four Rutland County towns.

Washington County is located in central Vermont. The Green Mountains traverse the county from north to south and are the predominant landscape feature. Washington County includes 54,928 residents, encompasses 689 square miles (440,960 acres), and has 6,407 acres (slightly more than 1% of the county) of NFS lands in one municipality. NFS lands are located in the Green

Mountains in the southwestern corner of the county.

Windham County is located in the southeastern corner of Vermont. The county borders New Hampshire and the Connecticut River on the east and Massachusetts to the south. The Green Mountains are on the county's western side and the Vermont Piedmont on the eastern side. Windham County includes 41,588 residents, encompasses 789 square miles (504,960 acres), and has 35,352 acres (approximately 4% of the county) of NFS lands in seven municipalities. NFS lands are located on the western side of the county in the Green Mountains.

Windsor County is located in the central portion of Vermont on the eastern side. The county borders New Hampshire and the Connecticut River. The Green Mountains are on the county's western side and the Vermont Piedmont on the eastern side. Windsor County includes 54,055 residents, encompasses 971 square miles (621,440 acres), and has 22,512 acres (approximately 12% of the county) of NFS lands in nine municipalities. NFS lands are located in the northwestern part of the county in the Green Mountains. The GMNF Appalachian Trail corridor lands traverse six Windsor County towns.

The Green Mountain National Forest is within a day's drive of more than 70 million people inhabiting a number of major population centers in the east. These urban areas include New York City, Boston, Philadelphia, Washington, DC, Toronto, Canada, and Montreal, Canada. Figure 3.21-2 shows the regional location of the GMNF.

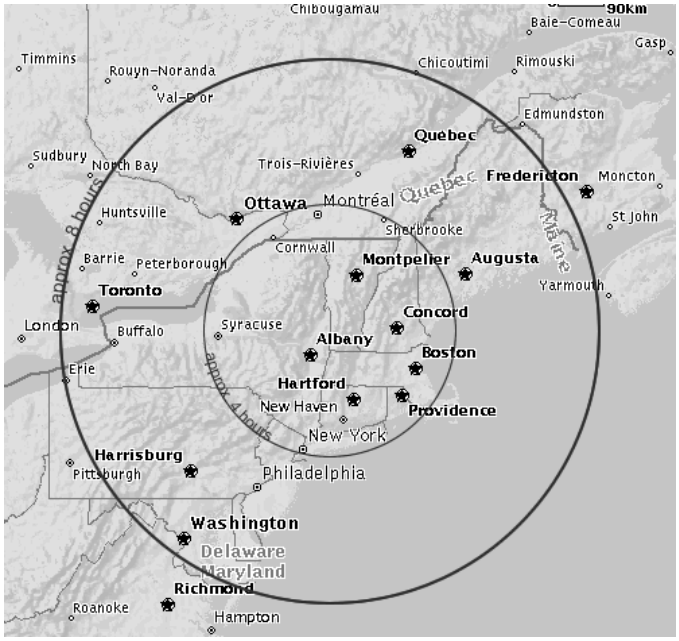

Figure 3.21-2: Cities included within four and eight hour driving times of the Green Mountain National Forest. Source: MapQuest

Trends

Population

The six counties with NFS lands all had increases in population from 1990 to 2000 (Table 3.21-2). Addison County had the largest percent increase at 9.2 percent and Rutland County had the lowest percent increase at 2 percent. The State of Vermont's population increase from 1990 to 2000 was 8.2 percent. The majority of towns with NFS lands had population increases. Seven towns with NFS lands, however, lost population from 1990 to 2000 and one town had no change in population. The trend for in-migration to Vermont from other states has continued over his same period (1990 to 2000). The six counties with NFS lands were no exception with 10 percent to 16 percent of new residents coming from another state or country (Table 3.21-3). There has also been a small increase in the percentage of people who are still living in the same house as they were in 1990 with 60 percent to 62 percent of the population fitting this category.

Table 3.21-2: Percent Change in Population and Age Class from 1990-2000.

	Total Pop. 1990	Total Pop. 2000	% Change Total Pop., 1990-2000	% Change Age < 20, 1990-2000	% Change Age 20-65, 1990-2000	% Change Age > 65, 1990-2000
Vermont	**562,758**	**608,827**	**8%**	**2%**	**9%**	**17%**
Addison County	**32,953**	**35,974**	**9%**	**4%**	**10%**	**19%**
Bristol	3,762	3,788	1%	-2%	1%	9%
Goshen	226	227	0%	-7%	4%	5%
Granville	309	303	-2%	-13%	-7%	133%
Hancock	340	382	12%	-11%	22%	16%
Leicester	871	974	12%	-8%	12%	79%
Lincoln	974	1,214	25%	25%	25%	19%
Middlebury	8,034	8,183	2%	-1%	0%	19%
Ripton	444	556	25%	19%	29%	21%
Salisbury	1,024	1,090	6%	-5%	9%	23%
Bennington County	**35,845**	**36,994**	**3%**	**-4%**	**3%**	**15%**
Arlington	2,299	2,397	4%	-6%	7%	13%
Bennington	16,451	15,737	-4%	-12%	-4%	8%
Dorset	1,918	2,036	6%	8%	3%	13%
Glastenbury	7	16	129%	300%	100%	NA
Landgrove	134	144	7%	16%	16%	-27%
Manchester	3,622	4,180	15%	15%	12%	27%
Peru	324	416	28%	74%	17%	13%
Pownal	3,485	3,560	2%	-5%	1%	30%
Readsboro	762	809	6%	2%	8%	9%
Rupert	654	704	8%	1%	1%	41%
Searsburg	85	96	13%	50%	24%	-53%
Shaftsbury	3,368	3,767	12%	5%	14%	21%
Stamford	773	813	5%	10%	1%	18%
Sunderland	872	850	-3%	-6%	-10%	40%
Winhall	482	702	46%	-6%	48%	128%
Woodford	331	414	25%	-4%	36%	57%
Rutland County	**62,142**	**63,400**	**2%**	**-3%**	**2%**	**11%**
Brandon	4,223	3,917	-7%	-12%	-6%	-5%
Chittenden	1,102	1,182	7%	10%	4%	24%
Clarendon	2,835	2,811	-1%	-19%	5%	27%
Danby	1,193	1,292	8%	0%	7%	42%
Killington	738	1,095	48%	48%	41%	124%
Mendon	1,049	1,028	-2%	-7%	-5%	29%
Mt. Holly	1,093	1,241	14%	10%	17%	4%
Mt.Tabor	214	203	-5%	0%	-2%	-22%
Pittsfield	389	427	10%	17%	2%	43%
Shrewsbury	1,107	1,108	0%	-12%	1%	32%
Wallingford	2,184	2,274	4%	-7%	5%	26%
Washington County	**54,928**	**58,039**	**6%**	**-2%**	**9%**	**8%**
Warren	1,172	1,681	43%	32%	48%	12%
Windham County	**41,588**	**44,216**	**6%**	**-1%**	**8%**	**14%**
Dover	994	1,410	42%	36%	40%	73%
Jamaica	754	946	25%	11%	36%	12%
Londonderry	1,506	1,709	13%	1%	13%	42%

Table 3.21-2: Percent Change in Population and Age Class from 1990-2000.

	Total Pop. 1990	Total Pop. 2000	% Change Total Pop., 1990-2000	% Change Age < 20, 1990-2000	% Change Age 20-65, 1990-2000	% Change Age > 65, 1990-2000
Somerset	2	5	150%	NA	50%	NA
Stratton	121	136	12%	58%	-4%	41%
Wardsboro	654	854	31%	22%	36%	25%
Wilmington	1,968	2,225	13%	2%	8%	78%
Windsor County	**54,055**	**57,418**	**6%**	**0%**	**7%**	**14%**
Barnard	872	958	10%	-2%	15%	12%
Bridgewater	895	980	9%	-1%	15%	7%
Hartford	9,404	10,367	10%	5%	10%	23%
Norwich	3,093	3,544	15%	19%	11%	22%
Pomfret	874	997	14%	15%	9%	41%
Rochester	1,181	1,171	-1%	-18%	0%	31%
Stockbridge	618	674	9%	-6%	7%	57%
Weston	488	630	29%	19%	24%	58%
Woodstock	3,212	3,232	1%	-9%	2%	10%

Source: U.S. Census Data Sets. http://factfinder.census.gov *1990 Summary File 1, Table QT-P1A. 2000 Summary File 1, Table P12*

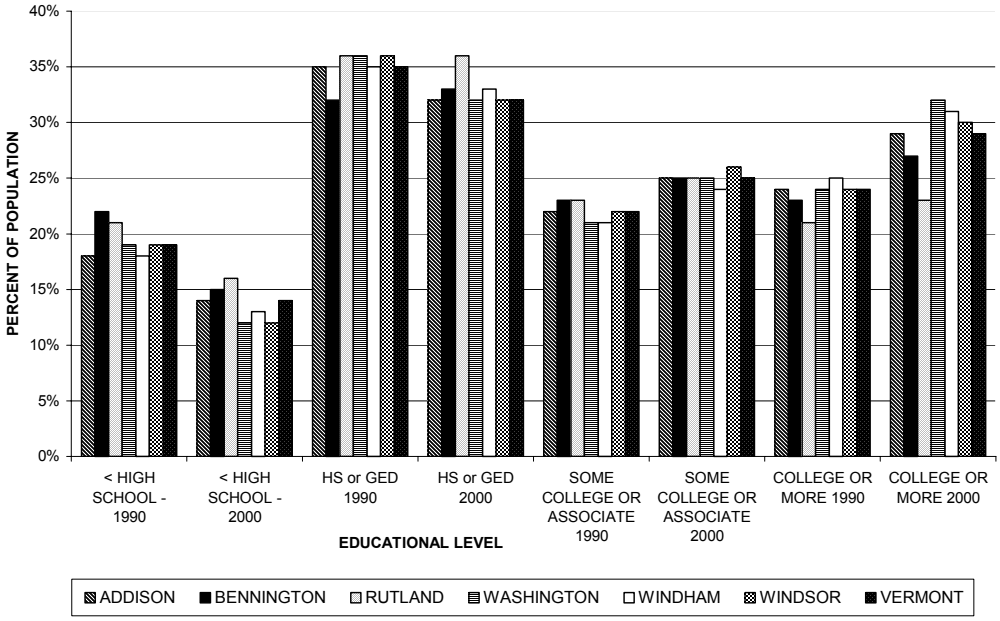

Figure 3.21-3: Educational Attainment by % of Population Over 25
Source: U.S. Census Data Sets. http://factfinder.census.gov

Table 3.21-3: Percent of Population Living in Vermont by Place of Origin*

Area	Same House		Same State		Different State / Country	
	% 1990	% 2000	% 1990	% 2000	% 1990	% 2000
Vermont	52%	59%	33%	28%	15%	13%
Addison County	50%	60%	33%	26%	17%	14%
Bennington County	55%	62%	26%	25%	19%	14%
Rutland County	55%	62%	33%	28%	13%	10%
Washington County	57%	60%	31%	28%	13%	12%
Windham County	53%	60%	28%	25%	19%	15%
Windsor County	54%	61%	30%	23%	16%	16%

Source: U.S. Census Data Sets. http://factfinder.census.gov
1990 Summary File 3, Table P043. 2000 Summary File 3, Table P24.
* Includes residents 5 years of age and older.
The census question asked for the individual's place of residence on April 1 five years prior to the census collection year.

Table 3.21-4: Racial Composition for Counties with NFS Lands

	1990			2000		
	Total Pop. 1990	Total White (%)	Other Races (%)	Total Pop. 2000	Total White (%)	Other Races (%)
Vermont	562,758	555,088 (98.6%)	7804 (1.4%)	608,827	589,208 (98.6%)	19,619 (3.2%)
Addison County	32,953	32,506 (98.6%)	447 (1.4%)	35,974	34,844 (96.9%)	1,130 (3.1%)
Bennington County	35,845	35,464 (98.9%)	381 (1.1%)	36,994	36,161 (97.7%)	833 (2.3%)
Rutland County	62,142	61,639 (99.2%)	503 (0.8%)	63,400	62,214 (98.1%)	1,186 (1.9%)
Washington County	54,928	54,334 (98.9%)	594 (1.1%)	58,039	56,326 (97.0%)	1,713 (3.0%)
Windham County	41,588	41,012 (98.6%)	576 (1.4%)	44,216	42,764 (96.7%)	1,452 (3.3%)
Windsor County	54,055	53,439 (98.9%)	616 (1.1%)	57,418	56,107 (97.7%)	1,311 (2.3%)

Source: U.S. Census Data Sets. *http://factfinder.census.gov,1990 Summary File 1, Table P06; 2000 Summary File 1, Table P7.*
The categories for 1990 were: White, Black, American Indian, Eskimo or Aleut, Asian or Pacific Islander, and Other. The categories for 2000 were: White Alone, Black or African American Alone, American Indian or Alaska Native Alone, Asian Alone, Native Hawaiian and Other Pacific Islander Alone, Some Other Race Alone, and Two or More Races.

In 2000, the large majority (over 96%) of the population in the counties with GMNF lands are white. The counties had a non-white population ranging from 3.3 percent to 1.9 percent. This is, however, a substantial increase from 1990 with the number of non-white residents more than doubling from 1990 to 2000 (Table 3.21-4). Most of the population (over 57%) in the six counties is between the ages of 20 and 65. The portion of county residents in this age group has remained steady from 1990 to 2000. The portion of the county population under age 20 has decreased slightly since 1990 and the portion of the county population over age 65 has increased slightly since 1990. The State of Vermont shows a 2 percent decrease in the portion of the State population less than 20, and a 1 percent increase in the portion of the State in both the 20 to 65 and the over 65 age categories (Table 3.21-2).

From 1990 to 2000, there has been a substantial decrease in the percentage (-15% to -30%) of people with less than a high school education in the six counties and in the State of Vermont (Figure 3.21-3). This trend is consistent in most of the towns with GMNF lands but nine towns have seen an increase in the number of residents with less than a high school education. The percentage with some college or an associates degree, or with a bachelors degree or higher have increased since 1990. The number of residents having a high school degree or equivalent has not shown a consistent directional trend with some counties and towns remaining the same, some showing a decrease, and some showing an increase in the number of residents with high school diplomas or equivalent.

Below Poverty Level

A variety of indicators are used by the US Census Bureau to determine the poverty level. In 1989, the poverty level for one person with no dependents was $6,310; that number was adjusted to $8,501 for 1999. A household includes all the people who occupy a housing unit as their usual place of residence. Households are classified by type: 1) Married Couple Household, 2) Other Family Household which may include families with a male or female head of household or other types of families with people related by birth, marriage, or adoption, and 3) Unrelated Individual Household. All counties in the study area saw a decrease in the number of Married Couple Households below the poverty level from 1989 to 1999 (Table 3.21-5). All counties, except Bennington County, saw an increase in the number of Other Family Households below the poverty level. Rutland County had a considerably higher increase (69.8%) than the other counties and the State of Vermont (26.7%). All six counties had an increase in the number of Unrelated Individual Households below the poverty level. Table 3.21-5 displays the number and change of households below the poverty level by household type.

Forest Users

Trends in forest use and users can be derived from a number of sources including visitor use and national trend surveys. The National Survey on Recreation and the Environment (NSRE) is a long-term survey of outdoor recreation participation patterns across the United States. In the most recent survey conducted in 2001, approximately 90,000 people aged 16 and over from across all geographic and socioeconomic segments of US society were polled. Survey topics included questions about several topics such as recreation activity participation and frequency, environmental attitudes and values, opinions about management of public lands, and lifestyle issues such as home-based activities and hobbies, community and civic activities, travel and cultural activities, and new technologies. Broad generalizations regarding trends in the social and demographic profiles of outdoor participants show that outdoor recreationists are increasingly more college educated, with a family income of greater than $50,000, of minority races, and from smaller households. Walking for pleasure, family gatherings, viewing wildlife, and visiting nature centers had the highest increase in participation from the 1994/1995 NSRE survey to the 2000/2001 survey, with each activity having an increase of more than 30 million people (The Interagency National Survey Consortium 2000-2002).

Information and data are now also published by state and by region. NSRE information on

Vermont and the Vermont Market Region (Massachusetts, New Hampshire, New York and Vermont) were compiled for the Green Mountain and Finger Lakes Socio-Economic Assessment and the Vermont Statewide Comprehensive Outdoor Recreation Plan (SCORP). These data show an increase in all but three outdoor recreation activities. The five activities with the highest increases in participation from 1995 to 2003 were jet skiing, snowboarding, snowmobiling, backpacking, and wildlife viewing. The activities with the highest number of participants in 1995 and 2003 were walking for pleasure, visiting nature centers, picnicking, visiting historic sites, sightseeing, and swimming in lakes and ponds. Three activities experienced decreases in levels of participation between 1995 and 2003: sightseeing, small game hunting, and big game hunting. The 2001 National Survey of Fishing, Hunting, and Wildlife-Associated recreation found a decrease in wildlife related recreation activities such as hunting, angling, and wildlife watching among Vermont residents from 82 percent in 1991 to 67 percent in 2001 (USDI USFW 2001 and 1991). Additional information on recreation trends and complete trend tables are in the Recreation Opportunities and Forest Settings section (3.10) of Chapter 3.

Table 3.21-5: Families and Individuals Below Poverty Level for Counties with NFS Lands

	Below Poverty Level, by Household Type								
	Married Couple Family			Other Family			Unrelated Individuals		
	1989	1999	% Change '89-'99	1989	1999	% Change '89-'99	1989	1999	% Change '89-'99
Vermont	15,651	13,898	-11.2%	16,282	20,622	26.7%	18,314	20,986	14.6%
Addison County	1,154	841	-27.1%	825	944	14.4%	812	1,106	36.2%
Bennington County	1,029	919	-10.7%	1,619	1,516	-6.4%	945	1,153	22.0%
Essex County	339	305	-10.0%	195	322	65.1%	312	256	-17.9%
Rutland County	1,665	1,557	-6.5%	1,598	2,713	69.8%	2,155	2,445	13.5%
Washington County	1,084	984	-12.5%	1,519	1,733	14.1%	1,482	1,761	18.8%
Windham County	1,077	875	-18.8%	1,301	1,657	27.4%	1,210	1,506	24.5%
Windsor County	1,871	1,161	-36.1%	1,305	1396	7.0%	1,633	1,789	9.6%

Source: U.S. Census Data Sets *http://factfinder.census.gov* 1990 Summary File 1, Table P016. 2000 Summary File 1, Table P18.

Employment and Income

The dominant occupation information is gathered through the US Census. The dominant occupation changed from "Service or Technical, Sales and Office" in 1990 to "Management, Professional and Related" in 2000 for five counties with NFS lands (Bennington, Rutland, Washington, Windham, and Windsor), as well as the State of Vermont. Addison County, the sixth county containing NFS lands, remained constant with "Management, Professional and Related" as the dominant occupation in both 1990 and 2000. Farming, Fishing, and Forestry had a considerable decline (-77% to -55%) in all six counties from 1990 to 2000. The State of Vermont saw a similar decrease (-64.5%) in Farming, Fishing, and Forestry occupations.

Employment by industry is derived from the Bureau of Economic Analysis Standard Industrial Classification (SIC) data. The Service Industry employs the highest number of people in all six counties and the State of Vermont. The Service Industry has employed the highest number of people in all but Windsor County since 1980. At that time, Windsor County's highest employment was the Manufacturing Industry, but this changed to the Service Industry in 1990. From 1980 to 2000 there has been a steady decline in people employed in the Farming Industry (-34% in Vermont and -23 % in the six counties). Three counties with NFS lands have seen small increases in farming employment from 1990 to 2000: Addison, Washington, and Windham. The largest increase in the State of Vermont from 1980 to 1990 (+112%) and from 1990 to 2000 (+62.5%) was in the industries involved with agricultural services, forestry, and fishing. This trend is also true for the six counties with GMNF lands.

The unemployment rate decreased in the six counties and the State of Vermont from 1990 to 2002. Decreases ranged from a 2.1 percent drop in Windham County unemployment (from 4.8% in 1990 to 2.7% in 2002) to a 0.7 percent drop in Rutland County unemployment (from 4.8% to 4.1%) (Table 3.21-6).

Table 3.21-6: Comparative Overview of Unemployment Rates, 1990 to 2002, for the State of Vermont and for Counties with NFS Lands

	1990	1995	2000	2002
Vermont	5.0%	4.2%	2.9%	3.7%
Addison	4.3%	4.4%	2.6%	3.3%
Bennington	5.5%	4.3%	3.2%	4.6%
Rutland	4.8%	4.7%	3.6%	4.1%
Washington	5.4%	4.8%	3.1%	4.2%
Windham	4.8%	4.0%	3.05	2.7%
Windsor	4.4%	3.4%	2.3%	3.1%

Source: http://data.bls.gov/cgi-bin/dsrv Employment and Unemployment, LAUS statistics

From 1989 to 1999, average per capita income for the State of Vermont increased by 52.5 percent to $20,625 per year (Table 3.21-7). Five of the six counties with NFS lands had an average per capita income increase higher than the State increase; the exception was Rutland County with an increase of 47.7 percent to $18,874 per year. Table 3.21-7 shows the actual and percentage increase for Vermont and the six counties with NFS lands.

Table 3.21-7: Per Capita Income (PCI) for Counties with NFS Lands

	PCI 1989	PCI 1999	% Change '89-'99
Vermont	**$13,527**	**$20,625**	**52.5%**
Addison County	$12,717	$19,539	53.6%
Bennington County	$13,543	$ 21,193	56.5%
Rutland County	$12,780	$18,874	47.7%
Washington County	$13,547	$21,113	55.9%
Windham County	$13,134	$20,533	56.3%
Windsor County	$14,262	$22,369	56.8%

Source: U.S. Census Data Sets *http://factfinder.census.gov* 1990 Summary File 3, Table P114A; 2000 Summary File 1, Table P82.

Income from industries affected by GMNF management, such as forestry, wood products and processing, and tourism, are tracked through the SIC. Income from the wood products and processing industry as measured in constant 2000 dollars has decreased by 3 percent in the six counties with NFS lands from 1980 to 2000 from $86,164,000 in 1980 to $83,440,000 in 2000 (Table 3.21-8).

Table 3.21-8: Income from Wood Products and Processing for Counties with NFS Lands (1980 to 2000)

	Thousands of Dollars			% Change
	1980*	1990*	2000	
Vermont	**127,139**	**129,154**	**(D)**	
Addison	11,682	7,563	10,448	-11
Bennington	9,124	6,062	7,998	-14
Rutland	25,205	25,718	28,388	13
Washington	3,644	9,711	6,461	77
Windham	22,195	17,987	18,786	-15
Windsor	14,314	16,226	11,359	-21
Total from counties shown **	**86,164**	**67,652**	**83,440**	**-3**

* Dollar amounts have been adjusted to 2000 dollars.
(D) Not shown to avoid disclosure of confidential information.
** Totals do not include information omitted to avoid disclosure of confidential information.
Source: Bureau of Economic Analysis, Regional Economic Accounts; Local Area Personal Income – Series CA05. *http://www.bea.doc.gov/bea*

The six individual counties show fluctuations in income from wood products and processing over some 10 year periods. Four of the six counties have shown decreases in income from wood products over the past twenty years, while 2 counties, Rutland and Washington, have shown increases during the same time period(Table 3.21-8). The number of wood product mills including commercial sawmills, small sawmills, specialty mills, and veneer mills in the analysis area has remained relatively constant with 108 mills in 1997 and 107 mills in 2002. The number of mills actually declined steadily from 1997 to 2000 but has increased in both 2001 and 2002. During this same time period, the volume of timber processed in the analysis area declined from 134,194 thousand board feet (mbf) to 127,686 mbf. The State of Vermont had an increase in mills from 182 in 1997 to 185 in 2002, but saw a decline in the volume of timber processed from 296,723 mbf to 207,992 mbf. Income trends from Forestry, Farming, Fishing, and Other SIC industries are difficult to assess. Some county information cannot be disclosed due to issues with confidentiality.

Tourism is a particularly difficult "industry" to assess because there is no single set of indicators that reflect the complexity of tourism economic activity. Moreover, the causal relationships between events or policy changes and tourism activity are not well understood. While it would be desirable to include information about tourism retail sales, retail data are presented as a single category in State and county statistics, and the proportion attributed to recreation and tourism is not identified. Other sectors listed do not segregate tourism-related income from resident and business spending. These indicators represent a collection of SIC groups having tourist receipts. The SIC groups include:

- **Eating and Drinking Places** – Includes establishments that sell prepared food and drinks, such as restaurants and refreshment stands, for both on-site eating and take-away for immediate consumption.
- **Hotels and Other Lodging** – Includes commercial and non-commercial establishments that provide lodging, with or without meals, such as hotels, motels, and camping facilities.
- **Amusement and Recreation Services** – Includes establishments not classified elsewhere which provide entertainment services.
- **Motion Pictures** – Includes businesses that produce, distribute, or show motion pictures, or similar television or film productions (Stokowski et al. 2004).

The total income from tourism-related SIC groups, as measured in constant 2000 dollars, has increased by over 70 percent in the six counties with NFS lands from 1980 to 2000. Vermont's income from these sectors has grown by approximately 81 percent County increases range from a high of 79 percent in

Windsor County to an increase of 59 percent in Bennington County. Table 3.21-9 shows the total tourism-related income growth from 1980 to 2000.

Table 3.21-9: Income from Tourism-Related Industries for Counties with NFS Lands (1980 to 2000)

	(Thousands of Dollars)			%
	1980	1990	2000	change
Vermont	**271,544**	**491,866**	**592,911**	**81**
Addison	8,802	14,852	19,245	69
Bennington	21,953	34,845	41,999	59
Rutland	36,481	64,036	71,188	76
Washington	23,649	39,088	45,705	65
Windham	37,157	62,258	69,918	68
Windsor	28,983	51,762	64,861	79
Total from counties shown **	**157,025**	**266,841**	**312,916**	**70**

Source: Bureau of Economic Analysis, Regional Economic Accounts; Local Area Personal Income, Series CA05. http://www.bea.doc.gov/bea
* Dollar amounts adjusted to 2000 dollars.
** Tourism total was calculated by adding the dollar amounts from the "amusement and recreation services," "eating and drinking places," "hotels and other lodging places," and "motion pictures" categories. The tourism total county values do not include values omitted to avoid disclosure of confidential information, however all state totals do include these values.

Housing

From 1990 to 2000, housing values in the study area have increased (Table 3.21-20). The State of Vermont has seen a 16.8 percent increase in the median housing value. The six counties with NFS lands have all seen increases, with most being close to or slightly lower than, the State's increase. The exceptions are Addison County, with an increase of 24.4 percent and Rutland County, with an increase of only 3.4 percent.

All six counties with NFS lands saw an increase in the total number of housing units and a decline in the percentage of seasonal housing units from 1990 to 2000 (Table 3.21-11). The increase in total housing units ranged from 3 percent in Rutland County to 8 percent in Addison and Washington Counties. The percentage of seasonal housing units ranged from 11.2 percent in Washington County to 27.8 percent in Windham County.

Table 3.21-10: Median Housing Value for Specified Owner-Occupied Housing Units, for Counties with NFS Lands

	1990 Median Housing Value	2000 Median Housing Value	% Change 1990-2000
Vermont	$95,500	$111,500	16.8%
Addison	$93,400	$116,200	24.4%
Bennington	$97,100	$113,300	16.7%
Rutland	$94,000	$ 97,200	3.4%
Washington	$89,900	$105,200	17.0%
Windham	$97,200	$112,400	15.6%
Windsor	$97,300	$112,100	15.2%

Source: U.S. Census Data Sets
http://factfinder.census.gov
1990 Summary File 1, Table H023B. 2000 Summary File 4, Table HCT66.

According to U.S. Census definition, the term "Specified Owner-Occupied Housing Units" refers to the total number of owner occupied housing units described as either a one family home detached from any other house, or a one family house attached to one or more houses on less than 10 acres of land with no business on the property.

Table 3.21-11: Number of Seasonal Homes for Counties with NFS Lands

	Total Housing Units			Total Number of Seasonal Homes*			Percent of Seasonal Homes	
	1990	2000	% Change	1990	2000	% Change	1990	2000
Addison County	14,022	15,312	8%	1,926	1,746	-9%	13.7%	11.4%
Bennington County	18,501	19,403	5%	3,870	3,673	-5%	20.9%	18.9%
Rutland County	31,181	32,311	3%	5,761	5,293	-8%	18.5%	16.4%
Washington County	25,328	27,644	8%	2,974	3,098	4%	11.7%	11.2%
Windham County	25,796	27,039	5%	7,695	7,519	-2%	29.8%	27.8%
Windsor County	29,849	31,621	6%	6,446	6,243	-3%	21.6%	19.7%

Source: U.S. Census Data Sets *http://factfinder.census.gov* 1990 Summary File 1, Table H005, H002, H001. 2000 Summary File 1, Table H5, H4, H1.

Total number of seasonal homes is a subset of Vacant Housing Units.

Total number of vacant housing units includes those: For rent; For sale only; Rented or sold, not occupied; For seasonal, recreational, or occasional use; For migrant workers; and Other vacant.

Seasonal units are: Vacant housing units used or intended for use only in certain seasons, for weekends, or other occasional use throughout the year. Seasonal units include those used for summer or winter sports or recreation, such as beach cottages and hunting cabins. Seasonal units may also include quarters for such workers as herders and loggers. Interval ownership units, sometimes called shared-ownership or time-sharing condominiums, are also included in this category.

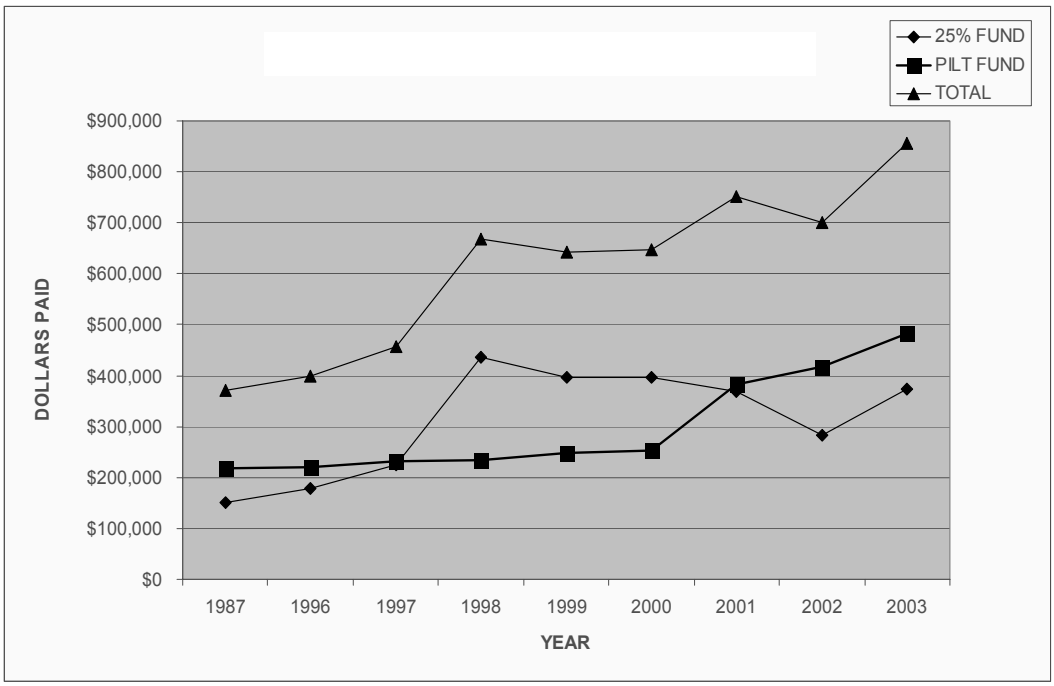

Figure 3.21-4: Total Payments to Vermont Towns

Forest Payments to Towns

The payments to towns made by the Forest Service, in order to compensate for lost taxes due to federal ownership (Payment in Lieu o f Taxes), have increased over the past 15 years. The payment based on Forest Service revenues received for Special Use Permits and timber sales, the 25-Percent Fund, has declined since its highest level in 1999. Timber sale revenues have decreased over the past 5 years due to lack of program funds, increased environmental analysis, litigation, and a hold on new projects due to the threatened Indiana bat and a required threatened and endangered species amendment to the 1987 Plan. The total payments to Vermont towns in the Payment in Lieu of Taxes, 25-Percent fund, and total payments between 1987 and 2003 are shown in Figure 3.21-4.

Land Use

Since the early 1980s, there has been considerable growth in rural residential development in the six counties with NFS lands. This has contributed to the rural fragmentation of private farms and forests due to the conversion of these lands to residential use and the division of lands into smaller parcels. Population increases have been higher in rural towns and considerably lower in large towns and cities (Table 3.21-2). The highest increase in population and housing units has tended to occur near the ski resorts. Rural residential development often takes the form of large lot subdivisions, over ten acres and less than 25 acres, fragmenting private forest and farmland.

USDA Forest Service surveys of private forest land owners also show an increase in the number of parcels and acres less than twenty acres in size from 1983 to 1993 (Widmann and Birch 1988, Birch 1996) (Table 3.21-12).

The amount of forest land has remained relatively stable from 1983 to 1997. In 1983, 2,448,800 acres (79%) of land in the six counties were forested. In 1997, 2,458,500 acres (80%) were forested. The amount of forest land in timberland, defined as those lands capable of producing crops (timber) and not withdrawn from utilization, has also remained relatively stable during this time period with 2,360,600 acres (96.4% of forest land) in 1983 and 2,347,000 acres (95.5% of forest land) in 1997. Reserved forest lands (productive timber lands withdrawn from timber utilization) have increased by 8 percent from 78,900 acres (32.2%) of forest land in 1983 to 99,700 acres (40.5%) in 1997 (Table 3.21-13).

There has been a focus on land conservation from 1983 to 1997. Since 1987, the Forest Service has purchased approximately 75,000 acres of land in Vermont to add to the GMNF. Private non-profit conservation organizations, such as the Vermont Land Trust, conserved 124,916 acres in the six counties with NFS lands over the past 10 years (Osborne 2005).

Table 3.21-12: Size of Private Ownership Forest Land Holdings for Southern Vermont*

Parcel Size	1983 Ownerships	1983 Acres	1993 Ownerships	1993 Acres	% Change in Ownerships	% Change in Acres
1 to 9	17800	44,300	32,195	64,390	80.9%	45.3%
10 to 19	5000	70,800	10,227	128,780	104.5%	81.9%
20 to 49	8800	265,600	8,202	193,170	-6.8%	-27.3%
50 to 99	4000	283,400	3,785	257,560	-5.4%	-9.1%
100 to 199	3700	469,300	2,716	386,340	-26.6%	-17.7%
200 to 499	1400	354,200	1,876	386,340	34.0%	9.1%
500 to 1000	300	132,800	278	193,170	-7.3%	45.5%
1000 to 5000	100	203,700	38	128,780	-62.0%	-36.8%
5000 +	**	107,600	26	193,170	**	79.5%
Total	20,800	1,931,700	59,343	1,931,700	185.3%	0.0%

* Data is for Addison, Bennington, Rutland, Windham and Windsor counties and does not include Washington County
** Data not available
Source: USDA Forest Service Resource Bulletin NE-136 and NE -102

Table 3.21-13: Acreage and type of Forested Lands by County (in thousands of acres)

County	1983	1997	1983	1997	1983	1997	1983	1997
	Timberland		Reserve		Other Forest*		Total Forest	
Addison	285.6	239.6	23.4	49	4.1	4	313.1	292.6
Bennington	354.8	349.3	24.8	24.7	0.4	3.7	380	377.7
Rutland	444.7	472.5	27.8	19.3	3	0	475.5	491.8
Washington	353.8	339.2	0.8	6.7	1.1	3.8	355.7	349.7
Windham	421	436.2	0.1	0	0	0	421.1	436.2
Windsor	500.7	510.2	2	0	0.7	0	503.4	510.5
Total	2360.6	2347	78.9	99.7	9.3	11.5	2448.8	2458.5

*Other forest is classified as unproductive in 1983 and as other-urban forest and other residential forest in 1997.
Sources: USDA Forest Statistic for Vermont: 1973 and 1983
USDA Forest Statistic for Vermont: 1983 and 1997

Existing Forest Plan Management Direction

Social/Economics

The 1987 Forest Plan contains a number of goals related to social and economic concerns. These goals include:

> *Maintain flexibility in the ability of the GMNF to respond to an uncertain future. Flexibility will allow decision makers to make shifts to policy and land use as time passes and situations change. Maintaining flexibility will be an advantage to future generations who have the most to gain or lose from the decisions made today.*
>
> *Coordinate this plan and future activities with plans, goals and activities of the State of Vermont, regional planning commissions, town governments, conservation groups, and neighboring landowners.*
>
> *Provide the greatest good, for the greatest number, over the long run.*
>
> *Manage the GMNF to provide what private land does not so that the public selects from the widest variety of choices. Anticipate the changes, which are likely to occur on private lands over time and recognize the interrelated roles of private and public lands.*
>
> *Provide present and future generations with a wide range of choices on National Forest lands in order to satisfy an equally wide range of needs and wants.*
>
> *In areas designated for timber management, emphasize production of high quality sawlogs.*

Most of the social and economic related goals in the 1987 Forest Plan do not have specific objectives. The exceptions are in the production of sawtimber and pulpwood. The 1987 Forest Plan has an objective to annually harvest 7.4 million board feet (mmbf) of hardwood and softwood sawtimber and 8.2 mmbf of pulpwood.

General Administration standards and guidelines call for identifying Forest Service related opportunities that will benefit communities, building public consent during the development of Forest Service plans and programs, identifying opportunities for partnerships, and implementing a public information and education program.

General timber standards and guidelines state that timber will be offered for commercial sale to offset the cost of achieving desired price and non-price benefits, timber revenues will not be maximized to the detriment of other resources, and timber will be cut where financial revenues fall below financial costs when the public desires the resulting non-priced benefits.

Forest Service Land Ownership Adjustment

Land ownership adjustment includes purchase, donation, exchange, transfer, interchange, right-of-way acquisition, and boundary adjustment. The 1987 Forest Plan contains specific goals for land ownership adjustment including:

> *Aggressively acquire rights-of-way which provide public access to the National Forest.*
>
> *Adjust landownership within the National Forest boundary in accord with plans of other owners, the towns and State. Highest priority will be given to tracts which: are near the Appalachian and Long Trails; are within or adjoining Wilderness and Management Area 6.1, where Primitive recreation is emphasized; have uncommon or outstanding dualities which make them special; adjoin significant steams; have important wildlife habitats; or consolidate public ownership.*

General Land Ownership Adjustment standards and guidelines outline land adjustment required purposes and priorities.

Proposed Changes in Management Direction Common to All Alternatives

The revised Forest Plan will continue much of the current management direction to provide a wide range of uses and management flexibility. The revised Forest Plan goals have a greater emphasis on social, economic, and ecological sustainability; coordination with local communities to support local economies, and partnerships and educational opportunities.

The revised Forest Plan goal (Goal 1), "Provide for a wide range of uses and activities in an ecologically, socially, and economically sustainable way," is the overarching goal for the management of the Green Mountain National Forest. Because of its broad nature, this goal will be achieved by following the other goals and objectives in the Forest Plan. Other revised Plan goals that relate to social and economic conditions are Goals 8, 9, 11, 12, 17, 18, 19, and 20.

The revised Forest Plan has specific objectives designed to measure how well goals are attained. With the exception of Goal 1, which is measured by all the other goals and objectives, the goals relating to social and economic conditions now have objectives. These objectives are designed to improve or increase the social and economic benefits that the GMNF provides for the public.

The Administration standards and guidelines have been removed since most of these standards and guidelines are process related. A new standard and guideline section, Interpretation and Education, has been developed to provide guidance for this program.

The revised Forest Plan Timber standards and guidelines continue direction to allow timber sales to be used to enhance other resources and to allow timber to be cut where financial revenues fall below financial costs when the Forest Service determines the resulting non-priced benefits are needed, or desirable, to meet the goals of forest stewardship.

Forest Service Land Ownership Adjustment

Land ownership adjustment goals in the 1987 plan have been consolidated into one more general revised Plan goal (Goal 22):

> *Meet anticipated future needs and opportunities on public lands and improve management effectiveness of the National Forest through adjustment of land ownership.*

Guidelines for Land Ownership Adjustment continue to set the priorities for land ownership adjustment. The priorities in the revised Plan are similar to those in the 1987 Plan. One change is that the Taconics Proclamation Boundary expansion area has been added to priorities for land ownership adjustment.

A significant change in the Land Ownership Adjustment section is a new guideline on management area (MA) designations for newly acquired lands. The 1987 Plan placed newly acquired lands into the Newly Acquired Land MA (9.2). This MA was intended to be a study area that protected resources and facilities while a MA designation was being determined. Very few lands were assigned to another MA, however, during the past 15 years, resulting in over 91,000 acres currently in the Newly Acquired Lands MA (9.2). In order to address this concern, a new guideline states that newly acquired lands should be assigned a management area based on designations shown in the Forest Plan Proclamation Boundary map.

The entire Proclamation Boundary has been mapped with a potential MA designation for lands if they were to be acquired by the Forest Service (see Appendix G). This potential designation will not affect land acquisition priorities or management of lands that are not owned by the Forest Service.

Existing Condition – Social

Population

The population and age distribution of Addison, Bennington, Rutland, Washington, Windham and Windsor counties, and the towns within these counties that have NFS lands, are shown in Table 3.21-2. The majority of the towns with NFS lands have a population of less than 1,000 year-round residents. Only one town, Bennington with a population of 15,737, has a population greater than 10,000. The municipality in the analysis area with the largest population is Rutland City with a population of 17,282, located between the North Half and South Half of the GMNF. The population density per square mile ranges from lows of 0.18 and 0.36 people per square mile in Somerset and Glastenbury, respectively, to highs of 208.91 and 370.37 in Middlebury and Bennington, respectively. Somerset and Glastenbury are both unorganized towns with few services and utilities. Middlebury and Bennington are among the larger towns in the State of Vermont. The rest of the towns have population densities of less than 100 people per square mile and most of the towns have a density between 10 and 60 people per square mile.

The majority of residents in all towns were between the ages of 20 and 65, and white. Over 60 percent of the people in the six counties are living in the same house in 2000 as they were in 1990. The counties differ in the number of people that are native-born Vermonters with Addison being the highest (58%) and Windsor being the lowest (37%) (US Census 2000).

Over 50 percent of the age 25 and over population in five of the six counties have an educational level of some college or higher. The exception is Rutland County with 48 percent of the population having this educational level. The majority of towns with NFS lands have over 50 percent of their 25 or older population with an educational level of some college or more; over a third of the towns with NFS lands have more than 60 percent of this population age at this educational level or higher (US Census 2000).

Forest Use and Users

National Survey on Recreation and the Environment (The Interagency National Survey Consortium 2000-2002) data comparisons show that outdoor recreation participation by Vermont residents is considerably higher than for other people in the market region, especially for the following activities: viewing and photographing wildlife, driving for pleasure, swimming in lakes and streams, snow and ice activities, gathering mushrooms, berries and other forest products, viewing and photographing birds, day hiking, visiting a wilderness or primitive area, fishing, mountain biking, canoeing, cross country skiing, hunting, and snowmobiling. Walking for pleasure is enjoyed by nearly 91 percent of Vermonters, while only 4 percent (slightly over 19,000 people) are involved in jet skiing. In comparison with the national trends, Vermont residents participate more frequently in cross country skiing and snowmobiling, but they participate less than others in the country in horseback riding and jet skiing activities (Stokowski et al. 2004).

From the National Visitor Use Monitoring (NVUM) survey data (USDA 2001d), it is estimated that the GMNF currently has approximately 3.4 million visits per year. Approximately 62 percent of Forest users are defined as “local,” meaning they live in a zip code area within 30 miles of the GMNF boundary (Stynes and White 2004). The top five recreational activities on the GMNF were viewing natural features, hiking and walking, downhill skiing or snowboarding, general relaxation, and gathering special forest products (mushrooms, berries, firewood, and other natural products). Seventy one percent of Forest users are male, over 98 percent are white, most are between 20 and 60 years of age, and the average length of stay was 6.5 hours.

Wilderness use accounted for approximately 50,000 visits per year. Two thirds of the wilderness visitors were between the ages of 31 and 40, 74 percent were male, 95.5 percent were white, and the average stay was 13.7 hours.

Surveys have been conducted in recent years to gain information on how people feel about northern New England forests. Though it is likely that not all of the people surveyed are users of the GMNF, this information is useful in understanding the attitudes of those who live near and use the Forest. In the 2002 survey report "New Englander's Attitudes toward Forests of Northern New England: Findings and Analysis from a Regional Survey," the majority of respondents believed that the protection of forests in New England was very important (74%), however, creating and keeping jobs in New England rated higher than forest protection. Most people thought that forest health was good, that forests were relaxing, quiet, and calming, and an important economic resource. Most people responded that an important reason to protect forests was to provide natural habitats (over 65%) and fewer than 32 percent responded that forests should be protected to ensure a source of timber. Most respondents thought that designated wilderness areas should be increased in each state in New England (over 61% for New England and 65% for Vermont) (Belden 2002).

Partnerships

The Green Mountain National Forest has much community interest as reflected by the number of groups involved with the Forest. The use of partnerships and volunteers to assist with Forest Service management activities has increased over the life of the 1987 Forest Plan. Some of the areas where partnerships and volunteers have assisted with management activities include:

- Trail maintenance
- Heritage projects
- Road maintenance
- Fish stocking
- Watershed health
- Ecological mapping
- Bird population monitoring
- Wildlife habitat projects
- Education
- Law enforcement and fire fighting

Land Use

The land use within the analysis area can be characterized as a combination of larger regional centers, small towns, villages, and agricultural lands located in river and stream valleys, and upland plateaus surrounded by forested mountains. A transportation network that follows the valleys connects these lands and has encouraged a land use pattern of rural residential development along road corridors. The six counties with NFS lands range from 59 percent forested in Addison County to 87 percent forested in Bennington County (Frieswyk and Widmann 2000). The majority of the forest land in the six counties is owned by individuals (60%), rather than the forest industry (3%), or government (20%) (Table 3.21-14).

The analysis area also has nine alpine ski areas, three of which are partially located on NFS lands and are operated under a special use permit. The largest regional center in the analysis area is Rutland City with services, shopping, businesses, and manufacturing. Adjacent Rutland Town also contributes to these regional land uses. Other regional centers in the six counties include the Barre–Montpelier area, Bennington, Brattleboro, Manchester, Middlebury, Springfield, and White River Junction. The majority of residential land use is for primary homes. The percentage of seasonal homes ranges from 11.2 percent (3,098) in Washington County to 27.8 percent (7,519) in Windham County. A number of towns, predominantly in rural areas near ski resorts, have a very high percentage in seasonal homes, over 60 percent. There are a number of town forests and 22 State parks and State forests in the six counties, as well as numerous private campgrounds, inns, and resorts.

Community Values

Town and regional plans are considered to be representative of community values and visions for the future. The Vermont Planning and Development law, enacted in 1989, enables towns and regional commissions to adopt town and regional plans. The law outlines requirements for plans including that they are consistent with the 13 Vermont planning goals, address certain topics in required sections,

solicit participation of local citizens, and hold public hearings. Act 250, the Vermont State Land Use and Development Law, has a criterion that requires projects under Act 250 review to be in conformance with adopted town and regional plans. Vermont Environmental Board case law refers to town and regional plans as "a clear written community standard" specifically in regard to aesthetics (Hasen 2004).

The five regional planning commissions with NFS lands in their region all have adopted plans (Addison County Regional Planning Commission 2004, Bennington County Regional Commission 1997, Rutland Regional Planning Commission 2001, Two-Rivers Ottauquechee Regional Commission 1999, Windham Regional Commission 2001). The regional plans have goals and policies that relate to forest land, wilderness, and specifically to the GMNF. In addition, all five regional plans have goals that:

- Support economic opportunities and diversity
- Support agricultural and forest industries
- Maintain and enhance natural resources including air, water, wildlife, land resources and natural features
- Maintain and enhance recreational opportunities
- Encourage energy conservation and efficiency
- Maintain historic settlement patterns
- Protect and preserve important features of the Vermont landscape both natural and historic.

Many of the towns in the analysis area have adopted town plans that have similar goals.

Table 3.21-14: Timberland Ownership Class by County in 1997 (thousands of acres)

	National Forest*	Misc/. Federal	State	County /Town	Forest Industry	Farmer	Corporate	Individual	Total
Addison	45.4	0	8.5	8.5	21.7	13.6	17	125	239.6
Bennington	107.4	0	0	26.2	0	11	50.1	154.6	349.3
Rutland	54	4.6	32.9	11.3	6.5	61.2	46.1	255.9	472.5
Washington	5.3	0	55.6	0	0	8.4	59.7	210.1	339.2
Windham	20.1	5.7	0	6.5	13.3	10.1	77.4	303.1	436.2
Windsor	22.5	15.2	25.3	0	26.4	1.4	68.1	351.6	510.5
Total	254.7	25.5	122.3	52.5	67.9	105.7	318.4	1400.3	2347.3

Source: USDA Forest Statistic for Vermont: 1983 and 1997. *Does not include Wilderness acres

A 1996 report titled "Social Values, Environmental Ethics, and National Forest Management" contains the results of a survey of Vermont households regarding forest use values and forest management issues. The forest use values were rated according to their importance. All values received at least a moderate level of support. The ten values were rated as follows from highest value to lowest (Manning et al. 1996):

- Aesthetic
- Ecological
- Recreation
- Educational
- Moral/ethical
- Historical/cultural
- Therapeutic
- Scientific
- Intellectual
- Spiritual
- Economic

Survey respondents generally agreed more strongly with statements that supported a non-material orientation to forest management over a material orientation. Activities such as protecting undisturbed forests, protecting wildlife habitats, and providing a wide range of uses were given greater approval than logging if it diminished scenic quality, was located in undisturbed areas, or used clearcutting as a harvesting method. Survey respondents also had positive attitudes toward ecosystem management and less positive attitudes toward management for political, social, and economic concerns, including the needs of surrounding communities (Manning et al. 1996).

Existing Condition - Economic

Income

The US Census Bureau defines "personal per capita income" (PPCI) as the mean income computed for every man, woman, and child in a particular group. It is derived by dividing the total income of a particular group by the total population in that group. The State of Vermont's PPCI in 1999 was $20,625. Three counties, Bennington, Washington and Windsor, had PPCIs that were above the State PPCI, the highest being Windsor at $22,369. Three counties were lower than the State PPCI although Windham County was very close with a PPCI of $20,533. The lowest county PPCI in the analysis area was Rutland County at $18,874 (Table 3.21-7). Town PPCI ranged from a high of $36,546 in Weston to a low of $10,472 in Searsburg.

According to the US Census Bureau, "household income" is computed by adding the income of the householder and all other individuals 15 years old and over in the household, whether they are related to the householder or not. (This differs from "income of families," because family income refers to the incomes of household members who are related to the householder, the person or persons in whose name the home is owned, being bought, or rented.) All six counties had over 70 percent of the household incomes between $10,000 and $74,999 per year. The counties were similar to the State as a whole in their income distribution. Table 3.21-15 shows ranges and percents of household incomes in 1999.

Table 3.21-15: 1999 Household Income for Counties with NFS Lands (Number of Households in Income Range)

	*Less than $10,000	$10,000 to $19,999	$20,000 to $29,999	$30,000 to $39,999	$40,000 to $49,999	$50,000 to $59,999	$60,000 to $74,999	$75,000 to $99,999	Over $100,000
Vermont	19,552	31,821	33,993	32,153	29,334	23,794	26,030	23,051	21,016
Addison County	943	1,517	1,794	1,741	1,711	1,486	1,483	1,311	1,091
Bennington County	1,377	2,111	2,035	1,901	1,838	1,388	1,455	1,290	1,427
Rutland County	2,414	3,913	4,131	3,462	3,167	2,567	2,591	1,863	1,578
Washington County	1,930	3,106	3,292	3,200	2,732	2,353	2,602	2,428	2,011
Windham County	1,571	2,792	2,733	2,465	2,157	1,902	1,781	1,557	1,411
Windsor County	1,973	3,153	3,596	3,130	2,953	2,395	2,430	2,243	2,293

Source: U.S. Census Data Sets *http://factfinder.census.gov* 1990 Summary File 3, Table P080; 2000 Summary File 3, Table P52

* The category of "Less than $10,000" is actually as follows: for 1989 data, "less than $9,999"; for 1999 data, "less than $10,000"

Table 3.21-16: Dominant Occupation for Counties with NFS Lands, 2000

Dominant Occupation	State of Vermont	Addison County	Bennington County	Rutland County	Washington County	Windham County	Windsor County
Management, professional, and related	115,136	6,912	6,056	9,667	12,246	7,956	10,790
Service	46,384	2,785	3,033	5,033	4,629	3,799	4,502
Technical, sales and office	77,608	4,125	4,404	8,198	8,308	5,379	7,073
Farming, fishing, and forestry	4,160	537	122	345	189	307	296
Construction, production, laborers, and transportation	73,846	466	5,065	8,386	5,904	5,860	6,693
Total	**317,134**	**14,825**	**18,680**	**31,629**	**31,276**	**23,301**	**29,354**

Source: U.S. Census Data Sets. http://factfinder.census.gov 1990 Summary File 3, Table PO78; 2000 Summary File 4, Table QT-P27
The U.S. Census counts only "full time" employment. It is not possible to compare the dominant occupation categories of 1980, 1990, and 2000 U.S. Census data because there have been many changes to each parameter over the 20 year period.

Table 3.21-17: Tourism Employment in Service Industries for Counties with NFS Lands, 2000

State of Vermont	Addison County	Bennington County	Rutland County	Washington County	Windham County	Windsor County
136,010	8,064	9,160	12,261	13,670	12,735	11,386

Source: Bureau of Economic Analysis, Regional Economic Accounts; Local Area Employment, Series CA25. *http://www.bea.doc.gov/bea*

Table 3.21-18: Full-Time and Part-Time Employment by Industry for Counties with NFS Lands, 2000

Employment by Place of Work	Vermont	Addison Co.	Bennington Co.	Rutland Co.	Washington Co.	Windham Co.	Windsor Co.
Total full-time & part-time employment	404,540	22,025	26,502	37,994	43,245	33,600	33,735
Wage and salary employment	318,421	15,836	20,644	31,204	35,014	26,189	25,173
Proprietors employment	86,119	6,189	5,858	6,790	8,231	7,411	8,562
Farm proprietors employment	6,790	872	172	557	395	373	585
Non-farm proprietors employment	79,329	5,317	5,686	6,233	7,836	7,038	7,977
Farm employment	9,495	1,533	249	739	531	532	704
Non-farm employment	395,045	20,492	26,253	37,255	42,714	33,068	33,031
Private employment	342,306	18,228	23,755	32,474	34,646	30,091	27,818
Ag. Services, forestry, fishing, other	6,862	578	**(D)**	568	458	**(D)**	778
Mining	920	49	**(D)**	321	179	**(D)**	128
Construction	26,444	1,649	1,642	2,476	2,188	2,155	2,474
Manufacturing	53,336	2,344	4,245	4,992	5,005	3,453	3,766
Transportation and public utilities	15,099	596	604	1,525	1,291	1,781	1,103
Wholesale trade	14,264	479	765	1,313	1,534	2,239	996
Retail trade	66,228	3,404	5,467	7,140	6,645	4,988	5,450
Finance, insurance, and real estate	23,143	1,065	1,359	1,878	3,676	1,912	1,737
Services	136,010	8,064	9,160	12,261	13,670	12,735	11,386
Government / government enterprises	52,739	2,264	2,498	4,781	8,068	2,977	5,213
Federal, civilian	6,018	153	154	422	344	215	1,411
Military	4,575	266	273	468	468	326	429
State and local	42,146	1,845	2,071	3,891	7,256	2,436	3,373
State government	15,349	202	636	1,027	4,655	196	654
Local government	26,797	1,643	1,435	2,864	2,601	2,240	2,719

Source: Bureau of Economic Analysis. http:/www.bea.doc.gov/; Regional Data, Local Area Annual Estimate, Table CA 25
(D) Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals
(L) Less than 10 jobs, but the estimates for this item are included in the totals; (N) Data not available for this year

Employment and Income by Employment Sector

Employment sectors are traditionally defined for economic analysis by the US Standard Industrial Classification (SIC) system. This information was compiled at the county level. The dominant occupation in all six Vermont counties with NFS lands and the State of Vermont in 2000 was Managerial, Professional and Related. The industry sector with the greatest number employed in each county and the State was the Service Industry. Farming, Fishing and Forestry have the lowest number of people in that occupational category. As of 2000, approximately 1,796 (slightly over 1%) of a total 145,025 employed people in the six counties were employed in the Farming, Agricultural Service, Forestry, and Fishing categories. Employment in tourism-related services for the six counties is approximately 67,276 or approximately 46 percent of the total employment. Tables 3.21-16 through 3.21-18 display the dominant occupation and employment industry figures for the area.

The industries most directly impacted by Forest Service management are: Manufacturing (in the form of wood processing); Forestry, Fishing, and Farming; Services; and Retail. As of 2002, the six counties with NFS lands contained 107 wood product mills (commercial, small, specialty, or veneer) that processed a total of 127,686 mbf. The personal income generated from wood processing in the six counties was $83,440,000. The Forestry, Fishing, Farming employment sector generated personal income of over $1,165,000. The six counties have many tourism oriented businesses such as four season resorts, ski areas, and small inns. Many other businesses such as retail and restaurants are dependent on tourism for part of their business. The total personal income from tourism-related industries in the six counties was $312,916,000. Table 3.21-19 shows the personal income for each county for these sectors and the percentage each represents of the county's total income.

Economic Impacts

An economic model, known as the FEAST/IMPLAN model, provides information on the current condition of Forest Service management's contribution to employment and income in the six counties, as well as the economic impacts of revised Plan alternatives. The information for the current condition (Tables 3.21-20 to 3.21-23) provided through the FEAST/IMPLAN model is based on 2003 Forest program revenues and expenditures (See Plan Appendix B for more information on analysis processes). Forest Service management of the GMNF currently contributes 2,411 jobs and over 50 million dollars in income to the six counties with NFS lands.

Housing Values

The median housing value in 2000 in the six counties ranged from a low of $97,200 in Rutland County to a high of $113,300 in Bennington County (Table 3.21-10). The 2000 median housing value for the State of Vermont was similar to the six counties at $111,500.

Recent research on the sale of properties in Vermont has shown the proximity to Wilderness increases parcel price. Parcels located in towns that contain Wilderness have a per-acre sales price that is thirteen percent higher than those in towns without Wilderness (Spencer 1999).

Forest Payments to Counties

There are three types of federal payments reaching municipalities that have NFS land: Payment in Lieu of Taxes (PILT), 25-Percent, and Full Payment Funds, of which the latter two come from the Secure Rural Schools and Self Determination Act of 2001. Each town with NFS lands receives the PILT fund and has the choice under law to receive either the 25-Percent fund or the Full Payment fund.

PILT payments are based on the acreage from the preceding fiscal year. The per-acre dollar amount, currently authorized by federal law as $1.92, is subject to a maximum per town resident (population cap). The legislation calls

for the payment amount to be indexed by the inflation rate. Congress, however, rarely appropriates the full amount.

The Secure Rural Schools and Community Self-Determination Act of 2001 (Secure Schools Act) was intended to stabilize the payments made in lieu of taxes to support education. Two methods of calculating payments are available: the 25-Percent fund or the Full Payment fund.

The amount a town receives for the 25-Percent fund is based on the National Forest acreage in the town for the current Fiscal Year. The total amount distributed is calculated as 25-Percent of gross receipts of the Green Mountain National Forest multiplied by a ratio of acreage in towns choosing 25-Percent fund divided by total Green Mountain National Forest acreage.

The amount a town receives for the Full Payment Fund is based on the "historical percentage" received by the town. At the present time, this means that the total amount that is sent to Vermont for distribution to the towns choosing Full Payment is based on history, and will not vary due to revenues received for goods such as permits or timber harvests. The total amount distributed is calculated as the average of the three highest annual 25-Percent Fund Payments for the GMNF between 1986 and 1999 multiplied by the historical percentage of land in the towns. It will be adjusted annually by half of the Consumer Price Index rate.

All Vermont towns with NFS lands elected to use the Full Payment Fund. Payments to towns from PILT and Secure Schools have generally increased since 1987(Figure 3.21-4). The total payments to all towns have more than doubled since 1987 from $397,930 to $853,885 in 2003. This amount has not, however, kept up with the rate of inflation. The 1987 amount of $397,930 would be worth $1,384,879 in 2003 dollars, considerably more than the $853,885 paid to towns in 2003.

Table 3.21-19: Personal Income by Employment Sector in 2000 (in Thousands of Dollars)

	All Sectors Total Income	Wood Processing		Forest/Farm/Fish		Tourism	
		Income	% of Total	Income	% of Total	Income	% of Total
Vermont	16,883,009	(D)	Not available	4,450	>1	592,911	4%
Addison County	920,719	10,448	1%	(D)	Not available	19,245	2%
Bennington County	1,079,815	7,998	>1%	116	>1	41,999	4%
Rutland County	1,648,971	6,461	>1%	475	>10	45,705	3%
Washington County	1,234,156	18,786	2%	(D)	Not available	69,918	6%
Windham County	1,664,294	11,359	>1%	415	>1	64,861	4%
Windsor County	8,196,033	83,440	1.0%	1,165	>1	312,916	4%

Source: Bureau of Economic Analysis, Regional Economic Accounts; Local Area Personal Income, Series CA05. *http://www.bea.doc.gov/bea*

(D) Not shown to avoid disclosure of confidential information. This information is included in the statewide totals.

Present Net Value of 1987 Forest Plan

Present Net Value (PNV) is defined as the value of discounted benefits (or revenues) minus discounted costs. A PNV analysis includes all outputs including timber and recreation, to which monetary values are assigned. In deriving PNV figures, costs are subtracted from benefits to yield a net value. "Future values," that is benefits received in the future, are discounted using an appropriate discount rate to obtain a "present value". The PNV is the discounted sum of all benefits minus the sum of all costs. PNV estimates, as required by NFMA (36 CFR 219), attempt to condense a large amount of information into a single value.

The first measurement in net public benefit uses quantitative criteria and is included in the financial efficiency analysis. Financial efficiency considers the value of activities and products that have a market cost or value. Essentially, financial efficiency considers things that can be bought or sold. The qualitative criteria are included as a part of the economic efficiency analysis and considered the public's perceived worth of various activities in the form of assigned values. In this context, these various activities are generally recreation activities. The final economic analysis combines the qualitative criteria with the quantitative analysis using their Present Net Value (PNV) to estimate an alternative's overall net public benefit.

The financial efficiency, economic efficiency, and Present Net Value for the 1987 Forest Plan have been recalculated using updated modeling information from Spectrum for timber outputs and monetary values, NVUM recreation outputs, and 1990 Resources Planning Act assigned values (see Appendix B for more information on the analysis process). The existing PNV is $2,308,593,000 and is displayed in Table 3.21-24 as Alternative A.

3.21.2 Environmental Consequences

Direct and Indirect Effects by Alternative

Indicator 1 – Community Values

Effects Common to All Alternatives

All alternatives are designed to be consistent with community values and to sustain the social and economic fabric of local communities. All alternatives will maintain and enhance natural resources, historic resources, scenic resources, and recreational opportunities through the implementation of goals, objectives, standards, guidelines, and management area direction. All alternatives:

- Provide opportunities for renewable energy use and development
- Support economic opportunities and diversity
- Support agricultural and forest industries
- Maintain and enhance natural resources including air, water, wildlife, and land resources and natural features
- Maintain and enhance recreational opportunities
- Encourage energy conservation and efficiency
- Maintain historic settlement patterns
- Protect and preserve important features of the Vermont landscape both natural and historic

Alternative A

Alternative A does not address the stated community concern over lack of management on newly acquired lands. Newly acquired lands remain in the Newly Acquired Land MA (9.2) allowing only maintenance of existing improvements and facilities. Alternative A does not address the desire for additional Wilderness designation, or the desire for improved timber economics and availability.

Alternative B

Alternative B provides the greatest opportunity to address community concerns about timber resources, forest related industries, and economics. The Newly Acquired Lands are assigned MAs with 84,464 acres (92.5%) going into MAs that allow timber harvesting.

Alternative B also allows for more opportunities for developed and motorized recreation. While these activities have higher levels of spending per trip, they are also at the lower end of the participation scale. Greater opportunities for these activities may detract from the community desire to have more areas with non-motorized use and to engage in activities such as walking, wildlife viewing, picnicking, and forest product gathering.

The desire for additional wilderness is addressed by adding to existing wilderness areas only to improve boundary management in towns that did not officially oppose additional wilderness. This provides only slightly more wilderness than Alternative A. Zero acres of Newly Acquired Lands in Alternative A were assigned to the Wilderness Study Area MA in Alternative B.

Alternative C

Alternative C provides an intermediate opportunity to address community concerns about timber resources, forest related industries, and economics. The Newly Acquired Lands are assigned MAs and 78,167 acres (85.6%) are assigned to MAs that allow timber harvesting. Alternative C has an intermediate level of opportunities for developed and motorized recreation.

Alternative C provides opportunities for tourism economics by assigning 12,702 acres (3%) to the Moosalamoo Recreation and Education Area, a management area emphasizing public use, interpretation and education; and the protection of the special values and attributes of the area that contribute to public enjoyment. An intermediate level of emphasis is placed on the community desire to have more areas with non-motorized use and to engage in activities such as walking, wildlife viewing, picnicking, and forest product gathering. These activities have higher levels of participation but tend to have lower levels of spending per trip (NSRE 2004 Vermont State Report).

The desire for additional wilderness is addressed by adding 29,360 acres, the second greatest amount next to Alternative D. In Alternative C, 6,353 acres (7%) of Newly Acquired Lands were assigned to the Wilderness Study Area MA.

Alternative D

Alternative D provides the second lowest opportunity to address community concerns about timber resources, forest related industries, and economics. The Newly acquired Lands are assigned MAs with 65,840 acres (72.1%) going into MAs that allow timber harvesting. Alternative D also allows for fewer opportunities for developed and motorized recreation.

Alternative D provides the greatest opportunity to address the community desire to have more areas with non-motorized use and to engage in activities such as walking, wildlife viewing, picnicking, and forest product gathering.

The desire for additional wilderness is addressed by adding 49,799 acres, the greatest amount of all the alternatives. In Alternative D, 13,871 acres (15%) of the Newly Acquired Lands were assigned to the Wilderness Study Area MA. The potential amount of wilderness in Alternative D may detract from the public desire for developed and motorized recreational opportunities, and may reduce opportunities for resource management through timber harvesting and other vegetation management tools.

Alternative E

Alternative E provides an intermediate opportunity, similar to C, to address community concerns about timber resources, forest related industries, and economics. This alternative focuses timber harvesting on the most suitable lands and in the most accessible areas

providing for increased economic sustainability. The Newly Acquired Lands are assigned MAs and 77,190 acres (84.5%) are assigned to MAs that allow timber harvesting. Alternative E has an intermediate level of opportunities for developed and motorized recreation.

Alternative E provides opportunities for tourism economics by assigning 12,375 acres (3%) to the Moosalamoo Recreation and Education MA. An intermediate level of emphasis is placed on the community desire to have more areas with non-motorized use and to engage in activities such as walking, wildlife viewing, picnicking, and forest product gathering.

The desire for additional wilderness is addressed by adding 27,473 acres, the intermediate amount between the alternatives, but only 1,887 acres less than alternative C. In Alternative E, 8,345 acres (9%) of the Newly Acquired Lands were assigned to the Wilderness Study Area MA.

Indicator 2 – Economic Impacts

The following analysis examines the effects of the Plan alternatives on employment and labor income opportunities within the analysis area of Addison, Bennington, Rutland, Washington, Windham, and Windsor counties. This information was developed using the IMPLAN model. The IMPLAN estimates of economic impacts include direct, indirect, and induced effects on the economic condition of the analysis area in terms of employment and income.

An example of a direct impact is the payment a logger receives from the harvesting and sale of trees to a wood products facility. The indirect effects are when the wages of the logger are spent on car maintenance and groceries. Induced impacts are when the auto repair shop owner and grocery store owner pay rent on their buildings and buy insurance and other goods and services. Another example of indirect and direct impacts is the revenue a resort owner receives from vacationers and then the subsequent investment of that income in fishing boat maintenance and buying bait.

The IMPLAN (Impact Analysis for Planning) model traces the ripple effects of localized economic, socio-political, or resource management changes on a region's employment, production, income, and natural resource base. The IMPLAN system consists of (USDA 2004d):

- A rich database of socio-economic information
- Software which constructs a model of an economy delineated by US and/or zip code boundaries
- An analysis program that estimates the impacts of projects, programs, policies, and economic changes on a region

IMPLAN outputs provided detailed reports on Addison, Bennington, Rutland, Washington, Windham, and Windsor counties describing trade, production, consumption, taxes, welfare and social security payments, savings and investment, debt, employment, and income. National average NVUM survey-based recreation visitor spending profiles were used in estimating economic impacts. Stumpage values were provided from recent timber sales and data compiled by Northern Woodland magazine. Based on past experience, it was estimated that 60 percent of the softwood sawlogs and 90 percent of the hardwood sawlogs harvested on the GMNF would be processed in the analysis area.

IMPLAN modeled complex economic interactions and provided this information for FEAST (Forest Economic Analysis Spreadsheet Tool). Forest information on program expenditures and revenues for each alternative are entered into FEAST. The Current Situation columns in the tables use actual revenue and expenditure data from Forest Service Programs in 2003. This information is provided for comparison to the projected expenditures and revenues for each alternative. Information was based on Fiscal Year 2003 revenues and expenditures. FEAST uses this information and the IMPLAN input to describe impacts to employment and labor income by resource program, major industry, and planning alternative.

Effects Common to All Alternatives

All alternatives would contribute positively to the economy of the six Vermont counties with NFS lands. The recreation and timber programs would contribute the most jobs and industry income. All alternatives would contribute at greater levels than the current condition. This is the result of an increase in timber harvesting in all alternatives over the amount currently being harvested. The Manufacturing employment sector would have the greatest increase in potential employment in all alternatives and the Service sector and Retail sector would continue to have the greatest potential benefit from Forest Service programs.

Alternative A

Alternative A provides the least potential employment and income contributions from Forest Service programs (Tables 3.21-20 to 3.21-23). This is due the lower volume of timber harvested as a result of not assigning the over 92,000 acres of Newly Acquired Lands to another management area designation.

Alternatives B, C, and E

Alternatives B, C, and E provide similar potential employment and income opportunities and have negligible differences in their economic impact on the analysis area (Sendak 2005). All three of these alternatives provide greater employment and income contribution opportunities than Alternative A. This is due to the greater volume of timber harvesting in Alternatives B, C, and E than Alternative A.

Alternative D

Alternative D provides an intermediate potential employment and income contribution from Forest Service programs, between Alternative A and the other alternatives. Alternative D provides the potential for approximately 800,000 to 1,000,000 dollars less income and 24 to 30 fewer jobs than Alternatives B, C, and E due to the lower volume of timber harvesting than in Alternatives B, C, and E.

Table 3.21-20: Employment by Program by Alternative (Average Annual, Decade 1)

		Total Number of Jobs Contributed				
Resource	**Current**	**ALT A**	**ALT B**	**ALT C**	**ALT D**	**ALT E**
Recreation	1,956	1,956	1,957	1,958	1,960	1,958
Wildlife and Fish	274	274	274	274	274	274
Timber	3	342	420	425	395	415
Minerals	0	0	0	0	0	0
Payments to States/Counties	4	53	65	65	60	64
Forest Service Expenditures	174	181	186	183	182	183
Total Forest Management	2,411	2,806	2,902	2,905	2,871	2,894
Percent Change from Current	---	16.4%	20.4%	20.5%	19.1%	20.1%

Source: GMNF FEAST/IMPLAN Model 2005

Table 3.21-21: Labor Income by Program by Alternative (Average Annual, Decade 1; in Millions of Dollars)

Resource	**Current**	**ALT A**	**ALT B**	**ALT C**	**ALT D**	**ALT E**
Recreation	$36.1	$36.1	$36.1	$36.1	$36.2	$36.1
Wildlife and Fish	$5.7	$5.7	$5.7	$5.7	$5.7	$5.7
Timber	$0.1	$10.2	$12.5	$12.7	$11.8	$12.4
Minerals	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Payments to States/Counties	$0.1	$1.7	$2.2	$2.1	$2.0	$2.1
Forest Service Expenditures	$8.1	$8.5	$8.9	$8.7	$8.6	$8.7
Total Forest Management	$50.1	$62.2	$65.3	$65.3	$64.2	$65.0
Percent Change from Current	---	24.1%	30.3%	30.4%	28.1%	29.7%

Source: GMNF FEAST/IMPLAN Model 2005

Table 3.21-22: Employment by Major Industry by Alternative (Average Annual, Decade 1)

	Total Number of Jobs Contributed					
Industry	**Current**	**ALT A**	**ALT B**	**ALT C**	**ALT D**	**ALT E**
Agriculture	32	34	34	34	34	34
Mining	0	0	0	0	0	0
Construction	27	32	33	33	33	33
Manufacturing	61	250	294	297	280	291
Transportation, Communication, & Utilities	63	75	77	78	77	77
Wholesale trade	44	56	59	59	58	59
Retail trade	619	651	659	660	657	659
Finance, Insurance, & Real Estate	67	78	80	80	79	80
Services	1,220	1,286	1,303	1,304	1,298	1,302
Government (Federal, State, & Local)	270	336	354	352	346	350
Miscellaneous	6	8	9	9	8	8
Total Forest Management	2,411	2,806	2,902	2,905	2,871	2,894
Percent Change from Current	---	16.4%	20.4%	20.5%	19.1%	20.0%

Source: GMNF FEAST/IMPLAN Model 2005

Table 3.21-23: Labor Income by Major Industry by Alternative (Average Annual, Decade 1 in Millions of Dollars)

Industry	**Current**	**ALT A**	**ALT B**	**ALT C**	**ALT D**	**ALT E**
Agriculture	$0.6	$0.6	$0.7	$0.7	$0.7	$0.7
Mining	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Construction	$1.0	$1.1	$1.2	$1.2	$1.2	$1.2
Manufacturing	$2.2	$7.8	$9.0	$9.1	$8.6	$9.0
Transportation, Communication, & Utilities	$2.8	$3.3	$3.4	$3.5	$3.4	$3.4
Wholesale trade	$1.9	$2.4	$2.5	$2.5	$2.5	$2.5
Retail trade	$10.4	$11.0	$11.2	$11.2	$11.2	$11.2
Finance, Insurance, & Real Estate	$1.6	$1.9	$2.0	$2.0	$1.9	$2.0
Services	$17.0	$18.8	$19.2	$19.3	$19.1	$19.2
Government (Federal, State, & Local)	$12.6	$15.1	$16.0	$15.9	$15.6	$15.8
Miscellaneous	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Total Forest Management	$50.1	$62.2	$65.3	$65.3	$64.2	$65.0
Percent Change from Current	---	24.1%	30.3%	30.4%	28.1%	29.8%

Source: GMNF FEAST/IMPLAN Model 2005

Indicator 3 – Forest Payments to Towns

Effects Common to All Alternatives

Payment in Lieu of Taxes (PILT)
Towns receive PILT to replace tax revenues lost due to federal ownership of lands. 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. Since these payments are based on the amount of acreage under Forest Service administration, these payments are not affected by changes in the Forest Plan and resource output levels as a result of direction provided in the Forest Plan.

Secure Rural Schools and Community Self Determination Act
All towns with GMNF lands chose the Full Payment Fund based on the State's three highest 25-Percent Fund payments between 1986 and 1999 instead of the 25-Percent Fund that is based on yearly revenues generated by resource outputs. Basing Secure Schools Act payments on past revenues means that the payments would not vary between alternatives.

Indicator 4 – Present Net Value (PNV)

When considering quantitative issues, PNV offers a consistent measure in dollars for comparison of alternatives. Benefits are both market values, as in timber, and non-market assigned values representing value derived from recreation experience on National Forest lands that the Forest Service has estimated based on research,. To determine the PNV for each alternative, Recreation Visitor Days (RVD) for assigned value recreational use categories were developed from NVUM 2000 data and historical use estimates.

The assigned value categories used in the analysis are:

- Camping, Picnicking, and Swimming
- Mechanized Travel and Viewing Scenery
- Hiking, Horseback Riding, and Water Travel
- Winter Sports
- Resorts
- Wilderness
- Other Recreation (except wildlife-oriented recreation)
- Hunting
- Fishing
- Non-consumptive Wildlife Uses

National recreation use demand projections were used to estimate the number of users in each category for each decade for the next 150 years. Wilderness use was varied according to the acreage of Wilderness and Wilderness Study Areas in each alternative (see Final Environmental Impact Statement Appendix B for complete information on the analysis process). The demand information was obtained from Projections of Outdoor Recreation Participation to 2050 (Bowker et al. 1999). Projected recreational use and the assigned values were multiplied to determine the projected value per year. Forest program costs and revenues were obtained from 2003 Forest budget information and Spectrum, the timber harvesting model. Revenues are not reduced for payments made to states, counties and towns.

While the short-term planning horizon for the Forest Plan is 10 to 15 years, the PNV analysis considers costs and benefits into the future to account for long-term benefits and to discount costs. Dollars are constant dollars with no allowance for inflation. A four percent discount rate per year was used over a period of 150 years. The reduction of PNV in any alternative, as compared to maximum PNV benchmark, is the economic trade-off, or opportunity costs of multiple use management, of achieving that alternative.

Effects Common to All Alternatives

The PNV for market values without timber is the same for all alternatives. Revenues and expenditures for resource programs other than timber are not estimated to vary by alternative. These values include all the costs and revenues received from all other Forest Service programs. The Forest Service traditionally uses federal funds to pay for the management of public lands. Table 3.21-24 shows these values as being constant in all five alternatives.

Alternative A

Alternative A provides the lowest Total PNV due to the lower amount of potential timber harvesting. This is a result of approximately 92,000 acres remaining in the Newly Acquired Lands Management Area (9.2).

Alternative B

Alternative B provides the highest PNV due to the greater amount of potential timber harvesting.

Alternative C

Alternative C provides a Total PNV that is higher than Alternative A and the second highest overall. This is due to the higher amount of potential Wilderness than in all alternatives but Alternative D, and the greater level of potential timber harvesting than in all alternatives but Alternative B.

Alternative D

Alternative D provides a Total PNV that is higher than Alternative A but is lower than Alternatives B, C, and E. This alternative has the highest assigned values because it has the greatest available area for potential and existing Wilderness. Alternative D has the second lowest potential for timber harvesting.

Alternative E

Alternative E has a higher Total PNV than Alternative A and is the intermediate level PNV of the alternatives. It has an intermediate opportunity level for potential and existing Wilderness areas and an intermediate level of potential timber harvesting.

Cumulative Effects

The Forest Service's management policies, combined with the effects of decisions and actions taken by those of other agencies, private industry, and private landowners, will affect the overall social and economic condition of the area but cumulative affects between alternatives would be minimal. The overall cumulative effects of Forest Service management to the communities in the six counties with FNS lands should continue to be socially and economically beneficial over the short-term and long-term.

Determining cumulative effects involves identifying the incremental impacts of Forest Service actions that add to other past, present and reasonably foreseeable future actions. Analyzing cumulative environmental consequences of the 2004 Forest Plan and alternatives requires delineation of the cause and effect relationships between proposed actions and the resources, ecosystems, and human communities of concern. Socio-economic changes within the economic impact analysis area are caused by actions initiated by individuals, businesses, governments, and other organizations. During the next decade, thousands of decisions made by individuals and by people within these organizations will affect such things as area employment, income, population, and housing. Economic impact area cumulative impacts are more affected by external business decisions than by Forest Plan decisions.

Cumulative economic effects related to the Green Mountain National Forest's resource management programs are difficult to predict. Most of the variables shaping the economic environment are beyond the control of the Forest Service. Other recreation and timber suppliers (State, counties, private landowners, and private industry) also play important roles in providing jobs and income within the six counties.

Table 3.21-24: Present Net Value (PNV) in Thousands of Dollars					
	Alt. A	**Alt. B**	**Alt. C**	**Alt. D**	**Alt. E**
Non-Market Assigned Value	2,360,579	2,360,692	2,362,022	2,363,025	2,361,929
Market Value without Timber	($168,504)	($168,504)	($168,504)	($168,504)	($168,504)
Timber Market Value	116,518	148,314	143,946	134,323	138,677
TOTAL PNV	2,308,593	2,340,502	2,337,464	2,328,844	2,332,102
Financial Efficiency	(51,986)	(20,190)	(24,558)	(34,181)	(29,827)
Economic Efficiency	2,308,593	2,340,861	2,337,464	2,328,844	2,332,102
Source: GMNF Spectrum model and NVUM 2001					

3.22 OTHER DISCLOSURES

3.22.1 Unavoidable Adverse Effects

The application of Forest-wide and Management Area standards and guidelines, and resource protection measures would limit the extent and duration of any adverse environmental effects. Nevertheless, some adverse effects are unavoidable. For detailed disclosure of all effects, including unavoidable adverse effects, see the preceding Environmental Consequences (Chapter 3) discussions for each resource area discussed. Implementation of any of the alternatives would generally move the landscape and ecosystem towards greater productivity and improved condition, but adverse environmental effects may occur even with standards and guidelines in place.

3.22.2 Relationship between Short-term Uses of the Environment and Long-term Productivity

Short-term uses are those expected to occur on the Forest over the next 10 to 15 years. These uses include, but are not limited to, recreation use, timber harvest, and prescribed burning. Long-term productivity refers to the capability of the land to provide resource outputs for a period of time beyond the next 10 to 15 years.

The minimum management requirement established by regulation (36 CFR 219.27) provides for the maintenance of long-term productivity of the land. Minimum management requirements prescribed by the Forest-wide and Management Area standards and guidelines will be met under all alternatives. Minimum requirements assure that long-term productivity of the land will not be impaired by short-term uses.

Although all alternatives were designed to maintain long-term productivity, there are differences among alternatives in the long-term availability or condition of resources. These types of differences among the alternatives are described in the EIS, Chapters 2 and 3.

3.22.3 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable commitment of resources is defined as follows in Forest Service Handbook 1909.15 (7/6/04):

The *irreversible commitment* of resources means that nonrenewable resources are consumed or destroyed. Examples include mineral extraction, which consumes nonrenewable minerals and potential destruction of such things as heritage resources by other management activities. These consumptions or destructions are only renewable over extremely long periods of time, if they are renewable at all.

The *irretrievable commitment* of resources includes opportunities foregone. They represent trade-offs in the use and management of forest resources. Irretrievable commitment of resources can include the expenditure of funds, loss of production, or restrictions on resource use.

Decisions made in a Forest Plan do not represent actual irreversible or irretrievable commitment of resources. A Forest Plan determines what kind and levels of activities are appropriate on the Forest; it does not

make site-specific or project decisions. The decision to irreversibly or irretrievably commit resources occurs when the Forest Service makes a project or site-specific decision.

Examples of irretrievable resource commitments associated with the Forest Plan decision are as follows:

- Commodity outputs and uses (such as motorized recreation) would be curtailed or eliminated in areas recommended for and subsequently designated as Research Natural Areas.
- Opportunities for non-motorized recreation, solitude, and primitive experiences would be foregone if portions of the Forests are not allocated for these purposes.
- Timber volume outputs would be foregone on land determined as not suitable for timber production.
- Commodity outputs would be reduced or foregone in areas allocated to specific uses or purposes, such as developed recreation sites.
- Non-commodity values, including scenic resources, may be reduced or foregone in areas allocated to commodity uses.

To the degree that an alternative preserves or encourages the development of mature and old forest habitat, opportunities to develop early successional habitat are reduced. The reverse is also true, to the degree that an alternative preserves or encourages the development of early successional habitat, opportunities to develop mature and old forest habitat are reduced.

3.22.4 Environmental Justice

Legislative and Regulatory Framework

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," mandates that "…each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (59 Fed. Reg. 7629 (1994)). Evidence shows that low-income and minority populations bear a disproportionate risk of suffering adverse environmental conditions in their communities. Some examples of this problem include the siting of toxic waste facilities, landfill operations, or unmonitored factory dumping grounds in impoverished or heavily ethnic areas. In order to protect the rights and health of these populations, the Executive Order requires federal agencies to consider and analyze the demographics of a location subject to a proposed federal action, including Forest Plan revision, within the NEPA framework.

Principles for considering environmental justice under NEPA are set forth in "Environmental Justice, Guidance Under the National Environmental Policy Act" (Council on Environmental Quality, 1997). Before a policy, proposal or, as in this case, a Forest Plan is implemented, the likelihood of a disproportionate effect on minority or low-income populations must be investigated and disclosed. The standards used to analyze environmental justice in a given location are as follows: 1) if the demographics of the location show a minority or low-income population greater than, but less than two times greater than the State average, and there are community-identified environmental justice

issues, then the potential for environmental injustice, i.e., ethnic or financial discrimination, exists; and 2) if the demographics of the location show minority or low-income populations equal to or less than that of the State average, then the potential for environmental injustice is considered nonexistent.

Affected Environment and Environmental Impacts

Tables 3.22-1 and 3.22-2 compare the ethnic and income demographics for the counties (Addison, Bennington, Rutland, Washington, Windham and Windsor) that potentially would be affected by the implementation of a revised Forest Plan alternative to Vermont State averages.

Table 3.22-2 demonstrates that none of the counties in question contain an ethnic population segment greater than two times that of the State average. In Addison, Washington, and Windham Counties, the Hispanic or Latino population is greater than, but not two times greater than, the State average. All other ethnic population segments are smaller than the State average for both counties.

Adoption and implementation of the revised Forest Plan is not expected to have a disproportionate effect on the Addison, Washington, or Windham County Hispanic or Latino populations, or any other ethnic population. Activities permitted under the revised Forest Plan are contemplated for sparsely populated areas and, in any event, not for areas in which concentrated Hispanic or Latino or other ethnic populations reside. No physical or financial ripple effects on ethnic populations are expected to occur. Further, any project work implemented under the revised Forest Plan would be subject to NEPA analysis, including environmental justice assessment.

Table 3-22.1: Income Demographics by County

County	Percent Below Poverty Level	
	1990	**1999**
Addison	9.7	8.6
Bennington	11.3	10.0
Rutland	9.6	10.9
Washington	8.3	8.0
Windham	9.5	9.4
Windsor	9.4	7.7
Vermont State	9.9	9.4

Sources: U.S. Census Bureau, Census 2000 Summary File 3 (SF 3) - Sample Data, November 29, 2004c; U.S. Census Bureau, Census 1990 Summary Tape File 3 (STF 3) – Sample Data, November 29, 2004d

Table 3-22.1 shows that neither of the counties analyzed bears individual poverty levels greater than two times the State average. In Bennington and Rutland Counties, the percentage of the population below poverty level exceeds that of the State as a whole, but not by a factor of two. All other counties bear low-income populations at or below the State average. Adoption and implementation of the revised Forest Plan is not expected to have a disproportionate effect on low-income populations. Activities permitted under the revised Forest Plan are not contemplated for areas in which low-income populations are concentrated. Any project work implemented under the revised Forest Plan would be subject to NEPA analysis, including environmental justice assessment.

The revised Forest Plan has an estimated life of 10 to 15 years. Although it is impossible to definitively state whether or not the revised Forest Plan would disproportionately affect minority or low-income populations ten years into the future, US Census data can be used to reasonably assess the potential for disproportionate effect. To that end, Census data can be used to get a sense of prospective growth of such populations by

looking at and extrapolating historical data. Tables 3.22-1 and 3.22-2 contain data not only from the 2000 US Census, but also from the 1990 US Census. By identifying trends in population data, future growth of minority and low-income populations can be projected, and then it can be determined whether the adoption and implementation of the revised Forest Plan would disproportionately affect these populations into the future.

Minority populations and population percentages in all counties in question, as well as in Vermont, increased across the board between 1990 and 1999 (Table 3.22-2). In all said counties, Native American, African American, and Asian populations increased but are below statewide population percentages. In Addison, Washington, and Windham Counties, the Hispanic or Latino population percentages increased and exceed the statewide Hispanic or Latino population percentages. The low-income population in Bennington County decreased, but remains above the statewide average (Table 3.22-4). The low-income population in Rutland County increased so that it now exceeds the statewide average. Based upon the extrapolation of the 1990 and 1999 Census data, the Hispanic or Latino populations in Addison, Washington, and Windham Counties, and the low-income populations in Bennington and Rutland Counties merit further analysis. Because the comparison of 1990 and 1999 population data makes it clear that all other ethnic and low-income populations in question would not be the subject of environmental justice issues in the foreseeable future, no further analysis of these populations will be conducted during the Forest Plan revision process.

As shown in Table 3.22-3, Hispanic or Latino populations in Addison, Washington, and Windham counties and in Vermont increased in terms of total population percentage between 1990 and 1999. Extrapolation of the 1990 and 1999 Census data indicates that said population is expected to continue to increase into the future. At no point in the foreseeable future, however, is it expected that the Hispanic or Latino population percentage in these counties would be more than twice that of the statewide Hispanic or Latino population. As a result, it is anticipated that the adoption and implementation of the revised Forest Plan would not bear a disproportionate impact on Hispanic or Latino populations.

As shown in Table 3.22-4, the poverty levels in Bennington and Rutland Counties exceeded that of Vermont as a whole in 1999. Extrapolation of the 1990 and 1999 Census data indicates that the poverty level in Rutland County is expected to increase into the future, while the poverty level in Bennington County will decrease. At no point in the foreseeable future, however, is it expected that the poverty level in either county would be more than twice that of the Vermont statewide poverty level. As a result, it is anticipated that the adoption and implementation of the revised Forest Plan would not bear a disproportionate impact on low-income populations.

Adoption and implementation of the revised Forest Plan is not expected to have a disproportionate adverse direct, indirect, or cumulative impact on minority or low-income populations over the life of the Plan, regardless of the alternative selected. No issues related to potential disproportionate impacts on either of these demographic groups were identified during public involvement associated with the Forest Plan revision process.

Table 3.22-2: Ethnic Demographics by County

County	% Native American		% African American		% Asian		% Hispanic or Latino	
	1990	1999	1990	1999	1990	1999	1990	1999
Addison	0.2	0.3	0.4	0.5	0.6	0.7	0.6	1.1
Bennington	0.2	0.2	0.3	0.4	0.5	0.6	0.6	0.9
Rutland	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.7
Washington	0.2	0.3	0.3	0.5	0.4	0.6	1.2	1.3
Windham	0.2	0.2	0.4	0.5	0.6	0.8	0.7	1.1
Windsor	0.2	0.2	0.2	0.3	0.5	0.6	0.5	0.8
Vermont	0.3	0.4	0.3	0.5	0.6	0.9	0.7	0.9

U.S. Census Bureau, Census 2000 Summary File 1 (SF 1) 100-Percent Data, November 29, 2004a.; U.S. Census Bureau, Census 1990 Summary Tape File 1 (STF 1) – 100-Percent Data, November 29, 2004b

Table 3.22-3: Hispanic or Latino Populations (Actual and Percent of Total)

County	1990		1999		2008	
	Actual	Percent	Actual	Percent	Actual (Projected)	Percent (Projected)
Addison County	208	0.6	397	1.1	758	1.9
Washington County	663	1.2	732	1.3	808	1.3
Windham County	303	0.7	493	1.1	802	1.7
Vermont	3,661	0.7	5,504	0.9	8,275	1.2

U.S. Census Bureau, Census 2000 Summary File 1 (SF 1) 100-Percent Data, November 29, 2004a; U.S. Census Bureau, Census 1990 Summary Tape File 1 (STF 1) – 100-Percent Data, November 29, 2004b

Table 3.22-4: Population Below Poverty Level[1] (Actual and Percent of Total)

County	1990		1999		2008	
	Actual	Percent	Actual	Percent	Actual (Projected)	Percent (Projected)
Bennington County	3,895	11.3	3,588	10.0	3,305	8.9
Rutland County	5,790	9.6	6,715	10.9	7,788	12.4
Vermont	53,369	9.9	55,506	9.4	57,729	9.0

[1] Includes only those individuals for whom poverty status was determined by Census.
U.S. Census Bureau, Census 2000 Summary File 3 (SF 3) - Sample Data, November 29, 2004c; U.S. Census Bureau, Census 1990 Summary Tape File 3 (STF 3) – Sample Data, November 29, 2004d